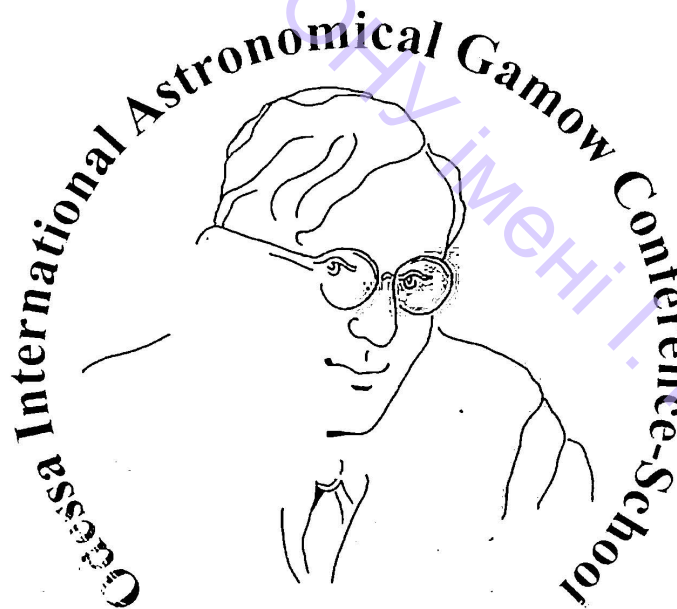


**5-th Gamow Memorial International Conference
dedicated to 111-th anniversary of George Gamow**

**ASTROPHYSICS AND COSMOLOGY AFTER GAMOW:
PROGRESS AND PERSPECTIVES**

and

**15-th Odessa International Astronomical Gamow Conference-School
ASTRONOMY AND BEYOND: ASTROPHYSICS,
COSMOLOGY, COSMOMICROPHYSICS, ASTROPARTICLE
PHYSICS, RADIOASTRONOMY AND ASTROBIOLOGY**



PROGRAM AND ABSTRACTS

August 16-23, 2015
Odessa, Ukraine

ORGANIZERS:

Odessa I.I.Mechnikov National University (Astronomical Observatory and Astronomy and Theoretical Physics Departments), Radio-Astronomical Institute NASU of Ukraine, Ukrainian Astronomical Association, Euro-Asian Astronomical Society, Russian Gravitational Society, Odessa Astronomical Society, South Scientific Centre of NAS of Ukraine

SCIENTIFIC ORGANIZING COMMITTEE:

Co-chairs of SOC: **G.S.Bisnovatyi-Kogan** (SRI RAS, Moscow, Russia, *gkogan@iki.rssi.ru*),
V.M.Shulga (IRA NASU, Kharkov, Ukraine, *shulga@rian.kharkov.ua*)

Vice-chairs: **A.I.Zhuk** (AO ONU, Odessa, Ukraine, *ai_zhuk2@rambler.ru*),
M.I.Ryabov (IRA NASU, Odessa, Ukraine, *ryabov-uran@ukr.net*)

Secretary: **S.M.Melikyants** (AO ONU, Odessa, Ukraine, *seda-melik@yandex.ru*)

Members of SOC: **S.M.Andrievsky** (ONU, Odessa), **I.L.Andronov** (ONMU, Odessa),
N.G.Bochkarev (SAI MSU, Moscow), **S.Chakrabarti** (S.N.Bose National Centre for Basic Sciences, Kolkata, India), **P.Chardonnet** (Universit de Savoie, Annecy-le-Vieux Cedex, France), **A.M.Cherepashchuk** (SAI MSU, Moscow), **A.D.Chernin** (SAI MSU, Moscow),
F.A.Danevich (INR, Kiev), **L.L.Jenkovszky** (ITP, Kiev), **A.A.Konovalenko** (IRA NASU, Kharkov), **A.Kosovichev** (Stanford University, USA), **V.N.Melnikov** (President of RGS, Moscow), **V.N.Obridko** (IZMIRAN, Moscow), **N.A.Russakovich** (JINR, Dubna), **S.Silich** (INAOE, Puebla, Mexico), **N.M.Shumeiko** (NC PHEP BSU, Minsk), **A.A.Starobinsky** (L.D.Landau Institute for Theoretical Physics, Moscow), **A.V.Stepanov** (Pulkovo observatory RAN, Saint-Petersburg), **Y.S.Yatskiv** (President of UAA, Kiev)

LOCAL ORGANIZING COMMITTEE:

Chair of LOC: **I.N.Koval** (Rector of ONU, Odessa, Ukraine)

Vice-Chair: **M.I.Ryabov**

Secretary: **A.A.Pilipenko**

Members of LOC: M.D.Brilenkov, R.D.Brilenkov, A.Yu.Burgazli, A.V.Chopovsky, A.Donskih, N.V.Ivanenko, T.I.Kabanova, N.I.Koshkin, S.O.Korzhavin, A.V.Kudinova, S.M.Melikyants, B.A.Murnikov, V.P.Olyeynik, S.L.Strakhova, A.L.Sukharev, V.V.Troianskyi, V.O.Yushenko

5-th Gamow Memorial International Conference dedicated to 111-th anniversary of George Gamow
"ASTROPHYSICS AND COSMOLOGY AFTER GAMOW: PROGRESS AND PERSPECTIVES"
and 15-th Odessa International Astronomical Gamow Conference-School

"ASTRONOMY AND BEYOND: ASTROPHYSICS, COSMOLOGY AND GRAVITATION,
COSMOMICROPHYSICS, RADIO-ASTRONOMY AND ASTROBIOLOGY"

PROGRAM AND ABSTRACTS

На английском языке

Одесская международная астрономическая Гамовская конференция-школа®

5-th Gamow International Conference in Odessa "ASTROPHYSICS AND COSMOLOGY AFTER GAMOW: PROGRESS AND PERSPECTIVES"

and

15-th Gamow Summer School "ASTRONOMY AND BEYOND: ASTROPHYSICS, COSMOLOGY, COSMOMICROPHYSICS, ASTROPARTICLE PHYSICS, RADIOASTRONOMY AND ASTROBIOLOGY"

16-23 August, 2015, Odessa, Ukraine

AGENDA

Sunday, 16.08.2015

Arrival

08.00 – 22.00 Registration of participants
20.00 – 22.00 *Video lecture by Nobel laureate John C. Mather «From the Big Bang to the Nobel Prize»*

Monday, 17.08.2015

05.57 Sunrise
09.00 – 13.00 Registration of participants
09.30 – 10.30 **Opening of the conference and Memorial** (Conference Hall "Sovinyon")
10.30 – 11.00 Coffee break
11.00 – 13.00 **Plenary session** (Conference Hall "Sovinyon")
13.00 – 14.30 Lunch
14.30 – 16.00 **Section sessions** (Conference Rooms in "Chernomorka", 1 and 2 floors)
16.00 – 16.30 Coffee break
16.30 – 18.00 **Section sessions** (Conference Rooms in "Chernomorka", 1 and 2 floors)
18.30 – 19.00 Dinner
19.00 – 20.00 **Guitar concert in memory of A.Shevchenko.** Performing musician *D.Pechkin*. Musical director *N.Shevchenko*.
20.05 **Sunset**
21.00 – 23.00 Welcome Party

Tuesday, 18.08.2015

05.58 Sunrise
09.30 – 11.00 **Plenary session** (Conference Hall "Grand Marine")
11.00 – 11.30 Coffee break
11.30 – 12.45 **Plenary session** (Conference Hall "Grand Marine")
12.45 – 13.00 **Photographing of participants** (near Conference Hall "Grand Marine")
13.00 – 14.30 Lunch

14.30 – 16.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 16.00 – 16.30 Coffee break
 16.30 – 18.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 18.30 – 19.00 Dinner
 19.00 – 22.00 **Cognac tasting in Odessa Shustov Cognac Winery Museum**
 20.04 **Sunset**

Wednesday, 19.08.2015

06.00 **Sunrise**
 09.30 – 11.00 **Plenary session** (Conference Hall “Grand Marine”)
 11.00 – 11.30 Coffee break
 11.30 – 13.00 **Plenary session** (Conference Hall “Grand Marine”)
 13.00 – 14.30 Lunch
 14.30 – 16.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 16.00 – 16.30 Coffee break
 16.30 – 18.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 18.30 – 19.00 Dinner
Optionally tour “Evening Odessa”, visit to the world famous Odessa Opera and Ballet Theater or to Odessa Philharmonic Hall (depending on the repertoire and time of the performances)
 20.02 **Sunset**

Thursday, 20.08.2015

06.01 **Sunrise**
 09.30 – 11.00 **Plenary session** (Conference Hall “Grand Marine”)
 11.00 – 11.30 Coffee break
 11.30 – 13.00 **Plenary session** (Conference Hall “Grand Marine”)
 13.00 – 14.30 Lunch
 14.30 – 16.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 16.00 – 16.30 Coffee break
 16.30 – 18.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 18.30 – 19.00 Dinner
 19.58 **Sunset**
 20.00 – 23.00 **Conference Dinner**

Friday, 21.08.2015

06.02 **Sunrise**
 09.30 – 11.00 **Plenary session** (Conference Hall “Grand Marine”)
 11.00 – 11.30 Coffee break
 11.30 – 13.00 **Plenary session and Conference closing** (Conference Hall “Grand Marine”)
 13.00 – 14.30 Lunch
 14.30 – 16.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 16.00 – 16.30 Coffee break
 16.30 – 18.00 **Section sessions** (Conference Rooms in “Chernomorka”, 1 and 2 floors)
 18.30 – 19.00 Dinner
 19.00 – 22.00 **Wine tasting at the station of wine “Dulov”**
 19.59 **Sunset**

Saturday, 22.08.2015

06.03 **Sunrise**

XII-th Congress of the Ukrainian Astronomical Association (The program will be announced later)

Round Table “From the History and Nowadays of Astronomy in Ukraine: New Books”

A boat trip on the Black Sea (if we have a sufficient number of participants)

19.57 **Sunset**

Sunday, 23.08.2015

06.05 **Sunrise**

Departure

19.55 **Sunset**

SECTIONS:

1. **Cosmology, gravitation, astroparticle physics, high energy physics** (Head A.I.Zhuk) (17-19 August)
2. **Astrophysics** (Head I.L.Andronov) (17-18 August)
3. **Radioastronomy** (Head O.A.Litvinenko) (19 August)
4. **Sun, Solar activity and Astrobiology** (Head V.M.Efimenko) (20 August)
5. **Solar system** (Head N.I.Koshkin) (20 August)

Subsection **“Virtual Observatory and Intensive Data”** (Head I.B. Vavilova) (21 August)

Attached section **“Planetarium of Ukraine”** (Head V.A.Zakhozhay) (21 August)

Round Table
 (in the Program of the XII-th Congress of the Ukrainian Astronomical Association):
“From the History and Nowadays of Astronomy in Ukraine: New Books” (Head Ya.Yatskiv) (22 August)

SCHEDULE OF THE PLENARY AND SECTION SESSIONS

Plenary sessions:

17 August

9.30 – 13.00 Conference Hall «Sovinyon»

18–21 August

9.30 – 13.00 Conference Hall «Grand Marine»

Section sessions (17–21 August):

Conference Rooms of the Sports and Recreation Centre "Chernomorka"

Data	17.08	18.08	19.08	20.08	21.08
Section 1. Cosmology, gravitation, astroparticle physics, high energy physics	14.30–18.10 Conference Room (2 floor)	14.30–18.00 Conference Room (2 floor)	14.30–18.20 Conference Room (2 floor)		
Section 2. Astrophysics	14.30–18.00 Conference Room (1 floor)	14.30–18.00 Conference Room (1 floor)			
Subsection "Virtual Observatory and Intensive Data"					14.30–18.00 Conference Room (1 floor)
Section 3. Radio-astronomy			14.30–18.00 Conference room (1 floor)		
Section 4. Sun, Solar activity and Astrobiology				14.30–18.00 Conference room (1 floor)	
Section 5. Solar system				14.30–18.30 Conference Room (2 floor)	
Att. Section "Planetarium of Ukraine"					14.30–18.00 Conference Room (2 floor)
Round Table "From the History and Nowadays of Astronomy in Ukraine: New Books"					22.08.2015 Conference Room (2 floor)

5-th Gamow International Conference in Odessa

"Astrophysics and Cosmology after Gamow: progress and perspectives"

and

15-th Gamow Summer School

"Astronomy and beyond: Astrophysics, Cosmology, Cosmophysics, Astroparticle Physics, Radioastronomy and Astrobiology"

(Ukraine, Odessa, Chernomorka, 16-23 August, 2015)

PRELIMINARY SCIENTIFIC PROGRAM

Sunday, 16.08.2015

DAY OF ARRIVAL

08.00 – 22.00 REGISTRATION OF PARTICIPANTS

19.30 – 22.00 Video lecture by Nobel laureate John C. Mather «From the Big Bang to the Nobel Prize»

Monday, 17.08.2015

09.30 – 10.30 OPENING OF THE CONFERENCE, MEMORIAL REPORTS AND GREETING TALKS (Conference Hall "Sovinyon")

Convener G.S.Bisnovatyi-Kogan

Greetings of the rector of Odessa I.I.Mechnikov National University I.N.Koval

Greetings of the president of Ukrainian Astronomical Association Ya.S.Yatskiv

Welcome on behalf of the Scientific Organizing Committee

MEMORIAL REPORTS:

Andrievsky S.M. ASTRONOMY IN ODESSA UNIVERSITY: 150 YEARS OF THE HISTORY

Ryabov M.I., Zhuk A.I. ODESSA ON THE WORLD LINE OF GEORGE GAMOW

Flin Piotr POLISH ASTRONOMERS IN ODESSA UNIVERSITY

10.45 – 11.15 Coffee break

11.15 – 13.00 PLENARY SESSION (Conference Hall "Sovinyon")

Convener V.M.Shulga

De Roeck A. (CERN, Geneva, Switzerland) NEWS FROM THE LARGE HADRON COLLIDER

Rubakov V.A. (INR RAS, Moscow, Russia) TOWARDS CREATING A UNIVERSE IN THE LABORATORY

Tuesday, 18.08.2015

09.30 – 11.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener V.A.Rubakov

Novosyadlyj B. (Ivan Franko National University of Lviv, Lviv, Ukraine) FROM GAMOW HYPOTHESIS TO PLANCK SPACE OBSERVATORY (TO 50 ANIVERSERY OF DISCOVERY OF CMB)

Antoniadis I. (Albert Einstein Center - University of Bern and LP THE CNRS, Paris, France) ASPECTS OF STRING PHENOMENOLOGY IN PARTICLE PHYSICS AND COSMOLOGY

11.00 – 11.30 Coffee break

11.30 – 13.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener A.D.Chernin

Bisnovatyi-Kogan G.S. (SRI RAS, Moscow, Russia) GRAVITATIONAL LENSING

Churyumov K.I. (Kyiv Shevchenko National University, Kyiv, Ukraine) SPACE MISSION ROSETTA-PHILAE TO COMET 67P/CHURYUMOV-GERASIMENKO NUCLEUS: THE FIRST SCIENTIFIC RESULTS

Wednesday, 19.08.2015

09.30 – 11.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener A.D.Dolgov

Gorbunov D. (INR RAS, Moscow, Russia) INITIAL CONDITIONS FOR THE INFLATION WITH FLAT POTENTIAL

Zhuk A.I., Eingorn M.V. (Odessa I.I.Mechnikov National University, Odessa, Ukraine) DISCRETE COSMOLOGY

11.00 – 11.30 Coffee break

11.30 – 13.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener I.Antoniadis

Eingorn M., Zhuk A., Brilenkov M., Vlahovic B. (North Carolina Central University, CREST and NASA Research Centers, USA) THREE SELECTED PROBLEMS RELEVANT TO COSMOLOGICAL SIMULATIONS

Dolgov A. (NSU, Novosibirsk and ITEP, Moscow, Russia ; University of Ferrara, Italy) CREATION OF QUASARS GAMMA BURSTERS, AND SUPENOVAE IN VERY EARLY UNIVERSE

Thursday, 20.08.2015

09.30 – 11.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener D.S.Gorbunov

Blas D., Garry M., Ivanov M., Sibiryakov S. (CERN, Geneva, Switzerland) TSPT: TIME-SLICED PERTURBATION THEORY FOR LARGE SCALE STRUCTURE

Arbuzova E.V., Dolgov A.D. (Dubna University, Novosibirsk State University, Russia) INSTABILITY IN CLASSICAL AND MODIFIED GRAVITY

11.00 – 11.30 Coffee break

11.30 – 13.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener F.A.Danevich

Chernin A.D. (SAI MSU, Moscow, Russia) DARK MATTER AND DARK ENERGY IN THE NEAREST GALAXY FLOWS

Bernabei R. (University of Rome "Tor Vergata", Roma, Italy) RECENT RESULTS FROM DAMA/LIBRA-PHASE1 AND PERSPECTIVES

Friday, 21.08.2015

09.30 – 11.00 PLENARY SESSION (Conference Hall "Grand Marine")

Convener R.Bernabei

Danevich F.A. (INR NASU, Kyiv, Ukraine) DOUBLE BETA DECAY EXPERIMENTS TO STUDY PROPERTIES OF NEUTRINO AND WEAK INTERACTION

Andronov I.L. et al. (Odessa National Maritime University, Ukraine) MULTI-COMPONENT VARIABILITY OF STARS: THE CLUES FROM THE "INTER-LONGITUDE ASTRONOMY" CAMPAIGN

11.00 – 11.30 Coffee break

11.30 – 13.00 PLENARY SESSION and CLOSING OF THE CONFERENCE (Conference Hall "Grand Marine")

Convener G.S.Bisnovatyi-Kogan

Krelowski Ja. (Center for Astronomy, Nicolaus Copernicus University, Torun, Poland) MOLECULES IN TRANSLUCENT INTERSTELLAR CLOUDS

Flin Piotr (Jan Kochanowski University, Institute of Physics, Poland) LUDWIK SILBERSTEIN (1872-1948) AND THE GENERAL RELATIVITY

Saturday, 22.08.2015

Round Table in Program XII-th Congress of the Ukrainian Astronomical Association
"From the History and Nowadays of Astronomy in Ukraine: New Books"

Convener Ya.S.Yatskiv

Shulga V. "DARK ENERGY AND DARK MATTER" (in 3 volumes, issued in 2013-2015)

Balyshev M., Vavilova I., Smirnov V. POKROVSKY'S LAWSUIT IN THE ARCHIVES OF THE SECURITY SERVICE OF UKRAINE (photo report)

Yatskiv Ya., Volvach A. HISTORY OF THE VLBI RESEARCH IN UKRAINE (presentation of the new book)

Novosyadlyj B. "THE UKRAINIAN SKY"/ ed. O.Petruk (presentation of the new book issued in L'viv)

Smirnov V. Reprinted book "ENTERTAINING SKETCHES ABOUT METEORITES" by I.S.Astapovich issued in 1939

SECTION SESSIONS

COSMOLOGY, GRAVITATION, ASTROPARTICLE PHYSICS, HIGH ENERGY PHYSICS

Monday, 17.08.2015

14.30 – 16.10 Section session «Gravitation» (Conference Room in “Chernomorka”, 2 floor)

Convener A.Zhuk

1. *Shtanov Yu.V.* PURE-CONNECTION THEORY OF GRAVITY (20 min)
2. *Zaslavskii O.B.* HIGH ENERGY PARTICLE COLLISIONS NEAR BLACK HOLES (20 min)
3. *Tanatarov I.V., Zaslavskii O.B.* BANADOS-SILK-WEST EFFECT WITH NON-GEODESIC (20 min) PARTICLES
4. *Chopovsky A.V., Eingorn M.V., Zhuk A.I.* PROBLEMATIC ASPECTS OF KALUZA-KLEIN MODELS WITH EINSTEIN INTERNAL SPACES (20 min)
5. *Gladush V.D.* THE MODEL FOR FINAL STAGE OF GRAVITATIONAL COLLAPSE MASSLESS SCALAR FIELD (20 min)

16.10 – 16.30 Coffee break

16.30 – 17.45 Section session «Gravitation» (Conference Room in “Chernomorka”, 2 floor)

6. *Turinov A.N.* A PROBLEM OF COSMOLOGICAL TIME IN THE DE SITTER SPACE-TIME (15 min)
7. *Olyeynik V.P.* ON GRAVITATIONAL SOLITARY WAVES WITH ROTATION IN GR (15 min)
8. *Novák Jan* MATHEMATICAL THEORY OF PERTURBATIONS IN EXTENSIONS OF GENERAL RELATIVITY (15 min)
9. *Rasulova A.M.* THE PROPERTIES OF TIDAL FORCES IN THE KERR METRIC (15 min)
10. *Shaymatov S.R.* THE EFFECT OF A TEST MAGNETIC FIELD ON THE PROCESS OF OVERSPINNING A ROTATING BLACK HOLE (15 min)

17.45 – 18.10 Posters

1. *Gladush V.D.* FIVE-DIMENSIONAL BOOSTS AND ELECTRIC FIELD IN THE KALUZA-KLEIN THEORY
2. *Brilenkov R.D., Eingorn M.V., Zhuk A.I.* DISCRETE COSMOLOGY APPLICATION CONCERNING DARK MATTER HALOS
3. *Murnikov B.A., Olyeynik V.P.* ROTATION CURVES OF GALAXIES AND RESTRICTIONS ON ISLAND MODEL PARAMETERS IN GR
4. *Bukalov A.V.* THE DOMINANCE OF DARK ENERGY LEADS TO REDUCTION OF THE ENTROPY OF GALAXIES FLOW AND ENTROPY OF THE UNIVERSE
5. *Balitsky Ja.* QUANTUM ORIGIN OF SUPPRESSION FOR VACUUM FLUCTUATIONS OF ENERGY

Tuesday, 18.08.2015

14.30 – 16.00 Section session «HEP» (Conference Room in “Chernomorka”, 2 floor)

Convener Yu.Shtanov

1. *Pankov A.A.* PRECISE DETERMINATION OF $Z-Z'$ MIXING AT THE CERN LHC (20 min)
2. *Pashitskii E.A., Pentegov V.I.* “BIG BANG” AS A RESULT OF THE CURVATURE-DRIVEN FIRST-ORDER PHASE TRANSITION IN THE EARLY COLD UNIVERSE (20 min)
3. *Pashitskii E.A.* ON THE MECHANISM OF THE MAGNETOHYDRODYNAMIC VORTICES FORMATION IN SOLAR CHROMOSPHERE (20 min)
4. *Fedorov Yu.I., Shakhov B.A., Kolesnyk Yu.L.* THE EVOLUTION OF SPECTRA OF ENERGETIC PARTICLES ACCELERATED IN SOLAR FLARES (15 min)
5. *Fedorov Yu.I., Gnatyk R.B., Hnatyk B.I., Kolesnyk Yu.I., Shakhov B.A., Zhdanov V.I.* THE DYNAMICS OF SPECTRUM OF ULTRA HIGH ENERGY COSMIC RAYS FROM NEARBY SOURCE (15 min)

16.00 – 16.30 Coffee break

16.30 – 17.30 Section session «HEP» (Conference Room in “Chernomorka”, 2 floor)

6. *Iakubovskiy D.A.* MEASUREMENT of an EXTRA EMISSION LINE at 3.5 keV in X-ray SPECTRA of DARK MATTER-DOMINATED OBJECTS (15 min)
7. *Savchenko D.O., Iakubovskiy D.A.* IDENTIFYING DECAYING DM TARGETS USING WAVELET SLIDING WINDOW TECHNIQUE (15 min)
8. *Moskaliuk S.S.* MULTISCALE MODELING IN NONCOMMUTATIVE ASTROPARTICLE PHYSICS (15 min)
9. *Zavestovskaya I.N.* THEORETICAL MODELING OF LASER FRAGMENTATION OF MEYAL NANOPARTICLES (15 min)

17.30 – 18.00 Posters

1. *Ivanchenko I.* VACUUM CURRENT AND MAGNETIC FIELD INDUCED BY AN IMPENETRABLE MAGNETIC FLUX TUBE
2. *Igdi-Sen M.* LOCATIONS of STARBURST GALAXIES IN CFHTLS W4
3. *Panko E., Emelyanov C.* THE DETERMINATION OF THE MORPHOLOGICAL TYPES OF GALAXY CLUSTERS USING CLUSTER CARTOGRAPHY
4. *Gotsulyak A.* THE ROLE OF BRIGHT GALAXIES IN OPEN GALAXY CLUSTERS OF PF CATALOGUE
5. *Panko E., Pugachov M.* THE MORPHOLOGY TYPES OF PF GALAXY CLUSTERS IN SUPERCLUSTERS

Wednesday, 19.08.2015

14.30 – 16.00 Section session «Cosmology» (Conference Room in “Chernomorka”, 2 floor)

Convener S.Parnovsky

1. *Shulga V.M., Kotvytskiy A.T.* GRAVITATIONAL LENSING ON COSMIC STRING AND ANTI-STRING (15 min)
2. *Rusov V.D., Eingorn M.V., Smolyar V.P.* AXION MECHANISM OF SUN LUMINOSITY VARIATIONS: LIGHT SHINING THROUGH THE RADIATION ZONE (15 min)
3. *Zhdanov V.I., Sliusar V.M., Fedorova E.V., Alexandrov A.N., Del Popolo A., Surdej J.* OBSERVATIONAL MIMICRY OF EXTENDED MASSES AS GRAVITATIONAL MICROLENSSES (15 min)
4. *Novosyadlyj B., Tsizh M., Kulinich Yu.* DYNAMICS OF SCALAR FIELD DARK ENERGY IN THE EXPANDING UNIVERSE AND IN THE GRAVITATIONALLY BOUND SYSTEMS (15 min)
5. *Parnovsky S.S.* BIG RIP AND OTHER SINGULARITIES IN HOMOGENEOUS COSMOLOGICAL MODELS WITH ARBITRARY EQUATION OF STATE (15 min)
6. *Avsajanishvili O.N.* COSMOLOGICAL TESTS OF DARK ENERGY (15 min)

16.00 – 16.20 Coffee break

16.20 – 18.20 Section session «Cosmology» (Conference Room in “Chernomorka”, 2 floor)

7. *Sergijenko O.* PRIMORDIAL GRAVITATIONAL WAVES IN COSMOLOGICAL MODELS WITH DYNAMICAL DARK ENERGY (15 min)
8. *Magd Kahil* STABILITY OF STELLAR SYSTEMS ORBITING Sgr A* (15 min)
9. *Tugay A.V.* HYDRODYNAMICAL SIMULATION OF SINGLE GALAXY FILAMENT (15 min)
10. *Bannikova E.Yu.* CLOUDS DISTRIBUTION IN OBSCURING TORI OF ACTIVE GALACTIC NUCLEI (15 min)
11. *Igdi-Sen M.* THE VELOCITIES OF IRREGULAR GALAXIES HAVE z_s VALUES IN CFHTLS W4 (15 min)
12. *Panko E., Gutsulyak A., Andrievsky S.* THE RICH PF GALAXY CLUSTERS WITH DIFFERENT GALAXY POPULATION (15 min)
13. *Vasylenko A.A., Vavilova I.B., Babyk Iu.V., Pulatova N.G.* X-RAY PROPERTIES OF THE ISOLATED LOW LUMINOSITY AGNs (15 min)
14. *Dobrycheva D.V., Melnyk O.V., Vavilova I.B., Elyiv A.A.* SINGS OF MERGING IN THE FORMATION OF EARLY-TYPE GALAXIES (15 min)

ASTROPHYSICS

Monday, 17.08.2015

14.30 – 16.00 Section session «Stellar Atmospheres» (Conference Room in “Chernomorka”, 1 floor)

Convener T.Mishenina

1. *Gopka V., Vasileva S., Shavrina A., Yushchenko V., Yushchenko A., Andrievsky S.* THE RESULTS OF ANALYSIS OF R- AND S-PROCESS ELEMENT ABUNDANCES IN THE ATMOSPHERES OF MAGELLANIC CLOUDS RED SUPERGIANTS
2. *Ismailov N.Z., Khalilov O.V., Bahaddinova G.R.* HE I 5876 LINE STRUCTURE IN THE SPECTRA OF IL CEP A
3. *Kuznyetsova Yu., Vidmachenko A., Matsiaka O., Shliakhetskaya Y., Krushevskaya V.* RESEARCHES OF LONG-TERM VARIATIONS IN SPECTRA OF URANUS AND NEPTUNE
4. *Y.M.Maharramov* SPECTRAL VARIABILITY OF THE STAR HD142983 (48 LIB)
5. *Yushchenko A.V., Vasileva S.V., Gopka V.F.* THE SPECTRAL INVESTIGATION OF BETELGEUSE
6. *Yushchenko V., Yushchenko A., Gopka V., Shavrina A., Kovtyukh V., Mkrtychian D., Hong K.S.* HIP 13962 – THE POSSIBLE FORMER MEMBER OF BINARY SYSTEM WITH SUPERNOVA
7. *Mishenina T., Paramonova O.* SULFUR ABUNDANCES BEHAVIOUR IN THE STARS OF GALACTIC DISC

16.00 – 16.30 Coffee break

16.30 – 18.00 Section session «Binary stars» (Conference Room in “Chernomorka”, 1 floor)

Convener N.Ismailov

8. *Andrych K.D., Andronov I.L., Chinarova L.L., Marsakova V.I.* "ASYMPTOTIC PARABOLA" FITS FOR SMOOTHING GENERALLY ASYMMETRIC LIGHT CURVES
9. *Babyk Iurii* THE X-RAY OBSERVATIONS OF THE BINARY SYSTEM PSR B1259-63/LS 2883 AROUND THE 2014 PERIASTRON PASSAGE
10. *Bobrov O.A., Andronov I.L.* STATISTICALLY OPTIMAL APPROXIMATIONS OF OVERLAPPED STELLAR IMAGES USING SUPERPOSITIONS OF RELATIVELY SHIFTED 2D GAUSSIAN FUNCTIONS
11. *Breus V., Hric L., Kundra E., Petrik K.* NEW RESULTS FROM BY-PRODUCTS OF THE LONG-TERM MONITORING OF THE INTERMEDIATE POLARS
12. *Marsakova V.I., Tvardovskyj D.E., Andronov I.L.* PERIOD CHANGES OF β LYRAE-TYPE ECLIPSING BINARY STARS
13. *Sergienko O., Panko E.* THE OBSERVATION OF V724 AQL IN THE KALINENKOV ASTRONOMICAL OBSERVATORY IN 2013 AND 2015
14. *Tkachenko M.G., Andronov I.L., Chinarova L.L.* REVISION OF THE PHENOMENOLOGICAL CHARACTERISTICS OF THE ALGOL-TYPE STARS USING THE NAV ALGORITHM

Tuesday, 18.08.2015

14.30 – 16.00 Section session (Conference Room in "Chernomorka", 1 floor)

Convener I.Andronov

1. *Shulga V.M., Antyufeev A.V.* CAN A STAR BIRTH DESTROY THE HOST MOLECULAR CLOUD?
2. *Gronowski Marcin, Turowski Michał, Custer Thomas, Szczepaniak Urszula, Kołos Robert* ISOMERIC VARIETIES OF INTERSTELLAR MOLECULES: THEORETICAL AND EXPERIMENTAL STUDIES
3. *Ikhsanov N.R., Kim V.Yu.* ORIGIN OF THE ISOLATED NEUTRON STAR WITH ANOMALOUSLY LONG PERIOD 6.7HR
4. *Ismailov N.Z.* LIGHT CURVE TYPES OF T TAURI STARS
5. *Kondratyev V.N., Korovina Yu.V.* NUCLEAR MAGICS AT MAGNETOROTATIONAL SUPERNOVA EXPLOSION
6. *K.S.Kuratov, A.S. Miroshnichenko, A.V.Kusakin, N.Sh.Alimgazinova, A.K.Kuratova* A STUDY OF MASS LOSS AND DUST FORMATION NEAR HOT STARS
7. *Kuratov K.S., Zakhzhay V.A., Miroshnichenko A.S., Zakhzhay O.V.* IRAS 22150+6109: A POORLY STUDIED YOUNG STAR

16.00 – 16.30 Coffee break

16.30 – 18.00 Section session (Conference Room in "Chernomorka", 1 floor)

Convener V.Zakhzhay

8. *Moiseenko S.G.* CORE-COLLAPSED SUPERNOVAE. MAGNETIC FIELD AND ROTATION
9. *Zakhzhay V.A., Kuratov K.S., Maylybayev A.T.* THE DESCRIPTION OF CASCADE FRAGMENTATION IN PROTOSYSTEMS WITH SMALL ANGULAR MOMENTUM WITH GRAPHS
10. *Bodryagin D., Maigurova N.* RESULTS OF DOUBLE STARS OBSERVATIONS AT RI NAO TELESCOPES
11. *Gorbar E.V., Rudenok Igor, Vilchinskii S.I.* MAGNETIC FIELDS AND CHIRAL ASYMMETRY IN PRIMORDIAL PLASMA
12. *Kryvdyk V.G.* NONTHERMAL ELECTROMAGNETIC RADIATION FROM STARS
13. *Oknyansky V.L., Gaskell C.M.* THE RELATIVE WAVELENGTH INDEPENDENCE OF IR LAGS IN AGNS: IMPLICATIONS FOR THE DISTRIBUTION OF THE HOT DUST
14. *Siparov S., Samodurov V., Laptev G.* PERIODIC COMPONENTS IN SPACE MASER SIGNAL – OBSERVATIONS AND INTERPRETATION

Posters:

1. *Kashuba S.V.* INVESTIGATION OF DIFFUSE INTERSTELLAR BANDS OF ORGANIC MOLECULES IN THE SPECTRA OF CEPHEID STARS
2. *Nazarenko V.V., Nazarenko S.V.* THREE-DIMENSIONAL NUMERICAL HYDRO-DYNAMICAL SIMULATION OF ON- AND OFF-STATES IN ACCRETION DISCS OF MICROQUASARS AND QUASARS ON BASE OF INDEFINITE PRECESSION

SUBSECTION
"VIRTUAL OBSERVATORY AND INTENSIVE DATA"

Friday, 21.08.2015

14.30 – 16.00 Section session (Conference Room in "Chernomorka", 1 floor)

Convener I.Vavilova

1. *Akhmetov V.S., Fedorov P.N., Velichko A.B.* THE CATALOGUE XPM2
2. *Akhmetov V.S., Fedorov P.N., Shulga V.M.* THE KINEMATICS PARAMETERS OF THE GALAXY USING DATA OF MODERN ASTROMETRIC CATALOGUES
3. *Protsyuk Yu.I., Kovalchuk A.N.* CREATION OF LARGE CATALOGUES BY USING OF VIRTUAL OBSERVATORIES
4. *Andruk V., Golovnya V., Ivanov G., Yizhakevych E., Pakuliak L., Protsyuk Yu., Shatokhina S.* CATALOG OF POSITIONS AND B MAGNITUDES OF STARS IN THE CIRCUMPOLAR REGION OF NORTHERN SKY SURVEY (FON) PROJECT
5. *Andruk V.M., Protsyuk Yu.I., Muminov M.M., Ehgamberdiev Sh.A., Yuldoshev Q.X., Relke H., Golovnya V.V., Vavilova I.B.* COMPARISON OF ZERO ZONE CATALOGS OF THE FON PROGRAM BASED ON THE KYIV AND KITAB OBSERVATIONS
6. *Gorbunov M.A., Shlyapnikov A.A.* IDENTIFICATION AND ANALYSIS OF OBJECTS FROM THE BRODSKAYA'S (B1963) AND RAZNIK'S (R1963) CATALOGS

16.00 – 16.30 Coffee break

16.30 – 18.00 Section session (Conference Room in "Chernomorka", 1 floor)

7. *Golovnya V.V., Andruk V.M., Vavilova I.B., Pakuliak L.K.* CATALOGUES OF THE FAINT OBJECTS AROUND AREAS WITH GAMMA-RAY BURSTS
8. *Elizarova N.V., Gorbunov M.A., Shlyapnikov A.A.* SCANNING, CALIBRATION AND EXAMPLES OF OPERATION WITH A DIGITAL VERSION OF ARCHIVE SBPOSS
9. *Shlyapnikov A.A.* ANALYSIS OF THE FLARE ACTIVITY OF STARS FROM THE GTSH10 CATALOG
10. *Protsyuk Yu., Andruk V., Kovylianska O., Protsyuk S., Yizhakevych O., Kashuba S., Kazantseva L.* DATA PROCESSING OF PLATES CONTAINING IMAGES OF URANUS AND NEPTUNE FROM UKRVO DIGITAL ARCHIVE: STRUCTURE, QUALITY ANALYSIS
11. *Yizhakevych O.M., Andruk V.M., Pakuliak L.K.* CATALOG OF ASTRONOMICAL POSITIONS OF SATURN'S MOONS, OBTAINED BY PHOTOGRAPHIC OBSERVATIONS ON MAO NASU IN 1961-1991

Posters:

1. *Protsyuk Yu.I., Andruk V.M., Relke H.* THE COMPILE CATALOGUE OF PHOTOVOLTAIC UBVR MAGNITUDES OF STARS IN THE TYCHO2 SYSTEM
2. *Kazantseva L.V., Andruk V.M., Shatokhina S.V., Protsyuk Yu.I., Eglitis I., Eglite M.* RESEARCH OF THE LONG-TERM BEHAVIOUR OF THE PLEIADES BY USING OF PHOTOGRAPHIC PLATES FROM UKRVO and LVO DIGITAL ARCHIVES
3. *Protsyuk Yu., Andruk V., Mazhaev A., Kovylianska O., Protsyuk S., Golovnya V.* DETERMINATION OF PROPER MOTIONS OF CIRCUMPOLAR STARS BY USING IMAGES FROM UKRVO PLATE ARCHIVES
4. *Zolotukhina A.V.* OBSERVATIONAL CCD-ARCHIVE OF STAR'S POSITIONS IN EQUATORIAL ZONE OF THE SKY
5. *Martynov M.V.* CROSS-MATCHING OF VERY LARGE CATALOGS

RADIOASTRONOMY

Wednesday, 19.08.2015

14.30 – 16.00 Section session (Conference Room in “Chernomorka”, 1 floor)

Convener O.Lytvynenko

1. *Zakharenko V.V., Kravtsov I.P., Vasyliieva I.Y., Ulyanov O.M., Shevtsova A.I., Skoryk A.O., Mykhailova S.S., Konovalenko O.O., Zarka P.* THE FIRST RESULTS OF TRANSIENT SIGNAL PROCESSING IN DECAMETER PULSAR/TRANSIENT SURVEY OF NORTHERN SKY
2. *Miroshnichenko A.P.* GALAXIES AND QUASARS WITH STEEP RADIO SPECTRUM AT RADIO LUMINOSITY-SIZE DIAGRAM
3. *Shepelev V.A., Vashchishin R.V., Lozinskyy A.B., Lytvynenko O.A.* OBSERVATIONS OF PULSARS WITH THE URAN AT DECAMETER WAVELENGTHS
4. *Tsvyk N.O.* ON THE ELECTRON-PROTON COSMIC RAYS AS MEDIATORS OF VISCOUS FORCES THAT CREATE SHOCK FRONT AND VORTEX STRUCTURES IN THE COCOON OF RADIO GALAXIES
5. *Vasilenko N.M., Sidorchuk M.A.* DIFFERENTIATION OF RADIO EMISSION AT DECAMETER WAVELENGTHS
6. *Stanislavsky A.A., Konovalenko A.A., Volvach Ya.S., Koval A.A.* GROUP OF SOLAR TYPE III BURSTS WITH HIGH-FREQUENCY CUTOFF
7. *Dumsky D.V., Isaev E.A., Samodurov V.A.* MONITORING THE COMMUNICATION CHANNEL FROM PUSCHSHINO TO MOSCOW IN THE PROJECT OF SPACE RADIO TELESCOPE "RADIOASTRON"

16.00 – 16.30 Coffee break

16.30 – 18.00 Section session (Conference Room in “Chernomorka”, 1 floor)

8. *Samodurov V.A., Rodin A.E., Kitaeva M.A., Isaev E.A., Dumskij D.V., Pugachev V.D., Churakov D.D., Manzyuk M.O.* THE DAILY 110 MHZ SKY SURVEY (BSA FIAN): ON-LINE DATABASE, SCIENCE AIMS AND FIRST RESULTS OF DATA PROCESSING
9. *Sukharev A., Ryabov M., Aller M.* VARIABILITY DYNAMICS OF THE QUASAR 3C454.3 AND FORECAST CHANGES IN THE RADIO FLUX BASED ON ITS QUASIPERIODIC OSCILLATIONS
10. *Donskykh G.I., Ryabov M.I., Sukharev A.L., Aller M.F.* THE STUDY OF EXTRAGALACTIC SOURCES 3C 446 AND 3C 345 WITH USING THE SINGULAR SPECTRUM ANALYSIS AND WAVELET ANALYSIS
11. *Lytvynenko O.A., Panishko S.K.* SEASONAL VARIATIONS OF THE IONOSPHERE SCINTILLATIONS PARAMETERS OBTAINED FROM THE LONG OBSERVATIONS OF THE POWER COSMIC RADIO SOURCES AT THE DECAMETER WAVE RANGE
12. *Lytvynenko O., Lytvynenko I., Derevyagin V.* RAPID VARIATIONS OF GPS-COORDINATE ERRORS AND THE IONOSPHERE TURBULENCE
13. *Gorbunov A.A., Ryabov M.I., Panishko S.K.* SECULAR DECREASE THE FLUX OF SUPERNOVA REMNANT CAS A ON MONITORING RESULTS TO TELESCOPE “URAN-4” IRA NASU

SUN, SOLAR ACTIVITY AND ASTROBIOLOGY

Thursday, 20.08.2015

14.30 – 16.00 Section session (Conference Room in “Chernomorka”, 1 floor)

Convener V.Efimenko

1. *Krivodubskij V.N.* DOUBLE MAXIMA IN 11-YEAR SOLAR CYCLES
2. *Leiko U.M.* LONG-TERM CHANGES OF ASYMMETRY OF SOLAR ACTIVITY
3. *Ryabov M.I., Sukharev A.L.* THE MAIN PROPERTIES OF THE ACTIVITY OF THE NORTHERN AND SOUTHERN HEMISPHERES IN 23-24 SOLAR CYCLES
4. *Lozitsky V.G., Gordovskyy M.* DIAGNOSTICS OF SPATIALLY UNRESOLVED MAGNETIC FIELDS IN SOLAR FLARES AND SUNSPOTS
5. *Lozitsky V., Masliukh V., Botygina O.* MAGNETIC FIELDS IN PROMINENCES AND LIMB FLARES ON THE SUN
6. *Osipov S.N., Lozitsky V.G.* SIMULTANEOUS MAGNETIC FIELD MEASUREMENTS IN SUNSPOTS USING FIVE SPECTRAL LINES OF MNI, FEI AND NII
7. *Pishkalo M.I., Leiko U.M.* SUN'S POLAR MAGNETIC FIELD REVERSALS IN SOLAR CYCLE 24

16.00 – 16.30 Coffee break

16.30 – 18.00 Section session (Conference Room in “Chernomorka”, 1 floor)

8. *Lozitska N.Y.* PROBLEM OF MISTAKES IN DATABASES, PROCESSING AND INTERPRETATION OF OBSERVATIONS OF THE SUN
9. *Galanin V.V., Isaeva E.A.* EVALUATION OF CORONAL SHOCK WAVE VELOCITIES FROM THE II TYPE RADIO BURSTS PARAMETERS
10. *Kravetz R.O., Galanin V.V.* PECULIARITIES OF IONOSPHERE LAYERS PARAMETERS SEASON VARIATIONS DURING THE SOLAR ACTIVITY MAXIMUM
11. *Gromozova E.N., Kachur T.I., Voychuk S.I., Kharchuk M.S.* THE REACTION OF PHOSPHORUS-CONTAINING INTRACELLULAR INCLUSIONS ON THE CHANGE OF SPACE WEATHER
12. *Rudenchik E., Ragulskaya M., Obridko V., Hramova E., Gromozova E.* FACTORS OF SPACE WEATHER AND BIOSPHERE: THE DYNAMICS IN 23–26 CYCLES OF SOLAR ACTIVITY
13. *Parshina S.S., Samsonov S.N., Manykina V.I., Afanasyeva T.N., Petrova P.G., Petrova V.D., Strekalovskaya A.A., Tokayeva L.K., Kaplanova T.I., Potapova M.V.* PECULIARITIES OF A GROUP RESPONSE OF CARDIOVASCULAR SYSTEM OF VOLUNTEERS AT DIFFERENT LATITUDES TO CHANGES OF SPACE WEATHER PARAMETERS
14. *Shakhov B.A., Fedorov Yu.I., Kolesnyk Yu.L., Gromozova H.N., Vyshnevsky V.V., Sychev A.S.* GALACTIC COSMIC RAYS AS ONE OF THE MAIN POSSIBLE FACTORS OF THE INFLUENCE OF SPACE WEATHER ON EARTH'S BIOSPHERE PROCESSES AT THE CELLULAR LEVEL

Posters:

1. *Galanin V.V., Isaeva E.A.* CONNECTION BETWEEN THE CME VELOCITIES AND DECAMETER RADIO BURSTS PARAMETERS FROM URAN-4 OBSERVATIONS
2. *Kravetz R.O., Galanin V.V.* IONOSPHERE EFFECTS ON ST PATRICK'S DAY

SOLAR SYSTEM

Thursday, 20.08.2015

14.30 – 16.00 Section session (Conference Room in “Chernomorka”, 2 floor)

Convener N.Koshkin

1. *Sidorenkov N.S.* SYNCHRONIZATION OF TERRESTRIAL PROCESSES WITH FREQUENCIES OF THE EARTH-MOON-SUN SYSTEM
2. *Bizouard Christian.* ELLIPTICAL POLARISATION OF THE EARTH'S POLAR MOTION EXCITATION
3. *Ibadov Subhon.* ON THE POSSIBILITY OF APPEARANCE OF HOT PHASE IN COMETS
4. *Churyumov K.I., Ponomarenko V.O., Kleschonok V.V.* THE PHYSICAL PARAMETERS OF THE GAS AND DUST IN COMETARY ATMOSPHERES
5. *Kleshchonok V.V., Luk'yanyk I.V., Gorbaney Yu.M., Kashuba V.I., Nysenko R.O.* PHOTOMETRY OF PLASMA TAIL OF THE COMET C/2014 Q2 (LOVEJOY)
6. *Mozgova A.M., Churyumov K.I., Borovichka J., Gorbaney Yu.M.* THE COMPARATIVE ANALYSIS OF METEOR SPECTRA PROCESSING

16.00 – 16.30 Coffee break

16.30 – 18.30 Section session (Conference Room in “Chernomorka”, 2 floor)

7. *Golubaev A.V.* A TECHNIQUE FOR CALCULATING THE BASIC KINEMATIC PARAMETERS OF METEORS BASED ON THE SUPER-LONG STATION OBSERVATIONS (~152 km)
8. *Zhantayev Zh.Sh., Kuratov K.S., Alimgazinova N.Sh., Beisebayeva A.S., Nauryzbayeva A.Zh., Kuratova A.K.* THE RESEARCH OF PHOTOMETRIC CHARACTERISTICS AND ORBITS OF COMETS AND ASTEROIDS APPROACHING THE EARTH
9. *Kleshchonok V.V., Buromsky M.I., Mazur V.Jo.* TELEVISION OBSERVATION OF STAR OCCULTATION BY THE MOON IN 2014
10. *Pomazan A.V., Maigurova N.V., Kryuchkovskiy V.F.* THE RESULTS OF OBSERVATIONS OF MUTUAL PHENOMENA OF THE GALILEAN SATELLITES OF JUPITER IN 2009 AND 2015 IN NIKOLAEV ASTRONOMICAL OBSERVATORY
11. *Troianskiy V., Andruk V., Bazyey A., Kashuba V., Yizhakevych E., Zhukov V.* THEORY OF MOTION OF SELECTED SATURN'S SATELLITES
12. *Koshkin N., Shakun L., Korobeynikova E., Melikyants S., Strakhova S., Dragomiretsky V., Ryabov A., Golubovskaya T., Terpan S.* REMOTE SENSING OF THE SATELLITE ROTATION AROUND CENTER OF MASS USING PHOTOMETRY
13. *Komendant V.H., Koshkin N.I., Ryabov M.I., Sukharev A.L.* STUDY OF QUASI-PERIODIC VARIATIONS IN DRAG OF ARTIFICIAL SATELLITE AND EFFECTS OF SPORADIC CHANGES DURING 23–24 SOLAR CYCLES
14. *Sukharev A.L., Ryabov M.I., Orlyuk M.I., Romenets A.A., Sobitnyak L.I.* GEOMAGNETIC FIELD VARIATIONS IN THE AREA OF ODESSA REGIONAL MAGNETIC ANOMALY

Posters:

1. *Ivanenko N., Bazyey A.* KINEMATICS MOTION OF SOME BINARY NEAR-EARTH ASTEROIDS
2. *Ivanova O., Lukyanyk I., Shubina E., Kiselev M.I., Afanasiev V.* SOME PHYSICAL PARAMETERS OF THE COMET 103P/HARTLEY2
3. *Kazanetseva L.V., Yizhakevich E.M., Muminov M.M., Ehgamberdiev Sh.A., Kahharov B.B.* REPROCESSING OF LUNAR OCCULTATIONS OBSERVATIONS MADE IN UZBEKISTAN DURING 1882-1996

GAMOW'S COSMOLOGY

P. J. E. Peebles

Princeton University, Princeton NJ 08544, USA

An essay written by James Peebles especially for the Gamow Conference

George Gamow's distinctive style of research is illustrated by the history of three papers on cosmology published in 1948. The first, by Alpher, Bethe and Gamow, is celebrated but wrong. The second and third, by Gamow, correct the problem by introducing basic elements of the now established theory of cosmic evolution, including the presence of a sea of thermal radiation, the primeval abundances of helium and deuterium, and the formation of the galaxies.

George Gamow's deep physical insight, intuition and imagination, along with an inclination to leave the smaller details to others, is well illustrated by his research in cosmology that led to the paper by Alpher, Bethe and Gamow (1948), which is celebrated but wrong, and the papers by Gamow (1948a,b), which corrected the problem by introducing basic elements of the now established theory of cosmic evolution from a hot dense early state of expansion of the observable universe. This essay, on the occasion of the 111th anniversary of Gamow's birth in Odessa, draws from and enlarges on the discussion in Peebles (2014).

Gamow's cosmology is foreshadowed in part by analyses of the idea that the relative abundances of the chemical elements may have been determined by relaxation to Saha equilibrium at temperatures in the range of 10^9 to 10^{10} K (von Weizsäcker 1938; Chandrasekhar and Henrich 1942; Klein, Beskow and Treffenberg 1946; and others). It was supposed that this might happen in extreme conditions in stars, or else that, as Chandrasekhar and Henrich put it, “the cause of the original expanding and cooling . . . may be connected with the beginning of the expansion of the universe.” In the case of the latter picture these early discussions did not note that their application of the Saha relation implicitly assumed that the early universe was filled with a sea of thermal radiation, and there was no consideration of the rate of expansion of the universe. Gamow (1942) seems to have been the first to remark on the latter, and to note that in an expanding universe one may have to consider non-equilibrium element formation processes. Gamow (1946) was more explicit, writing that in the relativistic Friedman-Lemaître model the large mass density in the early stages of expansion of the universe requires rapid expansion, making it “very dangerous to speak about an equilibrium state”. Gamow (1946) suggested instead that in the very early universe free neutrons “were gradually coagulating into larger and larger neutral complexes which later turned into various atomic species by subsequent processes of β -emission.”

Gamow (1935) had earlier discussed the general idea of element buildup by radiative capture of neutrons, though applied to reactions in stars. We see later evolution of his thinking in the book on nuclear physics by Gamow and Critchfield (1949). (The book was published in 1949, but as will be discussed the text of interest was written no later than early 1948). Chapter X §6 recalls the proposal that the elements grew “as aggregations of neutrons”, and presents an expression for buildup of the elements by successive neutron captures,

$$\frac{dN_i}{dt} = N_0 v (\sigma_{i-1} N_{i-1} - \sigma_i N_i), \quad (i = 1, 2, 3, \dots), \quad (1)$$

where N_i is the relative abundance of species with atomic weight i . Beta decays were presumed to keep the neutron-to-proton ratio close the valley of stability. A footnote in the book states that “More detailed calculations on this non-equilibrium process are being carried out by R. A. Alpher and will be published in due course.”

Numerical solutions of equation (1) were the subject of Alpher’s (1948a) doctoral dissertation. Since the illustration of the nature of the solution in Gamow and Critchfield (1949) is much more crude than in Alpher’s thesis, I take it that the footnote mentioning Alpher was written when he was not very far along in his thesis research. The evidence is that Alpher deserves credit for finding measurements of neutron radiative capture rates $\sigma_i v$ for “MeV reactor neutrons,” and for using a smooth fit of $\sigma_i v$ as a function of i in the computation of numerical solutions to equation (1), not an easy task in those days. Alpher’s parameter to be adjusted for the best fit to the measured relative abundances is the time integral of the neutron number density $n(t)$. Alpher (1948a) found that the integrated exposure

$$\int_{t_0}^{\infty} n(t) dt = 0.81 \times 10^{18} \text{ s cm}^{-3} \quad (2)$$

produces a reasonable fit to the trend of measured abundances with atomic weight i , under the important assumption that the smooth approximation to $\sigma_i v$ as a function of i is warranted.

I arrive now at the paper Alpher, Bethe and Gamow (1948). It is known for Gamow’s addition of Hans Bethe to the author list so as to produce an approximation to α, β, γ . It is rightly celebrated as a step toward our now established cosmology. But the paper is wrong. The paper states that “In order to fit the calculated curve with the observed abundances it is necessary to assume that the integral of $\rho_n dt$ during the building-up period is”

$$\int_{t_0}^{\infty} \rho_n dt = 5 \times 10^4 \text{ g s cm}^{-3}. \quad (3)$$

The corresponding value of the integral of the baryon number density is

$$\int_{t_0}^{\infty} n(t) dt \sim 3 \times 10^{28} \text{ s cm}^{-3}, \quad (4)$$

some ten orders of magnitude larger than Alpher’s fit in equation (2).

We have a direct check that equation (3) is not a misprint. In a Friedman-Lemaître model dominated by non-relativistic baryons the time integral of the mass density agrees equation (3) if $t_0 = 20$ sec, the value stated in Alpher, Bethe and Gamow (1948).

The large value of equation (4) relative to (2) means that as protons are produced by neutron decay they would be promptly captured by neutrons to produce deuterons and

heavier elements, leaving little hydrogen. This is quite contrary to what was known then about the composition of stars (as reviewed in Haramundanis 1996 and Trimble 2010 p. 92). One could choose the starting time t_0 for nucleosynthesis to be just such that a substantial but not total fraction of the neutrons had decayed before nucleosynthesis commenced, so we would be left with a significant mass fraction in hydrogen, but this awkward arrangement rightly has received no attention.

Alpher (1948a) pointed out the vast discrepancy between equations (2) and (4) in his thesis. Gamow (1949) pointed it out in a paper in the *Reviews of Modern Physics*, a well-read journal. But apart from comments in later papers by Alpher and Herman, I have not been able to find a publication that takes notice of the problem in the many citations of Alpher, Bethe and Gamow (1948) prior to the book *Finding the Big Bang* (Peebles, Page and Partridge 2009). I share the fault in not noticing it earlier, and can only lament our often indifferent attention to our own history.

The Alpher, Bethe and Gamow (1948) paper is marked as received by *Physical Review* on 18 May. On 21 June the journal received the paper Gamow (1948a) that resolved problem and explained what determined the nucleosynthesis starting time t_0 . I take it as characteristic of Gamow’s style that he only notes that the integral of $\rho_n dt$ “was given incorrectly in the previous paper.” Gamow’s new proposal is that

Since the building-up process must have started with the formation of deuterons from the primordial neutrons and the protons into which some of these neutrons have decayed, we conclude that the temperature at that time must have been of the order $T_0 \simeq 10^9$ °K (which corresponds to the dissociation energy of deuterium nuclei)."

This statement requires analysis, again something I take to be characteristic of Gamow. What did he mean by “dissociation energy of deuterium nuclei”?

The binding energy of the deuteron, which is an order of magnitude larger than kT_0 at Gamow’s $T_0 \simeq 10^9$ °K, where k is Boltzmann’s constant, is stated and used in discussions of the nuclear force in Gamow (1937) and Gamow & Critchfield (1949). Thus I take it that by “dissociation energy” Gamow certainly did not mean the deuteron binding energy. He was familiar with the Saha relation; it was used in the computations by Chandrasekhar and Henrich (1942) reviewed in Gamow and Critchfield (1949). It will be recalled that in the established cosmology application of the Saha relation to the reactions



tells us that, since the dimensionless entropy per baryon is large, nucleosynthesis was suppressed until the temperature fell to a critical value close to Gamow's T_o , when the balance in equation (5) abruptly shifted from photodissociation of deuterium and heavier elements at $T \gtrsim T_o$ to suppression of photodissociation and accumulation of deuterium at $T \lesssim T_o$. Deuterium then became abundant enough to burn to heavier elements by particle exchange reactions. It seems clear that Gamow (1948a) had in mind this modern picture for how nucleosynthesis commenced, though I wish he had been more specific.

Alpher (1948a), in his thesis, presented the first published argument that in the element buildup picture the universe might be expected to have been filled with a sea of thermal radiation. He proposed that element buildup likely occurred at neutron kinetic temperature $T_o \sim 10^9$ K, because this avoids collisional dissociation at higher kinetic energy and it avoids resonances at lower energy that would spoil the general inverse relation between element abundance and neutron capture cross section. Alpher pointed out that neutrons at kinetic temperature $T_o \sim 10^9$ K might naturally be accompanied by thermal radiation at the same temperature, and that, if so, one would have to take account of the mass density in radiation, so that "An interpretation of the starting time and initial density for the neutron-capture process will therefore require the development of a new cosmological model." There is earlier precedent for the idea of the sea of thermal radiation in the studies of the Saha relation for element abundances (Von Weizsäcker 1938; Chandrasekhar and Henrich 1942, Klein, Beskow and Treffenberg 1946, and others). Although none of these authors stated it, the Saha relation applied in an expanding universe assumes the early universe was filled with a sea of thermal radiation. Still earlier, Tolman (1934, p. 427) had shown that a free sea of thermal radiation in a homogeneous and isotropic expanding universe would cool as the universe expands but preserve the thermal spectrum characteristic of the observed Cosmic Microwave Background radiation (the CMB). But the central point, that the radiation sets the time t_o for the onset of nucleosynthesis in an expanding Friedman-Lemaître cosmological model, appears for the first time in Gamow (1948a).

At high specific entropy the mass density in radiation in the early universe would have been well above the mass density in matter, as Alpher (1948a) had noted, so the expansion time would be determined by the radiation temperature. At $T_o = 10^9$ K the expansion time in the Friedman-Lemaître model is $t_o = 230$ sec. Gamow's (1948a) condition for significant but not excessive production of elements heavier than hydrogen is $\sigma v n_o t_o \sim 1$, where the nucleon number density at T_o is n_o , and v is the typical relative velocity of what are supposed to be comparable numbers of neutrons and protons. With " $\sigma \simeq 10^{-29}$ cm² the capture cross section of fast neutrons in hydrogen", Gamow (1948a) arrived at the baryon density at T_o ,

$$n_o \sim 10^{18} \text{ cm}^{-3} \text{ at } T_o \simeq 10^9 \text{ K.} \quad (6)$$

This is not far from the established value.

Gamow (1948a,b) recognized that the sea of radiation would have affected cosmic evolution after nucleosynthesis. He used the numbers in equation (6) to estimate the temperature at equality of mass densities in matter and radiation, $T \simeq 10^3$ K, which he recognized, perhaps by intuition, marks the start of the gravitational growth of clustering of matter (provided one can ignore the radiation drag on plasma). Gamow and Teller (1939) pointed out that the matter kinetic temperature determines the Jeans length at the minimum scale for gravitational growth of clustering of matter in the expanding universe. Gamow (1948b) had a temperature, and he used it to compute the Jeans mass, $M = 2.7 \times 10^7 M_\odot$, not far from the modern value. In the pioneering analysis of the growth of linear departures from the homogeneous Friedman-Lemaître model, Lifshitz (1946) concluded in the abstract that gravitational instability "cannot serve as centers of formation of separate nebulae or stars." The analysis was correct, but not the conclusion. Perhaps Gamow had not noticed the conclusion; perhaps he noticed and dismissed it. But Gamow proved to have been taking steps toward the modern picture of galaxy formation.

Alpher and Herman (1948a) concluded that "the temperature in the universe at the present time is found to be about 5° K." This is strikingly close to the measurement many years later, 2.726 K. This rightly celebrated statement calls for consideration of two points.

First, the predicted present temperature, T_{CMB} , of what we now identify as the CMB depends on the present baryon mass density,

$$T_{\text{CMB}} = T_o (\rho_{\text{present}} / \rho_o)^{1/3}, \quad (7)$$

where the baryon mass density is $\rho_o = m_n n_o$ at the start of nucleosynthesis at temperature $T_o \simeq 10^9$ K. Alpher, Gamow and Herman consistently used the present baryon density

$$\rho_{\text{present}} = 10^{-30} \text{ g cm}^{-3}. \quad (8)$$

I know of two citations that indicate the source. Gamow (1946) stated this density and, later in the paper, in connection with Hubble's constant, referred to Hubble (1936). Hubble (1936) used counts of nebulae, or galaxies, with masses derived from internal velocities, to find that the mean mass density is no less than 10^{-30} g cm⁻³, the value in equation (8). But Hubble found that the density could be as large 10^{-28} g cm⁻³ if he used the mean mass per galaxy derived from the Virgo Cluster. Alpher and Herman (1949) attributed the mass density in equation (8) to Hubble (1937), where it is reported that "the smoothed-out density of nebular material" is "between 10^{-29} and 10^{-30} grammes per cubic centimeter," a lower limit "because it ignores the matter that may lie between the nebulae." That is, Hubble was far less definite about the mass density than one might infer from the consistent use of

equation (8) by Alpher, Gamow and Herman. It is to be borne in mind also that Hubble's extragalactic distance scale was off by an order of magnitude. On the other hand, the considerable uncertainty in ρ_{present} translates to less uncertainty in T_{CMB} because it scales as the cube root of the density.

Second, Alpher and Herman differed from Gamow on how best to estimate n_o . Gamow chose n_o to permit significant but not excessive production of deuterium at the onset of nucleosynthesis, leaving for future work the details of how particle exchange reactions and further radiative captures would redistribute the mass to heavier elements. This allows a useful approximation to the mass fraction remaining as hydrogen. Alpher and Herman (1949) wrote that "We believe that a determination of the matter density on the basis of only the first few light elements is likely to be in error". They chose to adjust n_o at T_o to fit the broad run of relative element abundances with atomic weight i , in numerical solutions of the buildup equation (1) with the smoothed trend of $\sigma_i v$ with i . But Alpher (1948b) foresaw the failure of their approach: Element buildup beyond helium is suppressed by the absence of an acceptably long-lived nucleus of atomic weight 5. The suppression was confirmed by Enrico Fermi and Anthony Turkevich, as reported by Gamow (1949) and in more detail by Alpher and Herman (1950).

Table 1: Estimates of the CMB Temperature

$\rho_o, \text{ g cm}^{-3}$	$T_{\text{CMB}}, \text{ K}$	
2.0×10^{-6}	8	Gamow 1948a
1.4×10^{-7}	19	Alpher and Herman 1948a
5×10^{-9}	60	Alpher and Herman 1948b
4.8×10^{-6}	5.9	Alpher and Herman 1949

Although Gamow's approach proves to be the correct one it is interesting to compare the present radiation temperature T_{CMB} indicated by the several early estimates of the nucleon number density n_o at the start of nucleosynthesis. The values of n_o in Table 1 are drawn from the cited publications. The T_{CMB} are my computations from the n_o . The temperature indicated by Gamow's (1948a) original estimate of n_o (eq. [6]) in the first line is not unreasonably larger than the measured value, considering all the uncertainties. I do not know any evidence that Gamow actually computed this temperature, however. Alpher and Herman (1948a) presented a considerable list of corrections to Gamow's (1948a) computation, and reported that "Correcting for these errors, we find" $\rho_{\text{mat.}} = 4.83 \times 10^{-4}/t^{3/2}$. With $t = 231 \text{ s}$ at T_o in a Friedman-Lemaître radiation-dominated universe this translates to the baryon density in the second line of Table 1. It indicates a still larger present temperature, well above the "about 5° K" stated in this paper. The likely interpretation is that Alpher and

Herman (1948a) did not use n_o derived by Gamow's approach, but rather used the fit to the broad run of element abundances reported in Alpher and Herman (1949), where we read that their result "corresponds to a temperature now of the order of 5° K." This agrees with the "about 5° K" reported in Alpher and Herman (1948a), and it agrees reasonably well with my computation entered in the last line of the table. The value of ρ_o in Alpher and Herman (1948b) is stated also in the Alpher, Herman, and Gamow (1949) abstract for a contributed paper to the November 26-27 1948 meeting of the American Physical Society. Since the abstract almost certainly was submitted before the conference started, and the paper Alpher and Herman (1948b) was submitted to the publisher on 1 September, it seems likely that the authors reported the result of the same computation in paper and abstract. It indicates a considerably higher present temperature, $\sim 60 \text{ K}$, but it seems that Alpher and Herman (1949) returned to a larger ρ_o , with T_{CMB} consistent with their first report in 1948. In short, Alpher and Herman are to be honored for a signal advance in presenting the first estimate of the CMB temperature. However, the similarity of their stated value with the measured temperature is not to be taken seriously.

Another complicated and historically interesting story is the steps in the late 1940s toward the evidence that helium largely originated the early universe. Gamow (1948b) presented a numerical computation of the buildup of deuterium in his picture, ignoring the conversion of deuterons to heavier elements. His choice of parameters indicated remnant hydrogen mass fraction $X \sim 0.6$, which is in line with his statement in this paper that "hydrogen is known to form about 50 percent of all matter." The sentiment was repeated in Gamow (1953), where he showed a computation of element buildup by Fermi and Turkevich, with final hydrogen mass fraction $X \sim 0.6$ and helium mass fraction $Y \simeq 0.36$, "in good agreement with the observed relative amount of Hydrogen and Helium in the universe." Gamow's impression that the helium abundance is large might trace back to the discussion in Gamow and Critchfield (1949) of Schwarzschild's (1946) Solar model, in which the relative masses in hydrogen, helium, and heavier elements are stated, in the paper and the book, as

$$X = 0.47, Y = 0.41, Z = 0.12. \quad (9)$$

At the time Fred Hoyle had quite a different opinion. In his generally positive review of the book on nuclear physics by Gamow and Critchfield (1949) Hoyle (1950) wrote that "a calculation is given purporting to show that the Sun contains 41% helium. This calculation depends critically in the assumption that the chemical composition of the Sun is uniform. As this is unlikely to be valid the conclusion is hardly likely to be of much value." Hoyle (1949) wrote that "hydrogen still constitutes about 99 per cent of all material." This was based on his estimate of the small production of helium in stars and his unstated assumption of negligible initial helium. Hoyle (1949) cited the Steady State papers by Hoyle, Bondi and

Gold as in press. In the Steady State cosmology one is free to postulate continual creation of helium as well as neutrons or protons and electrons, but I have seen no arguments for this idea. And we are free to speculate that the Steady State model might have contributed to Hoyle's sense that the helium abundance likely is small.

Did the weight of evidence in the early 1950s favor Gamow's high helium abundance over Hoyle's low abundance? Hoyle's (1950) objection to Schwarzschild's (1946) Solar model is no longer discussed, but the model may be criticized for its convective core and radiative envelope. However, the Schwarzschild, Howard, and Härm (1957) Solar models with convective envelope and radiative core, and with $Z \gtrsim 0.015$, which the authors state is indicated by spectroscopic observations, the initial helium mass fraction is $Y \gtrsim 0.2$. Hoyle and Schwarzschild (1955), in their study of the evolution of Pop. II stars, use $Y = 0.1$, but there is no citation of evidence for this compromise between the high and low helium camps. Unsöld (1948) found high helium abundance in τ Scorpii, but one might question whether this massive star is a fair sample. Aller and Menzel (1945, Table 6, in a summary of a series of prewar papers) found that the helium abundance in planetary nebulae is about 10% of hydrogen by number, or helium mass fraction $Y \sim 0.3$, but one might wonder whether this might be helium produced in the evolving stars. Thus it appears that in the early 1950s there were indications of Gamow's high helium abundance, but they were not persuasive.

By the end of the 1950s the improved evidence for $Y \sim 0.3$ led Osterbrock and Rogerson (1961) to remark that

The helium abundance $Y = 0.32$ existing since such an early epoch could be at least in part the original abundance of helium from the time the universe formed, for the build-up of elements to helium can be understood without difficulty on the explosive formation picture.²¹

The reference (21) is to Gamow (1949). Burbidge (1962) referred to Osterbrock and Rogerson (1961), and noted, as the last of four possible explanations of the evidence for high helium abundance, that

The bulk of the transmutation of H to He took place in the first few minutes in the expansion of the Universe.

Burbidge cited Alpher and Herman (1950) and Gamow (1953). Here are respected scientists pointing to possible evidence for Gamow's cosmology: the high abundance of helium compared to what might be expected to have been produced in stars. But I have found no indication the community noticed. Hoyle and Tayler (1964) reviewed the evidence for

$Y \sim 0.3$, and cited Alpher, Bethe and Gamow (1948), Hayashi (1950) and Alpher, Follin and Herman (1953), but not Osterbrock and Rogerson (1961) or Burbidge (1962). We cannot know whether Hoyle and Tayler (1964) would have at last attracted interest in Gamow's cosmology, because in the following year wide attention was drawn to another piece of evidence, the sea of microwave radiation, and the proposed interpretation as the "Primeval Fireball." It could have been termed "Gamow's Radiation," but we were slow to recognize the connection.

I use the term "Gamow's Cosmology" because Gamow (1948a,b) saw, by some combination of physical analysis and intuition, that detailed balance of radiative formation and dissociation of deuterium in thermal radiation in the early universe could have determined the start of nucleosynthesis, to have been followed by rapid buildup of deuterium, "which should yield $Y \sim 0.5$... since hydrogen is known to form about 50 per cent of all matter", and that the radiation would also set the start of gravitational growth of cosmic structure at the time of equality of mass densities in matter and radiation. Alpher (1948a) and Alpher and Herman (1948b, 1949, 1950) computed relative element abundances in the wrong picture, because Gamow had changed his mind. They are to be credited for these pioneering studies that figure now in element formation in stars, and for their early development of numerical methods for machine computation, no easy task. The Alpher, Follin and Herman (1953) computation of the evolution of the ratio n/p of the relative numbers of neutron and protons, which takes account of the role of the weak interactions pointed out by Hayashi (1950), is close to the modern theory. And they deserve credit for dealing with Gamow's capricious ways.

The capricious nature of this story is particularly evident at least in part because there were just three main actors, and in the late 1940s they were publishing frequently enough that we have easy access to a reasonably detailed record of what they were thinking. I expect that other advances in science, if examined in such close detail, would also reveal a tangled mix of observational evidence that was variously ignored, or misread, or a productive guide, and of theoretical ideas that were variously wrong, or misunderstood, or remarkably productive. The cosmology story is particularly unusual, though, because we see the work of an exceptionally creative master of physical intuition, George Gamow.

I am indebted to Pierre Demarque, Masataka Fukugita and Virginia Trimble for discussions that materially improved this essay.

REFERENCES

- Aller, L. H., & Menzel, D. H. 1945, *ApJ*, 102, 239
- Alpher, R. A. 1948a, PhD thesis, *On the Origin and Relative Abundances of the Elements*, George Washington University
- Alpher, R. A. 1948b, *Physical Review*, 74, 1577
- Alpher, R. A., Bethe, H., & Gamow, G. 1948, *Physical Review*, 73, 803
- Alpher, R. A., Follin, J. W., & Herman, R. C. 1953, *Physical Review*, 92, 1347
- Alpher, R. A., & Herman, R. C. 1948a, *Nature*, 162, 774
- Alpher, R. A., & Herman, R. C. 1948b, *Physical Review*, 74, 1737
- Alpher, R. A., & Herman, R. C. 1949, *Physical Review*, 75, 1089
- Alpher, R. A., & Herman, R. C. 1950, *Reviews of Modern Physics*, 22, 153
- Alpher, R. A., Herman, R. C., and Gamow, G. 1949, *Physical Review*, 75, 332
- Burbidge, G. 1962, *Annual Review of Nuclear and Particle Science*, 12, 507
- Chandrasekhar, S., & Henrich, L. R. 1942, *ApJ*, 95, 288
- Gamow, G. 1935, *Ohio Journal of Science*, 35, 406
- Gamow, G. 1937, *Structure of Atomic Nuclei and Nuclear Transformations*, Oxford: the Clarendon Press
- Gamow, G. 1942, *Journal of the Washington Academy of Sciences*, 32, 353
- Gamow, G. 1946, *Physical Review*, 70, 572
- Gamow, G. 1948a, *Physical Review*, 74, 505
- Gamow, G. 1948b, *Nature*, 162, 680
- Gamow, G. 1949, *Reviews of Modern Physics*, 21, 367
- Gamow, G. 1953, *Dan. Vid. Selskab Mat.-fis. Medd.* 27, 1
- Gamow, G. and Critchfield, C. L. 1949, *Theory of Atomic Nucleus and Nuclear Energy Sources*, Oxford: the Clarendon Press
- Gamow, G., & Teller, E. 1939, *Nature*, 143, 116
- Hayashi, C. 1950, *Progress of Theoretical Physics*, 5, 224
- Haramundanis, K. *Cecilia Payne-Gaposchkin : an autobiography and other recollections*, ed. Katherine Haramundanis, second edition, Cambridge University Press
- Hoyle, F. 1949, *Nature*, 163, 196
- Hoyle, F. 1950, *The Observatory*, 70, 194
- Hoyle, F., & Schwarzschild, M. 1955, *ApJS*, 2, 1
- Hoyle, F., & Tayler, R. J. 1964, *Nature*, 203, 1108
- Hubble, E. P. 1936, *Realm of the Nebulae*, New Haven: Yale University Press
- Hubble, E. P. 1937, *The Observational Approach to Cosmology*, Oxford: the Clarendon Press
- Klein, O., Beskow, G. & Treffenberg, L. 1946, *Arkiv för Math. Astron. och Fysik*, 33B
- Lifshitz, E. 1946, *Journal of Physics*, X, 116
- Osterbrock, D. E., & Rogerson, J. B., Jr. 1961, *PASP*, 73, 129
- Peebles, P. J. E. 2014, *European Physical Journal H*, 39, 205
- Peebles, P. J. E., Page, L. A. and Partridge, R. B. 2009, *Finding the Big Bang*, Cambridge University Press
- Schwarzschild, M. 1946, *ApJ*, 104, 203
- Schwarzschild, M., Howard, R., Härm, R. 1957, *ApJ*, 125, 233
- Tolman, R. C. 1934, *Relativity, Thermodynamics and Cosmology*, Oxford: the Clarendon Press
- Trimble, V. 2010, *European Physical Journal H*, 35, 89
- Unsöld, A. 1948, *Zeitschrift für Astrophysik* 24, 306
- von Weizsäcker, C. F. 1938, *Physikalische Zeitschrift* 39, 633

This preprint was prepared with the AAS L^AT_EX macros v5.2.

ABSTRACTS

5-th Gamow International Conference in Odessa “Astrophysics and Cosmology after Gamow: progress and perspectives” and

15-th Odessa International Astronomical Gamow Conference-School “Astronomy and beyond: Astrophysics, Cosmology and Gravitation, Cosmophysics, Radio-astronomy and Astrobiology” (Ukraine, Odessa, Chernomorka, 16-23 August, 2015)

MEMORIAL TALKS

ASTRONOMY IN ODESSA UNIVERSITY: 150 YEARS OF THE HISTORY

S.M.Andrievsky

*Astronomical Observatory, Odessa National University
Shevchenko Park, 650014, Odessa, Ukraine*

In 2015 Odessa University celebrated its 150th anniversary. Almost all this time astronomy was presented at the University. Two astronomical divisions were created in 19th century – the Department of Astronomy and Astronomical Observatory. Several prominent scientists headed both the Department and Observatory. Many bright astronomers graduated from Odessa University. Today Astronomical Observatory is well known around the World research center that keeps its good traditions established almost one and a half century ago.

LUDWIK SILBERSTEIN (1872–1948) AND THE GENERAL RELATIVITY

Piotr Flin

*Jan Kochanowski University, Institute of Physics
ul. Swietokrzyska 15, KIELCE, 25-409, Poland
sfflin@cyf-kr.edu.pl*

We present the main achievements of the Polish – American mathematical physicist, Ludwik Silberstein. He is the author of the first English monograph on General Relativity, strong criticism of the eclipse results, investigation of the V_r – distance relation, application of operator calculus to general relativity etc.

POLISH ASTRONOMERS IN ODESSA UNIVERSITY

Piotr Flin

*Jan Kochanowski University, Institute of Physics
ul. Swietokrzyska 15, KIELCE, 25-409, Poland
sfflin@cyf-kr.edu.pl*

The outlines of several distinguished Polish astronomers, connected with Odessa University before the First World War are presented.

ODESSA ON THE WORLD LINE OF GEORGE GAMOW

Ryabov M.I.¹, Zhuk A.I.²

*¹ Odessa observatory "URAN-4" of the Radio-
astronomical institute NAS, Ukraine*

*² Astronomical Observatory, Odessa I.I.Mechnikov
National University, Ukraine*

The present Conference and School are devoted to the 111th birthday anniversary of Georgij (George) Antonovich Gamow, one of the greatest physicists and cosmologists of the 20th century. Odessa became the starting point of his World line. He was born here on the 4th of March 1904 in a family of gymnasium teachers. George Gamow's "World line" during the scientific revolution of the XX century went through the centers of theoretical physics – Leningrad, Cambridge, Gottingen, Copenhagen, Paris and then in Universities of Washington and Colorado, USA. However, the life of great scientists does not end after their death but continues in the development of their ideas in science. George Gamow's World Line returned to Odessa in 1994, when the First International Gamow conference was held in Chernomorka. The present Conference and School will be the 5th Gamow Conference in Odessa, after those in 1994, 1999, 2004 and 2009 years, and the 15th annual Gamow Conference-School.

PLENARY TALKS

NEWS FROM THE LARGE HADRON COLLIDER

*De Roeck A.
CERN, Switzerland
deroeck@mail.cern.ch*

The Large Hadron Collider has started run-II at a new record centre of mass energy of 13 TeV for the proton-proton collisions. This contribution will discuss the first new results of the LHC, and give an overview on the status of the study of the Higgs boson and searches for physics beyond the Standard Model from the run-I 8 TeV data.

TOWARDS CREATING A UNIVERSE IN THE LABORATORY

V. A.Rubakov^{1,2}

*¹ Institute for Nuclear Research of the Russian Academy
of Sciences, 60th October Anniversary Prospect, 7a,
117312 Moscow, Russia*

*² Department of Particle Physics and Cosmology, Phy-
sics Faculty, M.V.Lomonosov Moscow State University
Vorobjevy Gory, 119991, Moscow, Russia
rubakov@minus.inr.ac.ru*

Null Energy Condition (NEC) can be violated in a consistent way in models with unconventional kinetic terms, notably, in Galileon theories and their generalizations. We make use of one of these, the scale-invariant kinetic braiding model, to discuss whether a universe can in principle be created by man-made processes. We find that even though the simplest models of this sort can have both healthy Minkowski vacuum and consistent NEC-violating phase, there is an obstruction for creating a universe in a straightforward fashion. To get around this obstruction, we design a more complicated model, and present a scenario for the creation of a universe in the laboratory.

FROM GAMOW HYPOTHESIS TO PLANCK SPACE OBSERVATORY (TO 50 ANIVERSERY OF DISCOVERY OF CMB)

*Novosyadlyj B.
Astronomical Observatory
Ivan Franko National University of Lviv
bnovos@gmail.com*

50 years ago in the short 1.5 pages paper in Astrophysical Journal Arno Penzias and Robert Wilson have informed about measurement of excess antenna temperature ~ 3 K on a wavelength of 7.35 centimeters of unknown nature. In the coming paper Robert Dicke with his colleagues from Palmer Physical Laboratory in Princeton have proposed the explanation related with cosmic microwave background (CMB), which has been predicted seventeen years ago by George Gamow. Such was made the announcement about one of the greatest discoveries in the science – the discov-

ery of cosmic microwave background radiation, which radically changed the development of cosmology in XX-XXI century. This is confirmed by a number of fundamental discoveries made as a result of its research. The last of them are making now using the measurements of temperature fluctuations and polarization of the CMB made by Planck Space Observatory and other modern ground-based observatories.

ASPECTS OF STRING PHENOMENOLOGY IN PARTICLE PHYSICS AND COSMOLOGY

*Antoniadis Ignatios
A. Einstein Center and LPTHE CNRS, France
ignatios.antoniadis@polytechnique.edu*

I will discuss the problem of scale hierarchies in string phenomenology and propose ways to address it. In particular I will present a mechanism for supersymmetry breaking in the presence of a tiny (tunable) positive cosmological constant and describe its phenomenological consequences.

GRAVITATIONAL LENSING

*G.S.Bisnovatyi-Kogan^{1,2}
¹ Space Research Institute, Russian Academy of Sciences,
Moscow, Russia
² National Research Nuclear University MEPhI,
Moscow, Russia*

After some historical remarks, we consider observational data on the gravitational lensing, different types of lensing: strong, weak, and microlensing, discovery of planets around distant stars by microlensing. We consider lensing with large deviation angles, when light passes close to the gravitational radius of the lens, and formation of weak relativistic rings. In the last part we consider influence of plasma on the gravitational lensing. When a gravitating body is surrounded by a plasma, the lensing angle depends on the frequency of the electromagnetic wave, due to dispersion properties of plasma, in presence of a plasma inhomogeneity, and due to a gravity. The second effect leads, even in a uniform plasma, to a difference of the gravitational photon deflection angle from the vacuum case, and to its dependence on the photon frequency. Both effects are taken into account. Dependence of the lensing angle on the photon frequency in a homogeneous plasma resembles the properties of a refractive prism spectrometer, which strongest action is for longest radio waves. We have shown that the gravitational effect could be detected in the case of a hot gas in the gravitational field of a galaxy cluster.

SPACE MISSION ROSETTA-PHILAE TO COMET 67P/CHURYUMOV-GERASIMENKO NUCLEUS: THE FIRST SCIENTIFIC RESULTS

K.I.Churyumov

Astronomical observatory of Kyiv Taras Shevchenko national university, Kyiv, klimchur@ukr.net

We present an overview of dramatic and exciting space mission Rosetta-Philae to the comet 67P/Churyumov-Gerasimenko from its start in Europe's spaceport in Kourou (French Guiana) in March 2, 2004 to the present moment when the probe Philae was soft-landed on the comet nucleus for the first time in history. We describe the research results of study of the Comet 67P/Churyumov-Gerasimenko nucleus, received by Rosetta and Philae, the methods and conditions for the implementation of the mission Rosetta and the state of the apparatus after the landing Philae on the comet nucleus.

INITIAL CONDITIONS FOR THE INFLATION WITH FLAT POTENTIAL

*Gorbuov Dmitry
INR RAS*

*60th October anniversary prospect, 7a, Moscow, 117312, Russia
gorby@ms2.inr.ac.ru*

Present cosmological data seem to favor inflationary models with flat potential. To fit to the scalar perturbation amplitude measured by CMB anisotropy probes and galaxy surveys the potential must be much below the Planck scale values. It makes conflict with standard initial conditions utilized in the chaotic inflation approach natural for inflation on large fields, such as R^2 -model or Higgs-inflation. We address this issue placing the chaotic initial conditions in different gravity frames and extend the discussion on the more general case of multifield inflation.

DISCRETE COSMOLOGY

Zhuk A.I.¹, Eingorn M.V.²

¹Astronomical Observatory, Odessa I.I.Mechnikov National University, Ukraine

²North Carolina Central University, CREST and NASA Research Centers, U.S.A.

ai.zhuk2@gmail.com, maxim.eingorn@gmail.com

We consider the Universe deep inside the cell of uniformity which is of the order of 190 Mpc. At these scales, the Universe is filled with inhomogeneously distributed discrete structures (galaxies, groups and clusters of galaxies), which perturb the background Friedmann model. Here, the mechanical approach is the most appropriate to describe the dynamics of the inhomogeneities which is defined, on the one hand, by gravitational potentials of inhomogeneities and, on the other hand, by the cosmological expansion of the Universe. We also demonstrate that within our approach, the theory of scalar perturbations is a good tool to select viable dark energy models.

THREE SELECTED PROBLEMS RELEVANT TO COSMOLOGICAL SIMULATIONS

*Maxim Eingorn¹, Alexander Zhuk², Maxim Brilenkov³,
Branislav Vlahovic¹*

¹North Carolina Central University, CREST and NASA Research Centers

²Astronomical Observatory, Odessa National University

³Department of Theoretical Physics, Odessa National University

*maxim.eingorn@gmail.com, ai.zhuk2@gmail.com,
maxim.brilenkov@gmail.com, vlahovic@nccu.edu*

The following interrelated problems relevant to cosmological N-body simulations are investigated: (i) determining the gravitational potential in the Lattice Universe where some or all spatial dimensions have toroidal topology, (ii) improving softenings of the gravitational attraction for the particle-particle method and bringing modern computer codes up to a higher standard, and (iii) ensuring zero average values of first-order cosmological perturbations by introducing the finite-range gravitational interaction.

CREATION OF QUASARS GAMMA BURSTERS, AND SUPENOVAE IN VERY EARLY UNIVERSE

Alexander Dolgov^{1,2}

¹Ferrara, Italy

²Novosibirsk State University, Russia

Astronomical data of recent years, which indicate serious inconsistency with the standard models of creation of stellar-like objects at high redshifts, are reviewed. The problem is essentially pronounced in observations of very luminous quasars which are supposed to be supermassive black holes with the enriched chemistry in the interstellar space. A model is suggested which may explain all the observed mysteries in the early universe. In the simplest version the model predicts abundant primordial antimatter in the universe. Possible observational signatures of the latter are discussed.

TSPT: TIME-SLICED PERTURBATION THEORY FOR LARGE SCALE STRUCTURE

Blas D.¹, Garny M.¹, Ivanov M.M.^{2,3,4}, Sibiryakov S.^{1,2,3}

¹Theory Group, Physics Department, CERN

²FSB/ITP/LPPC, École Polytechnique Fédérale de Lausanne

³Institute for Nuclear Research of RAS

⁴Faculty of Physics, Moscow State University

*diego.blas@cern.ch, mathias.garny@cern.ch,
mikhail.ivanov@ep.ch, sergey.sibiryakov@cern.ch*

I will present a new perturbative approach to the description of cosmological structures in the mildly non-linear regime relevant at the distance scales from 10 to 100 Mpc. In this framework equal-time correlation functions of cosmological perturbations are calculated using an ensemble with time-dependent statistical weight. The scheme is free from unphysical infrared divergencies plaguing the traditional approaches and allows a systematic resummation

of large infrared contributions to all orders of the perturbation theory. This greatly improves the description of the density power spectrum in the region of baryon acoustic oscillations. I will conclude with a discussion of open directions, which include infrared resummation of higher-point correlation functions and renormalisation of the contributions coming from short-wavelength modes.

INSTABILITY IN CLASSICAL AND MODIFIED GRAVITY

E.V.Arbutova^{1,2}, A.D.Dolgov^{2,3}

¹Dubna University, Russia

²Novosibirsk State University, Russia

³University of Ferrara, Italy

Gravitational instability in classical Jeans theory, General Relativity, and modified gravity is considered. A simple suggestion to eliminate the problem with zero order approximation in the Jeans theory is proposed.

It is shown that density perturbations in the background with an increasing density rise faster than in the standard case of time independent background.

Evolution of density and metric perturbations in the background of high frequency oscillations of curvature in F(R) gravity is studied. In addition to the usual Jeans-like instability new effects of amplification of perturbations, associated with parametric resonance and antifriction phenomena, are found.

DARK MATTER AND DARK ENERGY IN THE NEAREST GALAXY FLOWS

Chernin A.D.

*Sternberg Astronomical Institute, Moscow University
Russia*

Arthur.Chernin@gmail.com

HST data on the nearest expansion flows of galaxies are used to show that the dynamics of the flows is controlled by the interplay between gravity produced mainly by dark matter and antigravity produced by local dark energy.

RECENT RESULTS FROM DAMA/LIBRA-PHASE I AND PERSPECTIVES

Bernabei R.^{1,2}

*¹Department of Physics, University of Roma Tor Vergata,
00133 Rome, Italy*

*²INFN - Roma Tor Vergata. 00133 Rome, Italy
rita.bernabei@roma2.infn.it*

The DAMA/LIBRA set-up (about 250 kg highly radiopure NaI(Tl)) exploits the Dark Matter (DM) model independent annual modulation signature for the presence of DM particles in the galactic halo, at the Gran Sasso National Laboratory of INFN. The positive results obtained by the former DAMA/NaI and by DAMA/LIBRA-phase I satisfy all the many requirements of the exploited signature at high confidence level. Recently also results on possible diurnal effect in DAMA/LIBRA-phase I have been released. The experiment has been upgraded and at

present DAMA/LIBRA-phase 2 is running. Results and perspectives will be discussed.

DOUBLE BETA DECAY EXPERIMENTS TO STUDY PROPERTIES OF NEUTRINO AND WEAK INTERACTION

Danevich F.A.

*Institute for Nuclear Research
Prospekt Nauky 47 MSP 03680 Kyiv, Ukraine
danevich@kinr.kiev.ua*

Observations of neutrino oscillations give a clear evidence of effect beyond the Standard Model and provide a strong motivation to investigate neutrinoless double beta ($0\nu 2\beta$) decay of atomic nuclei. The $0\nu 2\beta$ decay violates the lepton-number conservation and is only possible if neutrino is a massive Majorana particle. Therefore, investigation of the process has a unique potential to clarify the nature of the neutrino (Majorana or Dirac particle), check the lepton number conservation, determine the absolute scale and the neutrino mass hierarchy. The $0\nu 2\beta$ decay is still not observed: the most sensitive experiments give half-life limits at the level of $T_{1/2} > 10^{24} - 10^{25}$ yr and provide a test of only the degenerate region of the neutrino mass hierarchy. The goal of the next generation 2β experiments is to explore the inverted hierarchy of the neutrino mass ($m_i \approx 0.05$ eV). The accomplishment of such an ambitious plan (the neutrino mass corresponds to the half-lives $T_{1/2} \sim 10^{26} - 10^{27}$ yr) requires construction of detectors containing a large number of 2β active nuclei ($10^{27} - 10^{28}$ nuclei, which corresponds to $\sim 10^2 - 10^3$ kg of isotope of interest), extremely low (ideally zero) radioactive background, high detection efficiency and ability to distinguish the effect searched for, in particular, as high as possible energy resolution. A cryogenic scintillating bolometers approach looks an extremely promising way to explore the inverted hierarchy and even go toward the normal hierarchy of the neutrino mass pattern.

MULTI-COMPONENT VARIABILITY OF STARS: THE CLUES FROM THE "INTER-LONGITUDE ASTRONOMY" CAMPAIGN

*I.L.Andronov, K.A.Andrich, K.A.Antoniuk,
A.V.Baklanov, P.Beringer, O.A.Bobrov, V.V.Breus,
V.Burwitz, L.L.Chinarova, D.Chochol, P.Dubovskiy,
W.Godlowski, T.Hegedüs, Ki-Young Han, Wonyong Han,
K.Hoňková, L.Hric, J.Juryšek, Chun-Hwey Kim,
Yonggi Kim, Young-Hee Kim, S.V.Kolesnikov,
L.S.Kudashkina, A.V.Kusakin, A.Liakos, V.I.Marsakova,
P.A.Mason, M.Mašek, R.H.Nelson, P.G.Niarchos,
A.Oksanen, Ji-Won Park, K.Petrik, K.Reinsch,
J.W.Robertson, I.M.Sergey, R.Szczerba, M.Szpakko,
M.G.Tkachenko, L.G.Tkachuk, I.Traulsen, J.Tremko,
V.S.Tsheymeystrenko, Joh-Na Yoon¹, S.Zola,
N.M.Shakhovskoy
ilandronov@gmail.com*

The project Inter-Longitude Astronomy is a series of smaller projects on concrete stars or groups of stars. It has no special funds, and is supported from resources and grants of participating organizations, when informal working groups are created. This ILA project is in some kind similar and

complementary to other projects like WET, CBA, UkrVO, VSOLJ, BRNO, MEDUZA, where many of us collaborate.

Totally we studied 1900+ variable stars of different types, including newly discovered variables. The characteristic timescale is from seconds to decades and (extrapolating) even more. The monitoring of the first star of our sample AM Her was initiated by Prof. V.P.Tsessevich (1907-1983). Since that time, more than 337 ADS papers were published.

In this overview, we present highlights of our photometric and photo-polarimetric monitoring and mathematical modeling of interacting binary stars of different types: classical (AM Her, QQ Vul, OTJ 0711, FL Cet), asynchronous (BY Cam, V1432 Aql), intermediate (V405 Aql, BG CMi, MU Cam, V1343 Her, FO Aqr, AO Psc, RXJ 2123, 2133, 0636, 0704) polars and magnetic dwarf novae (DO Dra) with 25 timescales corresponding to different physical mechanisms and their combinations (part Polar); negative and positive superhumpers in nova-like (TT Ari, MV Lyr, V603 Aql, V795 Her) and many dwarf novae stars (Superhumper); eclipsing cataclysmic variables (BH Lyn, DW UMa, EM Cyg; PX And); symbiotic systems (Symbiosis); spotted (and not spotted) eclipsing variables with (and without) evidence for a current mass transfer (Eclipser) with a special emphasis on systems with a direct impact of the stream into the gainer stars atmosphere, which we propose to call Impactors, or V361 Lyr-type stars. Time series analysis of the Super-Soft Source QR And shows QPOs at a time scale of 1700s and (less amplitude) 8s. Other parts of the ILA project are "Stellar Bell (interesting pulsating variables of different types and periods – M, SR, RV Tau, RR Lyr, δ Sct with changes of characteristics) and New Variable discoveries and classification based on special own observations and data mining with a subsequent monitoring for searching and studying possible multiple components of variability.

Special mathematical methods have been developed to create a set of complementary software for statistically optimal modeling of variable stars of different types.

MOLECULES IN TRANSLUCENT INTERSTELLAR CLOUDS

Jacek Krelowski

*Center for Astronomy, Nicolaus Copernicus University
Torun, Poland*

Translucent interstellar clouds produce three kinds of absorptions: continuous extinction, believed to be caused by interstellar dust particles, identified bands of simple radicals – most of them carbon bearing ones - and more than 400 unidentified diffuse interstellar bands (DIBs). The latter are commonly believed to be carried by complex molecular species likely carbon bearing ones (chain species based on a carbon skeleton, polycyclic aromatic hydrocarbons, fullerenes); however, none of them was until now identified beyond a doubt. High S/N spectra allow to determine precisely the corresponding column densities of the identified molecules and their rotational temperatures which differ seriously from object to object in cases of centrosymmetric species. Despite many laboratory based studies of possible DIB carriers, it has not been possible to unambiguously link these bands to specific species. This is unfortunate, as an identification of DIBs would substantially contribute to our understanding of chemical processes in the diffuse interstellar medium. The presence of substructures inside DIB profiles, discovered by Sarre et al. (1995) and Kerr et al. (1998), supports the idea that DIBs are very likely molecular features of gas phase species. Extinction is believed to be caused by interstellar dust particles of various sizes and shapes. The recent surveys of the extinction curves (extinction law) demonstrate a great variety of the observed curves which proves that grains are different if observed in different clouds. It is to be emphasized that physical conditions inside individual clouds can be drastically different which is being revealed by changes of the extinction law which is accompanied by changes in molecular and diffuse spectra. This demonstrates complex chemistry of translucent interstellar clouds. The observed molecular species are likely building bricks for prebiotic molecules.

COSMOLOGY, GRAVITATION, ASTROPARTICLE PHYSICS, HIGH ENERGY PHYSICS

COSMOLOGICAL TESTS OF DARK ENERGY

Avsajanishvili O.N.

*Abastumani Astrophysical Observatory, Ilia State University
olga.avsajanishvili@iliauni.edu.ge*

We study generic predictions of slowly rolling scalar field models by taking the Ratra-Peebles model as a representative example. We present a self-consistent and effective way of solving the joint equations for the background expansion and the growth rate.

We examine the application to the scalar field in the Ratra-Peebles model of the Chevallier-Polarsky-Linder (CPL) parametrization of a time-dependent equation of state as well as the application of the Linder's γ -parametrization between growth rate of the matter evolution and the total amount of non-relativistic matter. We show that the Ratra-Peebles model differs from Λ CDM in number of ways that are generic and do not depend on the specific values of model parameters.

For exploration of the consistency the observational data with the obtained theoretical results, we use a compilation of recent growth rate and baryon acoustic oscillation (BAO) peak measurements to put constraints on the parameter α describing the steepness of the scalar field's potential.

experimental data for the Coma cluster, we found the effective radius for the mass distribution inside this galaxy cluster. Our estimates give an opportunity to restrict the parameters of the Navarro-Frenk-White profile for considered cluster.

CLOUDS DISTRIBUTION IN OBSCURING TORI OF ACTIVE GALACTIC NUCLEI

Bannikova E.Yu.

Institute of Radio Astronomy NAS of Ukraine

A geometrically thick self-gravitating torus in active galactic nuclei (AGN) is considered in a model of discrete medium (clouds) orbiting the central mass. In the framework of N-body simulations we investigated influence of initial conditions on evolution of the torus and analysed evolution of the distribution of particles by their orbital elements. The results of simulations show that stability of a geometrically thick torus in AGN can be explained by movement of clouds in orbits with substantial spread by inclinations and eccentricities. We suggest the scenario of torus formation which is related to the beginning of the AGN's stage.

QUANTUM ORIGIN OF SUPPRESSION FOR VACUUM FLUCTUATIONS OF ENERGY

Balitsky Jaroslav

*Institute of Physics, National Academy of sciences of
Ukraine
balytskiyyaroslav@gmail.com*

By using a model with a spatially global scalar field, we show that the energy density of zero-point modes is exponentially suppressed by an average number of field quanta in a finite volume with respect to the energy density in the stationary state of minimal energy. We describe cosmological implications of the mechanism.

THE DOMINANCE OF DARK ENERGY LEADS TO REDUCTION OF THE ENTROPY OF GALAXIES FLOW AND ENTROPY OF THE UNIVERSE

Bukalov A.V.

*The Centre for Physical and Space Research, IIS
bukalov.physics@socionic.info*

According to I. Karachentsev, A. Chernin, M. Einhorn and A. Zhuk, the effects of antigravity manifested not only on a cosmic scale, but the scale of clusters of galaxies. For example, at distances $R_{ZG} = 1,3$ Mpc from the center of the gravitationally bounded Local Group of galaxies it is observed local divergence flow of dwarf galaxies. Therefore, when $R > R_{ZG}$ flow of receding galaxies starts. In this case the phase trajectories of the local flow tend to phase attractor $V=H_0 R$, that is, obey the Hubble law. From experimental diagram of velocities of galaxies we can estimate that the spread of own velocities of galaxies with $R < R_{ZG}$ reaches $\Delta V_{max} = \pm 150$ km/s, the average is $\Delta V = \pm 70$ km/s, while when $R > R_{ZG}$ velocity spread to the theoretical velocity of Hubble divergence flow averages about $\Delta V = 12$ km/s. Antigravity of dark energy, or the energy of the vacuum, reduces the dispersion of velocity galaxies. The difference in entropy in areas with $R < R_{ZG}$ and $R > R_{ZG}$ is negative, so "evaporation" of the galaxies from gravitationally bound clusters reduces its gravitational entropy. Thus the antigravitation area causes a decrease in entropy of "gas of galaxies" at different levels of the hierarchy, in clusters and superclusters. Hence, the dominance of dark energy, or vacuum energy,

DISCRETE COSMOLOGY APPLICATION CONCERNING DARK MATTER HALOS

Brilenkov R.D.¹, Eingorn M.V.², Zhuk A.I.³

¹ *Department of Theoretical Physics, Odessa National University.*

² *CREST and NASA research centers, North Carolina Central University*

³ *Astronomical Observatory, Odessa National University,
ruslan.brilenkov@gmail.com,
maxim.eingorn@gmail.com, ai.zhuk2@gmail.com*

We applied discrete cosmology for investigation of the density profiles of dark matter halos of clusters of galaxies. Comparing the derived velocity dispersion with the

on cosmological scales leads to the orderly movement of galaxies at the level of clusters and superclusters, reducing the gravitational entropy of the Universe as a whole, as it was shown by the author. With the gradual disappearance of black holes and their entropy and radiation, as well as the galaxies themselves of cosmic event horizon, the entropy of the observable Universe will only decrease, and negative entropy, or the degree of ordering of information, will increase asymptotically approaching a constant value.

PROBLEMATIC ASPECTS OF KALUZA-KLEIN MODELS WITH EINSTEIN INTERNAL SPACES

Chopovsky A.V.^{1,2}, Eingorn M.V.³, Zhuk A.I.²

¹Department of Theoretical Physics, Odessa National University,

²Astronomical Observatory, Odessa National University,

³North Carolina Central University

a.chopovsky@yandex.ru, maxim.eingorn@gmail.com, ai.zhuk2@gmail.com

We consider Kaluza-Klein (KK) models where internal spaces are compact Einstein spaces. These spaces are stabilized by background matter (e.g., monopole form-fields). We perturb this background by a compact matter source (e.g., the system of gravitating masses) with the zero pressure in the external/our space and an arbitrary pressure in the internal space. We show that the Einstein equations are compatible only if the matter source is smeared over the internal space and perturbed metric components do not depend on coordinates of extra dimensions. The latter means the absence of KK modes corresponding to the metric fluctuations. We also demonstrate that agreement with the observed PPN parameter gamma takes place either in the case of large mass of radion or for zero coupling between any massive particle and the radion.

SIGNS OF MERGING IN THE FORMATION OF EARLY-TYPE GALAXIES

D.V.Dobrycheva¹, O.V.Melnyk², I.B.Vavilova¹, A.A.Elyiv^{1,3}

¹Main Astronomical Observatory of National Academy of Sciences of Ukraine

²Astronomical Observatory, Taras Shevchenko National University of Kyiv

³Dipartimento di Fisica e Astronomia, Universita di Bologna

We have studied the correlations of color indices of central and satellite galaxies from the SDSS DR9. We used a limited sample of 93683 galaxies by redshift $0.02 < z < 0.06$ and absolute magnitude: $M_r < -20.7$ ($N=19235$) for central galaxies and $M_r > -20.7$ ($N=74448$) for faint satellite galaxies. We considered the central galaxies and their nearest (first) satellites with distance $R < 100$ kpc as close galaxy pairs. We found a statistically significant excess of close galaxy pairs with early morphological types in our sample in comparison with random pairs. Meanwhile the pairs of central galaxies with their second satellites do not show such a significant excess. Therefore we see a morphology-density relation and suggest that galaxy mergings may be responsible for the formation of early-type galaxies.

THE EVOLUTION OF SPECTRA OF ENERGETIC PARTICLES ACCELERATED IN SOLAR FLARES

Yu.I.Fedorov, B.A.Shakhov, Yu.L.Kolesnyk

Main Astronomical Observatory,

NAS of Ukraine, Kyiv, Ukraine

fedorov@mao.kiev.ua, shakhov@mao.kiev.ua, kolesnyk@mao.kiev.ua

The propagation in the interplanetary space of cosmic rays accelerated during solar flare on January 20, 2005 is investigated on the basis of kinetic equation. The instantaneous and prolonged particle injection in the interplanetary medium is considered. On the base of analytical kinetic equation solution it was shown that under instantaneous injection of accelerated particles impulsive increase of cosmic ray intensity occurs in the beginning of ground level enhancement, which is due to unscattered particles. In the case of prolonged particle injection the cosmic ray density increases gradually and the temporal injection profile affects sufficiently on the cosmic ray intensity enhancement. The evolution of solar cosmic ray energetic distribution was analyzed and it was shown that under simultaneous injection of particles with various energy values their spectrum has a sharp break in the low rigidity region. The maximum of solar cosmic ray spectrum and their low energy limit shift with time to smaller values of the particle rigidity and thus cosmic ray energetic spectrum becomes gradually softer.

THE DYNAMICS OF SPECTRUM OF ULTRA HIGH ENERGY COSMIC RAYS FROM NEARBY SOURCE

Yu.I.Fedorov¹, R.B.Gnatyk², B.I.Hnatyk², Yu.I.Kolesnyk¹, B.A.Shakhov¹, V.I.Zhdanov²

¹Main Astronomical Observatory, NAS of Ukraine, 03680 Kyiv, Ukraine

²Astronomical Observatory of Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

fedorov@mao.kiev.ua, gnatyk@observ.univ.kiev.ua, hnatyk@observ.univ.kiev.ua, kolesnyk@mao.kiev.ua, shakhov@mao.kiev.ua, zhdanov@observ.univ.kiev.ua

The rigorous approach to the cosmic ray propagation in extragalactic and interstellar space is based on the kinetic equation describing energetic charged particle scattering on magnetic irregularities. Starting from obtained kinetic equation solution the process of cosmic ray propagation in extragalactic magnetic fields is studied. The evolution of cosmic ray energetic spectra on various distances from the source of relativistic particles is analyzed under instantaneous and prolonged particle injection. It is shown that the cosmic ray energetic distribution has a maximum which moves with time in the low energy direction. Note that the generated spectrum of cosmic rays is supposed to be monotonically decreasing function of particle energy. It is shown that the cosmic ray spectrum in the given point of space becomes gradually softer with time past after relativistic particle injection.

THE MODEL FOR FINAL STAGE OF GRAVITATIONAL COLLAPSE MASSLESS SCALAR FIELD

Gladush V.D.

Department of Theoretical Physics, Dnepropetrovsk National University, vgladush@gmail.com

It is known that in GR, for some spherically symmetric initial conditions, the massless scalar field (SF) experience the gravitational collapse (Choptuik, 1989), and arise a black hole (BH). According Bekenstein, a BH has no "hair scalar", so the SF is completely under the horizon. Thus, the study of the final stage for the gravitational collapse of a SF is reduced to the construction of a solution of Einstein's equations describing the evolution of a SF inside the BH. In this work, we build the Lagrangian for scalar and gravitational fields in the spherically symmetric case, when the metric coefficients and SF depends only on the time. In this case, it is convenient to use the methods of classical mechanics. Since the metric allows an arbitrary transformation of time, then the corresponding field variable (g_{00}) is included in the Lagrangian without time derivative. It is a non-dynamic variable, and is included in the Lagrangian as a Lagrange multiplier. A variation of the action on this variable gives the constraint. It turns out that Hamiltonian is proportional to the constraint, and so it is zero. The corresponding Hamilton-Jacobi equation easily integrated. Hence, we find the relation between the SF and the metric. To restore of time dependence we using an equation $\partial L / (\partial q_i) = \partial S / (\partial q)$. After using a gauge condition, it allows us to find solution. Thus, we find the evolution of the SF inside the BH, which describes the final stage of the gravitational collapse of a SF. It turns out that the mass BH associated with a scalar charge G of the corresponding SF inside the BH ratio $M = G/(2\sqrt{\kappa})$.

FIVE-DIMENSIONAL BOOSTS AND ELECTRIC FIELD IN THE KALUZA-KLEIN THEORY

Gladush V.D.

Department of Theoretical Physics, Dnepropetrovsk National University, vgladush@gmail.com

In five-dimensional (5D) Kaluza-Klein (KK) theory metric is $ds^2 = g_{AB}(x^\mu)dx^\mu dx^\nu$, ($A, B = 0, 1, 2, 3, 4$; $\mu, \nu = 0, 1, 2, 3$), x^4 is closed. Physical fields appear in the result of the 4+1-splitting and 5D reduction. In the static spherically symmetric case we have $ds^2 = g_{ab}(r)dx^a dx^b - e^{2\lambda(r)} dr^2 - R^2(r)(d\theta^2 + \sin^2\theta da^2)$, ($a, b = 0, 4$). The metric allows linear coordinate transformation $x^a = L_0^a \bar{x}^a$ ($L_0^a = const$). Asymptotic conditions $\lim_{r \rightarrow \infty} g_{ab} = 0$, $\lim_{r \rightarrow \infty} \bar{g}_{ab} = 0$ lead to the 5D Lorentz transformations (5D boost). After 5D reduction of 5D vacuum Einstein equations for the diagonal 5D metric, we obtain the Einstein equations with tensor of energy-momentum for a massless scalar field. As a result of the 5D boost we obtain the off-diagonal metric, that corresponds to the appearance of the electric field. This

electric field is trivial, since the reverse 5D rotation it can be removed. As an example of metric with the trivial electric field, we are considered the known solution of Chodos and Detweiler (1982). It turns out that the condition of reducibility metrics to diagonal form by the 5D boost (i.e., the triviality condition) is the relation $g_{04}/(g_{00} + g_{44}) = const$. Solving equations 5D KK theory with nontrivial electric field obtained in our work (1980). This report examines the transformation properties of physical fields and charges relative to 5D boosts. The indicated symmetry is a subgroup of a more general group $SL(3, R)$ symmetries of 5D of equations, rewritten in 3 + 2-decomposition for the static spherically symmetric case. Herewith, the 5D Einstein equations take the form of equations for the σ -model. Mentioned symmetry used in the technique of generating new solutions. The solution with trivial electric field is obtained from the solution with diagonal 5D metric using a simple symmetry transformation, which reduces to the coordinate 5D transformation.

THE ROLE OF BRIGHT GALAXIES IN OPEN GALAXY CLUSTERS OF PF CATALOGUE

Alla Gotsulyak

Odessa National University, Astronomical Department Odessa, Ukraine

We analysed the positions of bright galaxies in 81 clusters O-type of PF Catalogue.

For clusters with signs of preference plane (direction) we found the bright galaxies show the tendency to concentration to the plane.

MEASUREMENT OF AN EXTRA EMISSION LINE AT 3.5 KEV IN X-RAY SPECTRA OF DARK MATTER-DOMINATED OBJECTS

Iakubovskiy D.A.

Bogolyubov Institute for Theoretical Physics, National Academy of Sciences of Ukraine dima806@gmail.com

We report a weak line at 3.539 ± 0.011 keV in X-ray spectra of the Andromeda galaxy, the Galactic Center and the Perseus galaxy cluster observed by the MOS and PN CCD cameras on-board the XMM-Newton X-ray mission. This line is not known as an atomic line in the spectra of galaxies or clusters. It becomes stronger towards the centers of the objects; is stronger for Galactic Center and Perseus cluster than for M31; is absent in the spectrum of a deep "blank sky" data set. Although for each object it is hard to exclude that the feature is due to an instrumental effect or an atomic line, it is consistent with the behavior of a dark matter decay line. Future (non-)detections of this line in multiple objects may help to reveal its nature.

THE VELOCITIES OF IRREGULAR GALAXIES HAVE Z_s VALUES IN CFHTLS W4

Igdi-Sen M.

Department of Aircraft Technology, Trakya University
mukaddersen@trakya.edu.tr

Irregular galaxies have z_s values in CFHTLS W4 are estimated and their velocities are calculated. The relationships between their velocities and redshifts are drawn. Their brightness varies in $19.162 \leq i'_{AB} \leq 23.397$. The removing velocity of the galaxy at $z = 1$ is estimated as 300×10^8 km/s.

LOCATIONS OF STARBURST GALAXIES IN CFHTLS W4

Igdi-Sen M.

Department of Aircraft Technology, Trakya University
mukaddersen@trakya.edu.tr

The photometric redshifts (z_p) ranges which are given the best values for maximum accuracy and minimum catastrophic error are estimated from photometric data of CFHTLS W4 wide field by fitting of model spectrums. Starburst (SB) galaxies in this field are discovered. Two different starburst galaxy types have found in $0.4 \leq z_p \leq 1$ and their location maps are drawn.

STABILITY OF STELLAR SYSTEMS ORBITING SGR A*

Kahil Magd

October University for Modern Sciences and Arts Basic sciences
mkahil@msa.eun.eg

Path equations of different orbiting objects in the presence of very strong gravitational fields are essential to examine the impact of gravitational effect on each system. Some authors, have applied the stability of planetary systems by solving the geodesic deviation equations in the presence of non-Riemannian geometries.

In the present work, it is important to examine the stability of orbiting stellar systems for massive spinning objects such as neutron stars or black holes- described in the context of bimetric theory of gravity. Such a trend can be applied to test the stability of S-stars orbiting SgrA*.

MULTISCALE MODELING IN NONCOMMUTATIVE ASTROPARTICLE PHYSICS

Moskaliuk S.S.

Bogolibov Institute for Theoretical Physics of NASU
mss@bip.kiev.ua

Multiscale modeling refers to a style of modeling in which multiple models at different scales are used simultaneously to describe a system. The different models usually focus on different scales of resolution. They

sometimes originate from physical laws of different nature, for example, one from continuum mechanics and one from molecular dynamics. In this case, one speaks of multi-physics modeling even though the terminology might not be fully accurate.

The need for multiscale modeling comes usually from the fact that the available macroscale models are not accurate enough, and the microscale models are not efficient enough and/or offer too much information. By combining both viewpoints, one hopes to arrive at a reasonable compromise between accuracy and efficiency.

The subject of multiscale modeling consists of three closely related components: multiscale analysis, multiscale models and multiscale algorithms. Multiscale analysis tools allow us to understand the relation between models at different scales of resolutions. Multiscale models allow us to formulate models that couple together models at different scales. Multiscale algorithms allow us to use multiscale ideas to design computational algorithms.

ROTATION CURVES OF GALAXIES AND RESTRICTIONS ON ISLAND MODEL PARAMETERS IN GR

B.A.Murnikov, V.P.Olyeynik

Odessa I.I.Mechnikov National University, Odessa, Ukraine

From the point of nonlinear physics gravitational field in general relativity is a nonlinear dynamic medium with self-organization. In this medium there may appear localized three-dimensional structures (regular island systems, solitary waves) due to the dynamic interaction of local streams in the model. These local streams may be of two types: local streams of curved space-time as well as streams of matter, filling the space of the model. It is assumed that galaxies are dynamic island systems, which space-times are described by the nondiagonal metrics. We analyze the restrictions imposed by rotation curves of galaxies [1] on the functions, which determine the metric tensor of the model, and discuss, may the local streams in the model manifest itself as dark matter.

I. Y. Sofue et al. //Astrophys. J., 1999, V. 523. P. 136-146.

MATHEMATICAL THEORY OF PERTURBATIONS IN EXTENSIONS OF GENERAL RELATIVITY

Jan Novák

Charles University, Czech republic
jan.janno.novak@gmail.com

We will use the Geroch-Held-Penrose – formalism in reformulation of perturbations of Friedmann-Lemaître-Robertson-Walker spacetimes. Geroch-Held-Penrose – formalism, which is a more compact version of Newman-Penrose – formalism, is a convenient formalism, because we then work with partial differential equations of the first order.

We will be interested in the scalar and tensor perturbations, because of the origin of structure. These calculations will be done for the case of simplified right-hand side.

DYNAMICS OF SCALAR FIELD DARK ENERGY IN THE EXPANDING UNIVERSE AND IN THE GRAVITATIONALLY BOUND SYSTEMS

Novosyadlyj B., Tsizh M., Kulinich Yu.

Astronomical Observatory, Ivan Franko National University of Lviv

bnovos@gmail.com, tsizh@astro.franko.lviv.ua,
kul@astro.franko.lviv.ua

The properties and observational manifestations of scalar field dark energy at cosmological, cluster and galaxy scales are discussed. It is shown that cosmological observational data well constrain density and equation of state parameters of dark energy and practically do not define the effective sound speed.

The dynamics of quintessential dark energy at the center of dark matter halo strongly depends on the value of effective sound speed c_s (in units of speed of light). If $c_s \sim 1$ (classical scalar field) then the dark energy in the gravitationally bound systems is only slightly perturbed and its density is practically the same as in cosmological background. The dark energy with small value of effective sound speed ($c_s < 0.1$), contrary, is important dynamical component of halo at all stages of their evolution: linear, non-linear, turnaround, collapse, virialization and later up to current epoch.

We analyze also the behavior of dark energy in the static gravitational fields of stars and black holes with the Schwarzschild metric. It is shown that, in the case of stars, the static solution of the differential equations for energy-momentum conservation exists and describes the distribution of density of dark energy inside and outside of a star. We have found that for stars and galaxies its value differs slightly from the average and is a bit higher for the quintessential scalar field as dark energy and a bit lower for the phantom one. The difference grows with the decrease of the effective sound speed of dark energy and is large in the neighborhood of neutron stars. We obtain and analyze also the solutions of equations that describe the stationary accretion of the dark energy as a test component onto the Schwarzschild black hole. It is shown that the rate of change of mass of the dark energy is positive in the case of quintessential dark energy and is negative in the case of the phantom one.

These properties of dark energy can be used for constraining of the value of effective sound speed c_s by comparison of theoretical predictions with observational data related with the large scale gravitationally bound systems.

ON GRAVITATIONAL SOLITARY WAVES WITH ROTATION IN GR

V.P. Olyeynik

Odessa I.I.Mechnikov National University, Odessa, Ukraine

In 1955 Wheeler [1] set up the hypothesis that the empty curved space-time would have a rich nonlinear dynamics, in particular, there may exist regular islands of “mass without mass” or of “charge without charge” (geons). As pointed out in [2], general relativity does not allow the existence of topologically trivial static spherically symmetric solutions of Einstein's equations for geons. All the known in general relativity asymptotically flat spaces are the black holes [2] and can not be treated as regular three-dimensional solitary waves.

However, the situation may be different in the case of dynamic models: as it is well known from nonlinear physics, the solitary wave in a nonlinear medium may be generated by interacting streams of matter. Einstein's equations for gravitational field in vacuum are essentially nonlinear, so it is proposed that local streams of curved space-time in the model can lead to the formation of a solitary wave, regular in the entire space. It is assumed that space-times of island models under investigation are described by nondiagonal metrics. All scalar characteristics of these metrics depend on two parameters including the translational velocity of the model and its angular velocity of rotation. We study the following models: a) standing solitary wave; b) wave, moving with constant translational velocity; c) wave, which translational motion correlates with rotation.

1. J.A. Wheeler, Phys. Rev. 97 (1955) 511.
2. J. Louko, R.B. Mann, D. Marolf. Class. Quant. Grav. 22 (2005) 1451; arXiv:gr-qc/0412012v2.

THE RICH PF GALAXY CLUSTERS WITH DIFFERENT GALAXY POPULATION

Panko E.¹, Gutsulyak A.², Andrievsky S.²

¹ Nikolaev National University, Kalinenkov Astronomical Observatory, Nikolaev, Ukraine

² Odessa National University, Astronomical Department, Odessa, Ukraine

We study the distributions of galaxy ellipticities for 458 rich galaxy clusters selected from Catalogue of Galaxy Clusters and Groups PF [1]. The clusters have the morphological types according [2]. The morphological types take into consideration concentration towards the cluster center, indications of a preferential direction or plane, and the role of the brightest cluster galaxies. Two main types of galaxy ellipticity distribution were found: single-mode and bimodal. The first type we attribute as E-rich clusters while the second one as S-rich clusters. We shall add E-rich and S-rich types in the Catalogue of Morphological Types of Rich OF Galaxy clusters as one more classification parameter.

1. Panko E., Flin P.: 2006, *J. Astr. Data*, 12, 1.
2. Panko E.: 2013, *Odessa Astron. Publ.*, 26, 90.

THE DETERMINATION OF THE MORPHOLOGICAL TYPES OF GALAXY CLUSTERS USING CLUSTER CARTOGRAPHY

Panko E., Emelyanov C.

Nikolaev National University, Kalinenkov Astronomical Observatory, Nikolaev, Ukraine

The morphological types of rich PF galaxy clusters [1] were established using the numerical criteria according [2]. However, all given morphological types were controlled visually. We developed the Cluster Cartography set for mapping of PF galaxy clusters for the next work of study of morphology of 268 galaxy clusters forming the superclusters. The Cluster Cartography set constructs the map of galaxy cluster in the rectangular coordinates taking into consideration magnitudes of galaxies.

1. Panko E., Flin P.: 2006, *J. Astr. Data*, 12, 1.
2. Panko E.: 2013, *Odessa Astron. Publ.*, 26, 90.

PRECISE DETERMINATION OF Z – Z' MIXING AT THE CERN LHC

Pankov A.A.

Abdus Salam ICTP Affiliated Centre and Technical University of Gomel

We discuss the expected sensitivity to Z' boson effects in the W boson pair production process at the LHC. The W boson pair production process allows to place stringent constraints on the Z – Z' mixing angle. Specifically, we find that the present LHC bounds on the mixing angle obtained at the LHC energy of 8 TeV and integrated luminosity of 20/fb are of the order a few per mille, what is of the same order as those derived from the electroweak data. Further improvement on the constraining of this mixing can be achieved from the analysis of data at the LHC with nominal energy and luminosity, 14 TeV and 100/fb.

BIG RIP AND OTHER SINGULARITIES IN HOMOGENEOUS COSMOLOGICAL MODELS WITH ARBITRARY EQUATION OF STATE

Parnovsky S.S.

*Astronomical Observatory, Taras Shevchenko National University of Kyiv
par@observ.univ.kiev.ua*

We study the possible types of future singularities in the homogeneous cosmological models for the arbitrary equation of state of the contents of the Universe. We consider the isotropic FLRW models and the anisotropic models of Bianchi types I, II, VI₀, VII, VIII and IX. We obtain all known types of these singularities as well as an asymptotic behaviour of space-time near them. No additional singularity types are possible. We find the metric of the Bianchi type I cosmological model with a matter having an arbitrary equation of state P(ρ).

ON THE MECHANISM OF THE MAGNETOHYDRODYNAMIC VORTICES FORMATION IN SOLAR CHROMOSPHERE

E.A.Pashitskii

*Institute of Physics, National Academy of Sciences of Ukraine, pr. Nauki 46, Kyiv, 03028 Ukraine
pashitsk@iop.kiev.ua*

Based on the magnetohydrodynamic (MHD) equations for an incompressible conductive viscous fluid, the possible mechanism of the formation of giant MHD vortices recently discovered in the solar atmosphere (chromosphere) is analyzed. It is assumed that these vortices arise in the regions of the solar surface (photosphere) with ascending flows of hot plasma that arrives from the inner regions of the Sun as a result of thermal convection and is accelerated upward under the action of the chromospheric plasma pressure gradient. It is shown that, under the assumption of plasma incompressibility and flow continuity, the ascending plasma flows induce converging radial plasma flows, which create the convective and Coriolis nonlinear hydrodynamic forces due to the nonzero initial

vorticity of the chromospheric plasma caused by Sun's rotation. The combined action of these two forces leads to the exponential acceleration of the solid-body rotation of plasma inside the ascending flow, thereby creating a vortex that generates an axial magnetic field, in agreement with astrophysical observations.

“BIG BANG” AS A RESULT OF THE CURVATURE-DRIVEN FIRST-ORDER PHASE TRANSITION IN THE EARLY COLD UNIVERSE

E.A.Pashitskii, V.I.Pentegov

*Institute of Physics, National Academy of Sciences of Ukraine, pr. Nauki 46, Kyiv, 03028 Ukraine
pashitsk@iop.kiev.ua*

It is argued that the “Big Bang” initiating the creation of our Universe may be a consequence of a first-order phase transition induced by interaction of a fundamental nonlinear scalar field with gravitational field. The Lagrangian describing the scalar field φ characterized by “imaginary mass” and nonlinearity of φ^4 type, existing in the space-time with non-zero scalar curvature R , is proposed to be augmented with an additional term linear in φ , along with

the standard term $-R|\varphi|^2$ quadratic in φ . This additional linear term, playing the role of an “external field”, leads to a cubic equation in φ for the extrema of the potential energy of the scalar field and ensures the possibility of a first-order phase transition driven by the parameter proportional to R . It is assumed that the early Universe is filled with nonlinear scalar field in the ground state and cold matter, neutral with respect to all charges, satisfying the equation of state $p = \nu\varepsilon$. It is shown that given the condition $\nu > 1/3$ the scalar curvature $R = \kappa(3\nu - 1)\varepsilon - 4\Lambda$ (where Λ is the cosmological constant) decreases with diminishing of the energy density of matter during the Universe's expansion and reaches certain critical value $R_c < 0$ when the first-order phase transition occurs with the release of latent heat of the transition and rapid heating of matter. Such a transition may be considered a “Big Bang”.

THE PROPERTIES OF TIDAL FORCES IN THE KERR METRIC

A.M. Rasulova

*Theoretical Physics and Astronomy Department of the Herzen University, A.Friedmann Laboratory for Theoretical Physics, Saint Petersburg, Russia
arasulova@gmail.com*

Now in connection with the study of processes in galactic nuclei the models of deformation of stars and dust clouds in the vicinity of black holes are actively discussed.

In [1-3] a one-dimensional hydrodynamic stellar model of relativistic tidal compression in the field of a non-rotating Schwarzschild black hole is considered. Since this solution is spherically symmetric the tidal forces don't depend on the plane of falling. The most close

to the physical reality is the Kerr solution. The main difference between the Schwarzschild metric from the Kerr metric is the emergence in the latter of not-diagonal elements and the dependence of the diagonal members on the polar angle θ . The tidal forces in the Kerr metric were considered in [4-5], where numerical results for the polar and equatorial plane were obtained.

On the basis of General considerations, one can deduce the dependence of the tidal forces on the polar angle. On the other hand, any body of finite size can keep the form only at a certain distance from the gravitational center, without stretching in the direction of the force of attraction.

An approximate expression for the tidal forces can be obtained from semi-classical considerations. From the Newtonian theory, it follows that:

$$F \sim \frac{1}{r^3} \quad (1)$$

where r – the coordinate distance from the body to the black hole.

However, in the case of curved space coordinate distance doesn't coincide with the real distance.

The coordinate distance can be found from:

$$d\ell^2 = \left(-g_{ik} + \frac{g_{0i}g_{0k}}{g_{00}} \right) dx^i dx^k \quad (2)$$

In general case, g_{ik} depend on t and the element length (1) can change in time, therefore, the meaning of the concept of certain distance between bodies is lost. The integral can be defined in finite areas of space, if g_{ik} don't depend on time. The real distance (2) in the Kerr metric for radial geodesic ($\varphi = const = 0, \theta = const \Rightarrow d\theta = 0$) has the form:

$$\Delta\ell = \int \sqrt{\frac{r^2 + a^2 \cos^2 \theta}{r^2 - 2Mr + a^2}} dr \quad (3)$$

From the expressions (1) and (3) one can see that the tidal forces will depend on the polar angle and the rotational speed of the black hole:

$$F \sim \frac{\Delta\ell^3}{\cos^3 \theta} \quad (4)$$

In the report the case of tidal forces in the Kerr metric, which affect the body of falling in radially non-equatorial plane, will be considered. The tidal forces decrease with the decrease of the polar angle and are maximal in the equatorial plane.

1. Мизнер Ч., Торн К., Уиллер Дж. Гравитация.– М.: Мир, 1977.– Т. 3.– 510 с.
2. Brassart M., Luminet J. Relativistic tidal compressions of a star by a massive black hole. *Astron. Astrophys.* 511, A80 (2010).
3. Жидкова И.Е., Недряков И.П., Ростовцев В.А. О границах применимости экспериментального метода исследования сильных гравитационных полей.– Дубна: ОИЯИ, 1978.– 10 с.
4. Hiscock W.A. On tidal interactions with Kerr black holes. *The Astrophysical Journal*, 216, pp. 908–913 (1977).
5. Fishbone L.G. The relativistic Roche problem. I – Equilibrium theory for a body in equatorial, circular orbit around a Kerr black hole. *The Astrophysical Journal*, 185, pp. 43–67 (1973).

6. Ландау Л.Д., Лифшиц Е.М. Теория поля.– Издание 8-е, стереотипное.– М.: Физматлит, 2006.– 534 с.– («Теоретическая физика», том II).

AXION MECHANISM OF SUN LUMINOSITY VARIATIONS: LIGHT SHINING THROUGH THE RADIATION ZONE

V.D.Rusov¹, M.V.Eingorn², V.P.Smolyar¹

¹*Odessa National Polytechnic University, Ukraine*

²*CREST and NASA Research Centers, North Carolina Central University, Durham, North Carolina, U.S.A.*

The existence of the hypothetical pseudoscalar particles named axions is predicted within the framework of a theory related to the solution of the CP-invariance violation problem in QCD. Despite the numerous direct experiments, these particles have not been detected yet. However, these experiments together with the astrophysical and cosmological limitations leave a rather narrow band of the possible axion parameters. And within this mass range the axion is also a justified cold dark matter candidate.

Interestingly, the effect of “photon – axion-like particle” mixing in the magnetic fields of different astrophysical objects (including the active galaxies, galactic clusters, intergalactic space and Milky Way) may be the cause of such extraordinary phenomena as stars luminosity attenuation (e.g. supernova in the intergalactic magnetic field) or “light shining through the wall” (radiation from the distant objects traveling through the Universe). In the former case an astrophysical object's luminosity is attenuated because of a part of the photons conversion into axions within the object's magnetic field, while in the latter case the photons produced by an object turn into axions within the object's magnetic field and then after traveling some distance (“a wall”) turn back into photons within the magnetic field of another object (e.g. Milky Way). This makes the effective path length of the photon in the astrophysical medium seem larger.

We consider the possibility of the axion mechanism of Sun luminosity with the photons born in the solar core transform into axions through the Primakoff effect within the magnetic field of the core, and then after passing through the solar radiation zone, transform back into photons within the tachocline magnetic field.

Eventually we show that the variations of the γ -quanta of axion origin produced by the tachocline magnetic field variations, may be the actual reason of the solar luminosity variations marking the active and quiet phases of the Sun.

IDENTIFYING DECAYING DM TARGETS USING WAVELET SLIDING WINDOW TECHNIQUE

D.O.Savchenko, D.A.Iakubovskiy

Bogolyubov Institute for Theoretical Physics of NAS of Ukraine

If a line in spectra emerges from Dark Matter decays, one can see the line signal of comparable strength from many individual DM-dominated objects of different na-

ture – spiral, elliptical and dwarf spheroidal galaxies, galaxy groups and galaxy clusters.

Current approach to selection of the best decaying DM targets is to estimate the expected signal-to-noise ratio with respect to detect the decaying dark matter line over the sample of objects with known DM profiles.

The proposed independent approach is to search the line-like residuals in XMM-Newton/EPIC dataset of [1] after removal of detected point and distant extended sources using wavelet sliding window technique. Using sky map interface allows us to automatically search the line in spatially overlapped sets of observations. The observations from founded regions can then be post-processed with the highest significance in order to search the 3.5–keV line in combined spectrum.

We present the current results on development and application of wavelet sliding window technique.

[1] Savchenko D. O., Iakubovskiy D. A. Creation of 2-5 keV and 5-10 keV sky maps using XMM-Newton data, AASP, 2014 (Volume 4) Issue 1-2

PRIMORDIAL GRAVITATIONAL WAVES IN COSMOLOGICAL MODELS WITH DYNAMICAL DARK ENERGY

Sergijenko O.

*Astronomical Observatory of Ivan Franko National University of Lviv
olka@astro.franko.lviv.ua*

We put the observational constraints on contribution from the tensor mode of perturbations in the models with dynamical dark energy considering various inflation scenarios. The dark energy is assumed to be a classical scalar field with barotropic equation of state. The used datasets include Planck data on CMB anisotropy and lensing, Planck/BICEP2+Keck data on B-mode polarization, BAO from SDSS and 6dFGS, power spectrum of galaxies from WiggleZ, weak lensing from CFHTLenS and SN Ia data from the JLA compilation. We also investigate the existing degeneracies between dark energy parameters and other cosmological ones.

THE EFFECT OF A TEST MAGNETIC FIELD ON THE PROCESS OF OVERSPINNING A ROTATING BLACK HOLE

Shaymatov S.R.

*Institute of Nuclear Physics
Ulughbek, Tashkent 100214, Uzbekistan
sanjar@astrin.uz*

We investigate the effect of a test magnetic field on the process of destroying a near-extremal Kerr black hole with a charged test particle. It has been shown that it would be possible to throw a charged test particle into the near extremal rotating black hole and make it go past the extremality, i.e., turn the Kerr black hole into the Kerr–Newmann naked singularity. Typically, in an astrophysical scenario, black holes are believed to be surrounded by a magnetic field. The magnetic field, although small, affects

the motion of charged particles drastically due to the large Lorentz force, as the electromagnetic force is much stronger than the gravity. Thus, a test magnetic field can affect the process of destroying black holes and restore the cosmic censorship in the astrophysical context. We show that a test magnetic field would act as a cosmic censor beyond a certain threshold value. We try to gauge the magnitude of the magnetic field by comparing its energy density with that of the change in the curvature induced by the test particle. We find that the magnetic field required is either as strong as or slightly stronger as compared to the value for which its effect on the background geometry is comparable to the tiny backreaction as that of the test particle. In such a case, however, one has to take into account effect of the magnetic field on the background geometry, which is difficult to implement in the absence of any exact near-extremal rotating magnetized black hole solutions. We expect that magnetic field would still act as a cosmic censor.

PURE-CONNECTION THEORY OF GRAVITY

Shtanov Yu. V.^{1,2}

¹*Bogolyubov Institute for Theoretical Physics, Kiev, Ukraine*

²*Taras Shevchenko National University of Kiev, Kiev, Ukraine*

shtanov@bitp.kiev.ua

We describe a class of theories of gravity formulated in terms of complexified SU(2) gauge field, which makes them similar to the Yang–Mills theory. All theories in this class lead to second-order differential equations for the gauge field and can describe massless graviton at the linearized level. General relativity is a special case in this family, and all its modifications are described by a curvature-dependent Lambda-term. Some of the theories avoid singularity of Kasner type in the anisotropic cosmology. Although they all respect the analog of the Birkhoff theorem, the interior structure of black hole is strongly modified.

PERIODIC COMPONENTS IN SPACE MASER SIGNAL – OBSERVATIONS AND INTERPRETATION

S.Siparov^{1,2}, V.Samodurov³, G.Laptev⁴

¹*Department of Physics, State University of Civil Aviation, St-Petersburg, RF*

²*National Research University of Information Technologies, Mechanics and Optics, St-Petersburg, RF*

³*Radio Astronomy Observatory of Lebedev Physical Institute of the Russian Academy of Sciences, Pushchino, RF*

⁴*Teknavo Group, St-Petersburg, RF*

Space masers are the sources of almost monochromatic radiation produced by the dense condensations in the clouds of molecules in meta-stable states. Masers are expected to be extremely sensitive to changes in their environment, and the observations show the variations of their intensities in the time-spans from dozens of minutes to dozens of months. Very little is known about the periodic variability of maser fluxes, and the components of a spectrum usually shows the correlated variability,

which can be interpreted with regard to the pumping mechanism modulated by a binary system [1].

Our research deals with the case that cannot be explained by the local factors: in several sources out of 49 studied during ~ 150 sessions in 2002-2009 [2,3], the intensity of only one of the components of a maser spectrum corresponding to a single condensation appeared to change periodically with a period of dozens of minutes. The fact that other components did not show the periodic behavior proves that this cannot be an instrumental, weather or interstellar medium effect. The method used for the observational data processing was the consecutive statistical analysis. It includes fast Fourier transformations, Lomb-Scargle procedure and generalized Lomb-Scargle procedure, this enables one to exclude the possible false targets from the results.

In three of the sources, namely, W3(OH), Cep A and W 3(2) the same period of 68 minutes corresponding to a single component was registered, while in case of W3(OH), these periodic variations were registered twice during the subsequent sessions in 4 days. The phase shift between these variations appeared to be zero [4]. Later the components varying with periods of 68 min in NML Cyg and 145 and 149 min in Cep A were found.

The mechanism able to explain the observed effects was suggested in [5]. It is called optic-metrical parametric resonance and presents the following. An atom (a molecule) in a (saturated) space maser is a two-level system in a spectroscopically strong field. In this case the parametric resonance depending on the frequencies of atomic transition, of the external field and of Rabi oscillations (the last depends on the intensity of the field) is possible. If the distance between an atom and an observer periodically changes with a due frequency, the non-stationary component appears on the spectrum. The distance variation can be provided by a periodic gravitational wave (GW) emitted by a suitable binary system, while the distance to this binary can have an interstellar scale, because the effect is zero-order with regard to the GW amplitude. The candidates providing the demanded frequencies of the GW acting on the masers mentioned above, are close binaries V2214 Cyg, SBC9 1943 and V446 Her. They also suffice the geometrical conditions making the effect observable.

1. Goedhart S. et al. 2013, MNRAS, 437, 1808G
2. Samodurov V. A. et al. 2009, Astrophysics & Cosmology after Gamow. AIP Conf. Proc., 1206, p. 346.
3. Siparov S.V. and Samodurov V.A. 2009, Comp. Opt. 33 (1), p.79, (rus), 2009, arXiv:astro-ph/0904.1875.
4. Siparov S.V., Samodurov V.A. and Laptev G.A. 2015, Astronomy&Astrophysics, 574, p.L2.
5. Siparov S.V. 2004, Astronomy&Astrophysics, 416, p.815

GRAVITATIONAL LENSING ON COSMIC STRING AND ANTI-STRING

Shulga V.M.¹, Kotvytskiy A.T.²

¹*Institute of Radio Astronomy of Nat.Ac.Sci. of Ukraine,*

²*Karazin Kharkov National University, Ukraine*

Study of effect gravitational lensing is one of the cores in recent cosmology. We consider possibility of its application for detection of attributes of "negative" mass.

Existence of "negative" mass can be treated as a "unusual" matter. But the question on it does not cause total rejection among physicists. In researches «wormholes» it is not excluded "negative" mass [1]. In 2013 Izumi K. et al [2] have paid attention to gravitational repulsion of light ray at compact gravitational lensing object with «negative» mass. In the given work it is considered gravitational lensing at elongated one-dimensional object (space strings with usual or negative mass). The found features may be used for search of the localized exotic objects with long-term surveys of gravitational lenses in the far Universe.

1. Cramer J.G., Forward R.L., Morris M.S., Visser M., Benford G. and Landis G.A. // Phys. Rev. D 51, Issue 6, 1995, p.3117.
2. Izumi K., Hagiwara C., Nakajima K., Kitamura T., and Asada H. // Phys. Rev. D 88, 024049 (2013).

BANADOS-SILK-WEST EFFECT WITH NON-GEODESIC PARTICLES

Tanatarov I.V.^{1,2}, Zaslavskii O.B.^{2,3}

¹*Akhiezer Institute for Theoretical Physics, Kharkiv Institute of Physics and Technology,*

²*Department of Physics and Technology, V.N.Karazin Kharkiv National University,*

³*Institute of Mathematics and Mechanics, Kazan' Federal University, RF*

igor.tanatarov@gmail.com

If two particles collide near a black hole, the energy in their center of mass frame E_{cm} can, under certain conditions, grow unbounded. This is Banados-Silk-West effect. One of the common beliefs was that the action of force on these particles (say, due to gravitational radiation) should necessarily restrict the effect. We consider the cases of both extremal and non-extremal horizons and develop a model-independent approach to analyze the conditions for the force to preserve or kill the unbounded growth of E_{cm} . We show that the effect survives, provided the force is obeying some reasonable weak restrictions. The energy is estimated for the possibility that those are violated. The considered problem can be viewed both in its own right and as a simple setup in which we model the complicated gravitational self-force.

HYDRODYNAMICAL SIMULATION OF SINGLE GALAXY FILAMENT

A.V.Tugay

*Taras Shevchenko National University of Kyiv
Astronomy and Space Physics Department, Faculty of Physics
tugay.anatoliy@gmail.com*

Large-scale structure of Universe is often considered as cosmic web of elongated filaments and galaxy clusters. Although there are a number of methods for filament detection in numerical simulations of LSS, their application to real observations of galaxies is less effective. The aim of this work was to develop a simple model of filament and apply it to spatial galaxy distribution of Sloan Digital Sky survey up to $z=0.2$. The evolution of linear density fluctuation was simulated in hydrodynamical approach to select and trace the main parameters of filament. These parameters will be used to describe the features of the nearest elements of cosmic web.

A PROBLEM OF COSMOLOGICAL TIME IN THE DE SITTER SPACE-TIME

Turinov A.N.

*Oles Honchar Dnipropetrovsk National University,
Ukraine*

As in any other theory, in General Relativity there are many issues under discussion. In view of complexity of field equations obtaining of exact solutions becomes feasible only in spaces of high dimensionality. Therefore, every exact solution is considerably preferred than any kind of approximations [1]. The cosmological Big Bang model is based on Friedmann exact solutions. But they imply some difficulties including the initial singularity problem. One of the ways of its suppression is matching of Friedmann world and exact solution of field equations without initial singularity. Among the inflationary Universe models such solution is de Sitter one describing initial period of the Universe.

Our consideration leads to a new generalized representation of the de Sitter Universe by transforming to synchronous coordinate systems [2,3]. We study the properties of obtained representation by embedding of the 4-dimensional de Sitter world into the 5-dimensional flat space. Also, we show the feasibility of matching of de Sitter solution and the Tolman world. The de Sitter world may be the initial state for the Tolman Universe because a choice of integration functions is the choice of synchronous coordinate system, where it is possible to match these metrics. So, it proves, that in the de Sitter Universe it appears to be infinitely many "universal" times, not only three, as considered recently. In other words, the de Sitter Universe can be split by infinite number of possibilities into the worlds, each characterized by defined time value and one of three types of space curvature: positive, negative and zero. Thus, it is no way to introduce the notion of universal cosmological time in the de Sitter world.

1. Dabrowski M.P // e-print arXiv: 0606574v1 [astro-ph].
2. Hawking, S. The Large Scale Structure of Space-Time. – Series: Cambridge Monographs on Mathematical Physics, 1975. – 399 p.
3. Schrödinger, E. Space-Time Structure. – Cambridge, University Press, 1950. – 119 p.

X-RAY PROPERTIES OF THE ISOLATED LOW LUMINOSITY AGNS

*Vasylenko A.A.¹, Vavilova I.B.¹, Babyk Iu.V.^{1,2},
Pulatova N.G.¹*

¹ *Main Astronomical Observatory of the NAS of Ukraine*
² *Dublin City University, Ireland*

A study of the isolated galaxies with active nuclei is a very important to get a response to the internal evolution of galaxy activity. Wherein, their multi-wavelength properties, including in the X-ray range, are not fully analyzed as concerns with the influence of halo matter (baryonic/dark) on the formation and productivity of AGN's engine.

With this goal we have selected several isolated AGNs from 2MIG catalogue, for which the available X-ray data

were accessed. Among these objects are CGCG 179-005, NGC 6300, NGC 1050, NGC 2989, WKK 3050, ESO 438-009, and ESO 317-038. We have analyzed the spectral data obtained by XMM-Newton, Swift, Chandra, and INTEGRAL space observatories for each of these galaxies to determine corresponding spectral models and values of their parameters. For each galaxy we obtained an estimate of the spectral index and intrinsic absorption. For bright galaxies, NGC 6300 and Circinus, the X-ray spectra were analyzed up to 250 keV and their characteristics of emission features in 6-7 keV were obtained. The results, spectral models, and current problems are discussed.

HIGH ENERGY PARTICLE COLLISIONS NEAR BLACK HOLES

O. B. Zaslavskii

*Department of Physics and Technology, V. N. Karazin
National University, Kharkov, Ukraine*

A brief review of the effect of acceleration of particles by rotating and charged black holes to unbound energies in the centre of mass frame is suggested. Simple and general explanations of the effect are given: (i) the kinematic one based on the behaviour of relative velocity of colliding particles near the horizon, (ii) the geometric one, based on properties of particles' four-velocities with respect to a local light cone near the horizon. The similar effect near the inner black hole horizon is also discussed and the role of the bifurcation point is revealed. We also consider which energies can be detected by an observer at infinity. The possible role of gravitational radiation is discussed. Collisions in the magnetic field and near multi-black hole configurations are discussed. Alternative mechanisms due to collisions inside ergosphere are considered.

THEORETICAL MODELING OF LASER FRAGMENTATION OF MEYAL NANOPARTICLES

Zavestovskaya I.N.^{1,2}

¹ *Lebedev Physical Institute of RAS, Moscow, Russia*

² *National Research Nuclear University
"MEPhI", Moscow, Russia*

zavest@sci.lebedev.ru, INZavestovskaya@mephi.ru

Theoretical model of metal nanoparticles fragmentation in liquids under the action of femtosecond laser pulses at the example of gold particles in water is considered. The model is based on the electrolyzation of metal nanoparticles heated by a laser pulse, and their division under the development of instability of a charged drop of liquid metal. The process of hot electrons emission from the surface of a nanoparticle and further solvation in liquid has been studied. The critical fragmentation parameter, namely a particle charge, has been defined.

OBSERVATIONAL MIMICRY OF EXTENDED MASSES AS GRAVITATIONAL MICROLENSSES

*Zhdanov V.I.¹, Sliusar V.M.¹, Fedorova E.V.¹,
Alexandrov A.N.¹, Del Popolo A.², Surdej J.³*

¹ *Astronomical Observatory of Taras Shevchenko National
University of Kyiv, Ukraine*

² *Astrophysical Observatory of Catania University, Italy*

³ *Institute of Astrophysics and Geophysics of Liège
University, Belgium
valeryzhdanov@gmail.com*

We compare the gravitational microlensing effects by ordinary point masses (Schwarzschild microlenses) and extended clumps that may represent the dark matter substructures. We propose a "toy-model" of an extended microlens, which is analyzed in detail. This is compared to microlensing on extended structures having NFW mass

density profile. In case of isolated microlenses, we build dependencies of the amplification upon time for various parameters of the clump moving with respect to the source. Microlenses formed by combinations of point and extended masses are considered as well. The results show that it may be difficult to differentiate Schwarzschild microlenses from those formed by extended dark matter clumps of a comparable mass on the basis of light curves, which are typically observed during the Galactic microlensing events. However, some region of the clump parameters can be restricted at the present level of the photometric accuracy. In case of extragalactic gravitational lens systems formed by extended and point-mass microlenses, we study statistical properties of light curves. The autocorrelation functions of the light curves have been derived for different contributions and parameters of the extended clumps.

ASTROPHYSICS

THE KINEMATICS PARAMETERS OF THE GALAXY USING DATA OF MODERN ASTROMETRIC CATALOGUES

V.S.Akhmetov^{1,2}, P.N.Fedorov^{1,2}, V.M.Skulga^{1,2}
¹ V. N. Karazin Kharkiv National University
² Institute of Radio Astronomy NASU

We present some results to determining the kinematics parameters of Galaxy using absolute proper motions of the faint stars from new XPM2 catalogue. The kinematics analysis carries out by means of three-dimensional Ogorodnikov-Milne model. The XPM2 catalogue contains positions and proper motions with the magnitudes up to $B < 22$ mag of about 1 billion objects covering virtually the whole sky. The positions of stars in the catalogue were derived from the data of Schmidt surveys in the SuperCOSMOS Science Archive for the Northern and Southern hemispheres at the epoch of observations of a particular plate in filters J, R and I. The zero point of system of absolute proper motion has been determined using about 50 million galaxies with the magnitudes up to 20 Bmag and covering the whole sky, with the exception of a small region near the Galaxy plane. To exclude the zonal errors and the magnitude equation in the positions the UCAC4 data were used.

Based on the Ogorodnikov-Milne linear model, we used the absolute proper motions of stars XPM2 catalogue from 10 to 22 with step 0.5 magnitude for determining the kinematics parameters of Galaxy. Components of the rotation tensor were derived from the solution of the system of equations for population of stars of mixed spectral class and for stars with the different color index for individual magnitude range. A comparison of numerical values of these parameters with those presented various recent catalogues is demonstrated.

THE CATALOGUE XPM2

V.S.Akhmetov, P.N.Fedorov, A.B.Velichko
 Institute of Astronomy of Kharkiv National University,
 Sums'ka 35, 61022 Kharkiv, Ukraine.

We present a new high-density catalogue of positions and proper motions of stars, the XPM2 catalogue. It contains positions and proper motions with the magnitudes up to $B < 22$ mag of about 1 billion objects covering virtually the whole sky. The positions of stars in the catalogue were derived from the data of Schmidt surveys in the SuperCOSMOS Science Archive for the Northern and Southern hemispheres at the epoch of observations of a particular plate in filters J, R and I. To exclude the zonal errors in coordinates, the UCAC4 [1] data were used, while the XPM [2] data were used to exclude the magnitude equation in the positions derived.

The XPM system of proper motions was obtained by direct linking of about 1 billion of stars from the magnitude range $12 \text{ mag} < B < 22,5 \text{ mag}$ to the extragalactic reference frame [3], specified by about a 50 million galax-

ies from distributed evenly over the celestial sphere. We put a great deal of effort into correcting the position -, magnitude - and color - dependent systematic errors in the derived absolute proper motions.

Thus, the XPM2 catalogue is built according to the main principles of ICRS and can be regarded as the optical realization of ICRS. The stellar positions errors after reduction to the epoch of observations are typically in the 70 - 150 mas range, depending on a specific plate and stellar magnitude. The preliminary proper motions were derived from the individual positions of the catalogue's objects obtained in various epochs of observations. The proper motions errors are about 3 - 5 mas/year for 12th - 15th magnitude range and about 5 - 10 mas/year for fainter stars.

1. Fedorov, P. N., Myznikov, A. A., & Akhmetov, V. S. 2009, MNRAS, 393, 133
2. Fedorov P. N., Akhmetov V. S. and Schulga V.M., 2014, MNRAS, Volume 440, Issue 1, p.624-630
3. Zacharias N. et al., 2010, AJ, 139, 2184

CATALOG OF POSITIONS AND B MAGNITUDES OF STARS IN THE CIRCUMPOLAR REGION OF NORTHERN SKY SURVEY (FON) PROJECT

Andruk V.¹, Golovnia V.¹, Ivanov G.¹, Yizhakevych E.¹, Pakuliak L.¹, Protsyuk Yu.², Shatokhina S.¹
¹Main Astronomical Observatory (MAO) of National Academy of Sciences (NAS), Ukraine
²Research Institute: Nikolaev Astronomical Observatory, Ukraine
 andruk@mao.kiev.ua, golov@mao.kiev.ua,
 ivanov@mao.kiev.ua, izhak@mao.kiev.ua,
 pakuliak@mao.kiev.ua, yuri@nao.nikolaev.ua,
 svetash@mao.kiev.ua

For the circumpolar region (from 58 to 90 degrees) of Northern Sky Survey project the catalog of star positions and B-magnitudes has been created under the motto of the rational use of resources accumulated in UkrVO JDA (Joint Digital Archive) in MAO NASU. The total amount of processed plates is 477. Digitizing of astronegatives has been carried out with the help of Microtek ScanMaker 9800XL TMA and Epson Expression 10000XL scanners, with the scanning resolution - 1200 dpi, the linear size of the plates - 30x30 cm or 13000x13000 px. The catalog contains 1 975 967 stars and galaxies with $B \leq 16.5^m$ for the epoch of 1985.28. The coordinates of stars and galaxies were obtained in the Tycho-2 reference system, and B-value in the system of photoelectric standards. The internal accuracy of the catalog for all the objects is $\sigma_{\alpha\delta} = \pm 0.23''$ and $\sigma_B = \pm 0.12^m$ (for stars in the range of $B = 8^m - 14^m$ errors are $\sigma_{\alpha\delta} = \pm 0.11''$ and $\sigma_B = \pm 0.06^m$). Convergence between the calculated and reference positions is $\sigma_{\alpha\delta} = \pm 0.06''$ (for 171 124 stars from Tycho-2), and the convergence with photoelectric stellar B-magnitudes is $\sigma_B = \pm 0.15^m$ (for 5130 stars). External accuracy from the comparison with UCAC-4 is $\sigma_{\alpha\delta} = \pm 0.33''$ (1 928 367 stars and galaxies were cross identified).

COMPARISON OF ZERO ZONE CATALOGS OF THE FON PROGRAM BASED ON THE KYIV AND KITAB OBSERVATIONS

Andruk V.M.¹, Protsyuk Yu.I.², Muminov M.M.³, Ehgamberdiev Sh.A.³, Yuldoshev Q.X.³, Relke H.⁴, Golovnya V.V.¹, Vavilova I.B.¹

¹Main Astronomical Observatory of National Academy of Sciences, Ukraine

²Research Institute: Nikolaev Astronomical Observatory, Ukraine

³Ulugh Beg Astronomical Institute of the Uzbek Academy of Sciences, The Republic of Uzbekistan

⁴Walter Hohmann Observatory, Wallneyer St.159, 45133 Essen, Germany

andruk@mao.kiev.ua, yuri@nao.nikolaev.ua,
 muminov_mm@mail.ru, helena_relke@yahoo.com,
 golov@mao.kiev.ua, irivan@mao.kiev.ua

The two new catalogs for a zero zone of the FON program were created after processing of two different collections of the digitized astroplates. The plates have been received at the DAZ and DWA telescopes of the Kitab observatory of the Republic of Uzbekistan and of the Main astronomical observatory in Kyiv in number of 90 and 120 examples, respectively. Digitization of astroplates in frame of the Ukrainian Virtual Observatory project was conducted by means of the Epson Expression 10000XL scanner with scanning resolution 1200 dpi. Coordinates of stars and galaxies for the both catalogs are determined in the Tycho-2 catalog system and B-magnitudes in photo-electric standard system. Convergence between the calculated and reference positions is equal $\sigma_{\alpha\delta} = \pm 0.06 - 0.07''$. Internal accuracy of catalogs for all the objects is $\sigma_{\alpha\delta} = \pm 0.20''$, $\sigma_B = \pm 0.18^m$ and $\sigma_{\alpha\delta} = \pm 0.27''$, $\sigma_B = \pm 0.17^m$, respectively. We discuss results and provide a comparison of these catalogs both each other and with the UCAC-4 catalog.

"ASYMPTOTIC PARABOLA" FITS FOR SMOOTHING GENERALLY ASYMMETRIC LIGHT CURVES

Kateryna D. Andrych¹, I.L.Andronov², L.L.Chinarova¹, V.I.Marsakova¹

¹ Odessa National University, Ukraine

² Odessa National Maritime University, Ukraine

A computer program is introduced, which allows to determine statistically optimal approximation using the "Asymptotic Parabola" fit, or, in other words, the spline consisting of polynomials of order 1,2,1, or two lines ("asymptotes") connected with a parabola. The function itself and its derivative is continuous. There are 5 parameters: two points, where a line switches to a parabola and vice versa, the slopes of the line and the curvature of the parabola. Extreme cases are either the parabola without lines (i.e.the parabola of width of the whole interval), or lines without a parabola (zero width of the parabola), or "line+parabola" without a second line. Such an approximation is especially effective for pulsating variables, for which the slopes of the ascending and

descending branches are generally different, so the maxima and minima have asymmetric shapes. The method was initially introduced by Marsakova and Andronov [1] and realized as a computer program written in QBasic under DOS. It was used for dozens of variable stars, particularly, for the catalogs of the individual characteristics of pulsations of the Mira [2] and semi-regular [3] pulsating variables. For the eclipsing variables with nearly symmetric shapes of the minima, we use a "symmetric" version of the "Asymptotic parabola". Here we introduce a Windows-based program, which does not have DOS limitation for the memory (number of observations) and screen resolution. The program has an user-friendly interface and is illustrated by an application to the test signal and to the eclipsing symbiotic variable.

1. Marsakova V.I., Andronov I.L. // Odessa Astron. Publ., 1996, v.9. P. 127 (1996OAP.....9...49A).
2. Marsakova V.I., Andronov I.L. // Odessa Astron. Publ., 1998, v.11. P. 79 (1998OAP.....11...79M).
3. Chinarova L.L., Andronov I.L. // Odessa Astron. Publ., 2000, v.13. P. 116 (2000AP....13..116C).

THE X-RAY OBSERVATIONS OF THE BINARY SYSTEM PSR B1259-63/LS 2883 AROUND THE 2014 PERIASTRON PASSAGE

Babik Iurii
 MAO NAS of Ukraine, babikyura@gmail.com

In the PSR B1259-63/LS 2883 system, the millisecond (48 ms) pulsar (PSR B1259-63) is in a highly eccentric orbit around a massive Be star, LS 2883. Be star is characterized by a slow dense disk-like outflow of stellar material in the equatorial plane along with the fast diluted polar wind. In PSR B1259-63 the disk is inclined to the orbital plane, so that during the periastron passage pulsar crosses the disk twice. Interaction of the relativistic pulsar wind with the non-relativistic companion outflow leads to the broadband radiation visible from radio up to very high (TeV) energies. Throughout the orbit, different energy loss mechanisms - synchrotron radiation, Inverse Compton scattering and adiabatic losses caused by the expansion of pulsar wind against the external pressure - lead to the observed emission and provide a fascinating laboratory to study pulsar winds and pulsar wind interactions.

Despite quite intensive X-ray and radio observations it was not possible to unambiguously determine the energy of the relativistic particles of the pulsar wind. Fermi observations were thought to solve the puzzle. Indeed, observations around the periastron passage were inline with the theoretical predictions supporting moderate energy (Lorenz-factor ~ 50) of the relativistic electrons. However a month after the periastron passage a spectacular flare, not predicted by any theory, has been detected. We present results of our X-ray (Suzaku, Swift, XMM-Newton and Chandra) and GeV (Fermi/LAT) data analysis and discuss the general multi-wavelength properties of the source, and in particular the possible origin of this flare.

STATISTICALLY OPTIMAL APPROXIMATIONS OF OVERLAPPED STELLAR IMAGES USING SUPERPOSITIONS OF RELATIVELY SHIFTED 2D GAUSSIAN FUNCTIONS

O.A. Bobrov¹, I.L. Andronov²

¹ Odessa National University, Ukraine

² Odessa National Maritime University, Ukraine

For the CCD photometry, it is important to separate contribution of the separate stars creating a same asymmetric image. This is usual for the "crowded" fields in the Milky Way, but also may be apparently observed at high galactic latitudes. To solve the problem, we apply a mathematical model with 2D Gaussian functions with relative shift: $I(x,y) = C_1 + C_2 G(x-x_1, y-y_1) + C_3 G(x-x_2, y-y_2)$, where $G(x,y) = \exp(-C_4 x^2 - C_5 xy - C_6 y^2)$. Here (x_1, y_1) and (x_2, y_2) are coordinates of the centers of stellar images. Here the coefficients C_1, C_2, C_3 are determined using the least squares method, and $C_4, C_5, C_6, (x_1, y_1), (x_2, y_2)$ by non-linear optimization. For this purpose, we elaborated and tested computer programs realizing different methods for minimization function of few variables - Newton-Raphson, Davidson-Fletcher-Powell, Nelder-Mead, conjugate gradients and their modifications. Analytical and numerical estimates of the derivatives are used. We realize an algorithm with choosing the best new vector of the parameters after applying different methods for each iterations. For the set of images (as we typically have from the CCD monitoring), the algorithm is modified in the following manner: the co-ordinate distances are set as independent variables, as (x_1, y_1) may generally vary from image to image. There options to use the same set of parameters describing the shape of the image (C_4, C_5, C_6) for all images, or to each image separately (produces larger statistical noise). The program is called "Gauss2D" and is planned for use at the projects "Inter-Longitude Astronomy" and "Ukrainian Virtual Observatory".

RESULTS OF DOUBLE STARS OBSERVATIONS AT RI NAO TELESCOPES

Daniil Bodryagin, Nadiia Muigurova

Research Institute Nikolaev Astronomical Observatory

According to modern double stars researches, the percentage of stars included into double or multiple systems is in the range from 30 to 70%. Among them stars with large proper motions are especially interesting for observing, because they have rare observation history and cross-matching with other catalogues difficulties. In 2013-2014 regular observations of double stars with large proper motions were obtained by two telescopes at RI NAO. The Washington Double Stars Catalogue (WDS) was used for the observational program making up. Precise CCD-observations obtained at modern epoch allowed us to make stars proper motion more accurate. The parameters of double star system (position angle and separation between components) were also determined. The results are going to be sent to WDS.

NEW RESULTS FROM BY-PRODUCTS OF THE LONG-TERM MONITORING OF THE INTERMEDIATE POLARS

V. Breus¹, L. Hric², E. Kundra², K. Petrik³

¹ Odessa National Maritime University, Odessa, Ukraine

² Astronomical Institute of the Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

³ Observatory and planetarium Hlohovec, Hlohovec, Slovakia

During CCD observations of any object it is possible to see one or few variable stars in the same field of view and bigger it will be more stars will be possible to observe.

We present the results of CCD photometry of different objects in the field of view of the intermediate polars V709 Cas [1] (obtained by L. Hric and E. Kundra using G1 telescope of AI SAS in 2007 - 2011) and RXJ2133.7+5107 (obtained by V. Breus and K. Petrik using 60-cm Zeiss-Cassegrain in Hlohovec in 2012 - 2014). Both data sets obtained using same instruments, cameras and filters were processed using standard algorithm with dark and flat field correction, so any artificial variability should be excluded. CCD images were analyzed using C-Munipack, final time series were obtained using MCV [2].

The variable star NSV 15096 (2MASS 00272903+5919477) was discovered by Dahlmarm in 1986 [3]. Wozniak et al [4] determined R magnitude 10.544^m, the amplitude 0.600^m and announced the type SR+L with a pulsations period of 278^d. We did periodogram analysis of our data along with data from NSVS and Integral OMC data archives and we may conclude that there is only one period of 188.43^d which corresponds to all 3 light curves.

We discovered the variability of 2MASS J00283393+5915268. The highest peak at the periodogram corresponds to a period of 169.8^d. The trigonometric polynomial approximation gives a sinusoidal curve with an amplitude 0.282±0.019^m. Due to typical spectral class (M3) and period we may conclude that this star is semi-regular pulsating red giant.

Mis V1160 was discovered by S. Yoshida et al. [5]. They noted magnitude range 13.5 - 15.5^m unfiltered and Mira-type class. The period was not published. Using our data we got the period of 265.81^d. As characteristics are typical for this type we may confirm that it's Mira-type red giant. The maxima timing is BJD 2456356.8±0.5.

USNO-B1.0 1411-0397871 was discovered by Virmina et al [6]. It was classified as EW. The period was 0.371782±0.000006^d. The periodogram shows only 2 prominent peaks - 0.185887 and it's daily alias. So, the period could be 0.371774^d, that corresponds published value within the error estimate.

USNO-B1.0 1411-0397855 is another EW binary discovered by Virmina et al. [6]. The period was 0.91503±0.00015^d. Later Parimucha et al. [7] published the value of 0.915038±0.000027^d. Our periodogram for R filter reveals the highest peak that corresponds to the half of the orbital period like in the previous, the next peak is 0.86316^d. The periodogram for "V" filter reveals 0.86317^d period. It corresponds our light curve better.

1. Hric L., Breus V., Katysheva N. A., Shugarov S. Yu., Dubovský P. // *Astronomische Nachrichten*, 2014. Vol.335, Issue 4, p.362
2. Andronov I.L., Baklanov A.V. // *Astronomical School Reports*, 2004. 5, 264, <http://uavso.org.ua/mcv>
3. Dahlmarm L. // *Information Bulletin on Variable Stars*, 1986. 2878, 1
4. Wozniak P. R., Williams S. J., Vestrand W. T., Gupta V. // *AJ*, 2004. V.128, p.2965
5. Yoshida S., 2012, MISA0 project (online data)
6. Virmina N., Andronov I.L., Dubovsky P., Kudzej I. // *OEJV* 2010. Vol. 119, p.1
7. Parimucha S., Dubovsky P., Janik J., Kudzej I., Solovyova I. // *New Astronomy*, 2012. Vol. 17, p. 93.

SCANNING, CALIBRATION AND EXAMPLES OF OPERATION WITH A DIGITAL VERSION OF ARCHIVE SBPOSS

Elizarova N.V.¹, Gorbunov M.A.², Shlyapnikov A.A.²

¹ Solar Physics Department, SRI "Crimean Astrophysical Observatory"

² Stellar Physics Department, SRI "Crimean Astrophysical Observatory"

aas@crao.crimea.ua, mag@crao.crimea.ua, aas@crao.crimea.ua

We present a first step in creation of digital version of an archive "Small Body Patrol Observations Sky Survey" (SBPOSS) or "Crimean review minor planets". SBPOSS includes about 10,000 photoplates obtained in 1963-1999 with the double 400-astrograph. Each plate covers about 100 deg. sq. We started a digitizing of plates in 2008 and today we have an about 2000 digital images obtained with resolution 2400 dpi and dynamic range of 16 bit in grey scale. Plates SBPOSS were scanned on EPSON Expression 10000XL flatbed scanner. For preview images by performed the astrometric calibrations and created a file in FITS format for further processing by means of the interactive sky atlas ALADIN. Examples of using the digital version of archive SBPOSS are illustrated.

CATALOGUES OF THE FAINT OBJECTS AROUND AREAS WITH GAMMA-RAY BURSTS

Golovnya V.V., Andruk V.M., Vavilova I.B., Pakuliak L.K.

Main Astronomical Observatory (MAO) of National Academy of Sciences, Ukraine

golov@mao.kiev.ua, andruk@mao.kiev.ua, irivav@mao.kiev.ua, pakuliak@mao.kiev.ua

The results of GRB observations are being published in the GCN Circulars. To study all the objects in the sky areas around the GRB we identified them on the digitized MAO Double Wide angle Astrograph plates (D/F=40/2000) within the circle with the radius of dozens of arcminutes. We selected only GRB's with positional accuracy between ±0.3" and ±7.5" and the range of magnitudes is 14^m - 19^m. Another observational material was also analyzed.

We discuss the use of LINUX/MIDAS/ROMAFOT to obtain the catalogues of the faint objects in small areas in the GRB's vicinity. For the plates of DWA telescope the positional rms errors are ± 0.20" for RA and DEC, the photometric errors are ± 0.20^m. All results obtained in Tycho-2 system.

THE RESULTS OF ANALYSIS OF R- AND S-PROCESS ELEMENT ABUNDANCES IN THE ATMOSPHERES OF MAGELLANIC CLOUDS RED SUPERGIANTS

Gopka V.¹, Vasileva S.¹, Shavrina A.², Yushchenko V.¹, Yushchenko A.³, Andrievsky S.¹

¹ Odessa National University, Odessa, Ukraine

² MAO, Kyiv, Ukraine

³ Sejong University, Seoul, S. Korea

The identification of lines of r- and s-process elements in the spectra of Magellanic Clouds (MC) red supergiant stars was made. We used the spectra observed at 3.6 meter ESO telescope. Spectral resolving power is R=20000-30000, signal to noise ratio S/N more than 100, wavelength region 5750-6840 angstroms.

The enrichment of heavy elements (up to +0.4 dex) with respect to iron group elements is found. The possible reasons of this enrichment in MC stars are discussed.

MAGNETIC FIELDS AND CHIRAL ASYMMETRY IN PRIMORDIAL PLASMA

E.V. Gorbar^{1,2}, Igor Rudenok¹, S.I. Vilchinskii¹

¹ Department of Physics, Taras Shevchenko National Kyiv University, Kyiv, 03022, Ukraine

² Bogolyubov Institute for Theoretical Physics, Kyiv, 03680, Ukraine

Numerical simulations show that the observed magnetic fields $B \sim \mu\text{G}$ in galaxies and clusters of galaxies can be explained by astrophysical processes and the dynamo mechanism if there existed seed magnetic fields. The recent observation of magnetic fields $B \sim 10^{-15}\text{G}$ in voids [1-3], which are practically impossible to generate by known astrophysical mechanisms shows that these fields are, in fact, remnants of the early Universe and that cosmological magnetic fields are the seeds for the generation of the observed galactical magnetic fields.

The problem of magnetogenesis in the early Universe drew attention of researchers for a long time already. Many bright ideas for the generation of magnetic fields during inflation and the electroweak and strong interactions phase transitions were proposed and studied. The main problem of magnetogenesis in the early Universe is that the corresponding magnetic fields quickly dulited during the cosmic expansion and, therefore, it is difficult for them to survive and serve as seeds for the generation of galactical magnetic fields through the dynamo mechanism.

A remarkable new idea was proposed in [4] that chiral asymmetry, which possibly may exist in primordial plasma, can be very effective to help magnetic fields to survive until the nucleosynthesis. This mechanism relies on the chiral anomaly [5] which links the evolution of magnetic field helicity with the divergence of fermion axial current. Chiral asymmetry is encoded in chiral chemical potential. Note that chiral asymmetry was used to describe magnetogenesis in [6, 7].

The evolution of magnetic field proceeds the inverse cascade. Although momentum depended magnetic field was considered, an averaged over space the equation of

chiral anomaly and, consequently, a constant chiral chemical potential were used. By using the hydrodynamical approach, the the equation for the chiral chemical potential taking into account spatial derivatives was considered in a recent paper [8] and it was shown that the inverse cascade to persist too in the spatially inhomogeneous case. Here, in order to address the dependence of chiral chemical potential on spatial coordinates, we utilize the chiral kinetic theory.

- [1] A. Neronov and I. Vovk, *Science* 328, 73 (2010).
- [2] F. Tavecchio, G. Ghisellini, G. Bonnoli, and L. Foschini, *Mon. Not. Roy. Ast. Soc. Lett.* 406, L70 (2010).
- [3] K. Dolag, M. Kachelriess, S. Ostapchenko, and R. Tomas, *Ap. J. Lett.* 727, L4 (2011).
- [4] A. Boyarsky, J. Froehlich, and O. Ruchayskiy, *Phys. Rev. Lett.* 108, 031310 (2012).
- [5] S. L. Adler, *Phys. Rev.* 177, 2426 (1969); J. S. Bell and R. Jackiw, *Nuovo Cim. A* 60, 47 (1969).
- [6] M. Joyce and M.E. Shaposhnikov, *Phys. Rev. Lett.* 79, 1193 (1997).
- [7] M. Giovannini and M.E. Shaposhnikov, *Phys. Rev. D* 57, 2186 (1998).
- [8] A. Boyarsky, J. Froehlich, and O. Ruchayskiy, arXiv:1504.04854 [hep-ph].

IDENTIFICATION AND ANALYSIS OF OBJECTS FROM THE BRODSKAYA'S (B1963) AND RAZNIK'S (R1963) CATALOGS

Garbunov M.A., Shlyapnikov A.A.
Stellar Physics Department, SRJ "Crimean Astrophysical Observatory"
mag@crao.crimea.ua, aas@crao.crimea.ua

We created digital versions of Brodskaya's and Raznik's catalogs that were published in "Izvestiya" Crimean astrophysical observatory in 1963. The catalogs contains information on spectra, magnitudes and color indices of stars in the area with the center R.A. = 0^h00^m Decl. = +66°.5 and around of the Crab Nebula. All stars in catalogs have been presented in search charts and did not have coordinates. We identified all objects and found coordinates for them from the Tycho-2 catalogue. The comparison of magnitudes and spectral type with modern catalogs also represented.

ISOMERIC VARIETIES OF INTERSTELLAR MOLECULES: THEORETICAL AND EXPERIMENTAL STUDIES

Marcin Gronowski, Michal Turowski, Thomas Custer, Urszula Szczepaniak, and Robert Kolos
Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44, PL-01-224 Warsaw, Poland

Unlike molecules sharing the same atomic composition are known to be present in the interstellar medium. Many more such families of deceptively similar chemical compounds are likely to be found there. They may coexist within the same gas cloud, having one or more common precursors, and often featuring closely related synthetic pathways, as illustrated by the classic example of interstellar HCN and HNC [1] molecules. Theoretical and experimental investigations along these lines may contribute to

our understanding of interstellar chemistry, may stimulate the assignment of thus far unidentified spectral features, and may point to certain potential astro-molecules.

Based on our own studies, a brief discussion of selected examples will include:

The family of cyanoacetylene (HC₃N). Three isomers have been found in space. Four were observed in the laboratory [2, 3]. As many as five are theoretically predicted [4]. The fifth one, cyanovinylidene CC(H)CN, is a potential interstellar molecule [5].

The family of cyanodiacetylene (HC₅N). A total of 26 isomers have been theoretically investigated. Of the seven most stable species [6], four are expected to absorb strongly in the infrared, and have indeed been found via IR spectroscopy in cryogenic experiments [7, 8]. None of these, apart from HC₅N, have thus far been detected in space. Quantum chemical predictions for rotational and vibrational spectroscopy are available [9].

The family of methylcyanoacetylene. Theoretical investigations indicate a family rich in isomeric species. Laboratory experiments are under way. Two isomers, CH₃C₃N (methylcyanoacetylene) and H₂C₃(H)CN (cyanoallene), have been thus far been detected in interstellar gas clouds.

HMgNC / HMgCN pair. Simpler species, MgNC and MgCN are the known astrochemical molecules. Hydromagnesium isocyanide (HMgNC) was recently detected by Cabezas et al. [10] in the circumstellar shell of IRC +10 216, and its abundance has been derived based on our quantum mechanical prediction of the electric dipole moment [11].

The family of H₂NCS⁺. Both HNCS and NCSH are observed in dense interstellar clouds; they supposedly originate from the cations of the [H,H,C,N,S] stoichiometry. We addressed the problem of the interstellar synthesis of such ions. The collection of predicted molecular parameters [12, 13] should be of value to the relevant astro-spectroscopic research.

This research was supported by the National Science Centre projects No. 2011/03/B/ST4/02763 and 2011/01/D/ST4/04345.

- [1] J.-C. Loison, V. Wakelam, & K. M. Hickson, *Mon. Not. R. Astron. Soc.* 443 (2014) 398.
- [2] R. Kolos & J. Waluk, *J. Mol. Struct.* 408/409 (1997) 473.
- [3] R. Kolos & A.L. Sobolewski, *Chem. Phys. Letters* 344 (2001) 625.
- [4] R. Kolos & J.Cz. Dobrowolski, *Chem. Phys. Letters* 369 (2003) 75.
- [5] R. Kolos, M. Gronowski, & J.Cz. Dobrowolski, *Astrophys. J.* 701 (2009) 488.
- [6] M. Gronowski & R. Kolos, *Chem. Phys. Letters* 428 (2006) 245.
- [7] A. Coupeaud, M. Turowski, M. Gronowski, N. Piétri, I. Couturier-Tamburelli, R. Kolos, & J.-P. Aycard, *J. Chem. Phys.* 126 (2007) 164301.
- [8] A. Coupeaud, M. Turowski, M. Gronowski, N. Piétri, I. Couturier-Tamburelli, R. Kolos, & J.-P. Aycard, *J. Chem. Phys.* 128 (2008) 154303.
- [9] M. Gronowski & R. Kolos, *J. Molec. Struct.* 834-836 (2007) 102.
- [10] C. Cabezas, J. Cernicharo, J. L. Alonso, M. Agúndez, S. Mata, M. Guélin, & I. Peña, *Astrophys. J.* 775 (2013) 133.
- [11] M. Gronowski & R. Kolos, *J. Phys. Chem. A* 117 (2013) 4455.
- [12] M. Gronowski & R. Kolos, *EAS Publication Series* 58 (2012) 275.
- [13] M. Gronowski & R. Kolos, *Astrophys. J.* 792 (2014) 89.

ORIGIN OF THE ISOLATED NEUTRON STAR WITH ANOMALOUSLY LONG PERIOD 6.7HR

N.R. Ikhsanov, V.Yu.Kim
Central Astronomical Observatory of RAS at Pulkovo,
Pulkovskoe Shosse 65-1, St.Petersburg 196140, Russia

The point X-ray source 1E 161348-5055 is observed to produce pulsations with the period of 6.67 hr. The source is associated with the 2000 yr old supernova remnant RCW103 and is widely believed to be a neutron star. Observations give no evidence for the star to be a member of a binary system. Nevertheless, it resembles an accretion-powered pulsar with the magnetospheric radius ~3000 km and the mass-accretion rate ~10¹⁴ g s⁻¹. We show that the origin and the current state of the pulsar can be explained in terms of an accretion from a fossil non-Keplerian magnetic disk (magnetic slab) provided the surface magnetic field of the star is about 10¹² G [1]. The origin and basic parameters of the magnetic slab are briefly discussed.

- [1] N.R. Ikhsanov, V. Yu. Kim, N.G. Beskrovnaya, & L.A. Pustil'nik, *ApSS* 346, 105 (2013) [arXiv:1212.0375]
- [2] N. R. Ikhsanov, V.Yu.Kim, N. G. Beskrovnaya, *Astronomy Reports*, 2015, Vol. 59, No. 1, pp. 25–32.

LIGHT CURVE TYPES OF T TAURI STARS

Ismailov N.Z.
Shamakhy Astrophysical Observatory after named N.Tusi
ANAS

Based on many years of observational data from a photometric database on young stars, we propose a new classification scheme for the light curves of classical T Tauri stars. Our analysis of master light-curve shapes for 28 classical T Tauri stars is used to distinguish up to five light-curve types. The proposed scheme suggests a qualitative interpretation in terms of interaction of the central star with its circumstellar accretion disk.

HE I 5876 LINE STRUCTURE IN THE SPECTRA OF IL CEP A

Ismailov N.Z., Khalilov O.V., Bahaddinova G.R.
Shamakhi Astrophysical Observatory of the Azerbaijan
National Academy of Sciences
ismailovn@yahoo.com

We are presents the results of researches of the He I 5876 Å line in the spectrum of Herbig Be type star IL Cep A. Spectral observations were performed at the 2 m telescope of ShAO for 2006-2014. This line represents the absorption structure which has a width at the level of the continuum about 15-18 Å, and a FWHM about 6-8 Å. It is shown that the line HeI 5876 Å has a complex, multi-component structure. It has been allocated a total of 7 line components that confidence observed in all spectrograms. Radial velocities were measured for each of the selected components and the line center at half of the total intensity. The radial velocity of the individual components shows smooth time variability. The range of variation radial velocities of the individual

components is from 20 to 70 km/s. The average value of the radial velocities showed smooth variability, and the maximum value Vr achieved in 2009-2010.

Equivalent width of the line also shows significant changes from year to year, and during the one observation season. The total average value of this parameter remains constant for all observations. For all of the data, a mean value of the equivalent width of the absorption is equal 0.56 ± 0.025 Å, and the standard deviation from the mean ± 0.16 Å. The observed features in the line indicates that the field of education this line has a complex structure and physical conditions. The observed variability in the line indicates that possible the star is a spectroscopic binary system.

RESEARCH OF THE LONG-TERM BEHAVIOUR OF THE PLEIADES BY USING OF PHOTOGRAPHIC PLATES FROM UKRVO AND LVO DIGITAL ARCHIVES

Kazantseva L.V.¹, Andruk V.M.², Shatohina S.V.², Protsyuk Yu.I.³, Eglitis I., Eglite M.
¹Astronomical Observatory of Kyiv Shevchenko National University (AO KSNU), Ukraine
²Main Astronomical Observatory (MAO) of National Academy of Sciences (NAS), Ukraine
³Research Insitute: Nikolaev Astronomical Observatory, Ukraine
<kazl@ukr.net>, <andruk@mao.kiev.ua>, <svetash@mao.kiev.ua>

Pleiades Star Cluster (M45) is one of the most studied star clusters in the Galaxy. At the same time as part of the Pleiades are many long-period variable stars, including flashing, that need further study. Recent work on the processing of photographic images of the Pleiades obtained in different observatories revealed a number of stars with large variations. So, you want to understand the reason of that. Collection of UkrVO unified digital archive contains a number of plates with images of the stars of the Pleiades obtained on different instruments. Processing of this material allows to test out standard programs for digital astronomical images processing. Also we will add information about variable stars and will improve the coordinates and proper motions of cluster stars. Selected material covers the period of 1909 to 1988. The plates have different margins, scale, number of stars on images and obtained limiting magnitude. Exactly this diverse set of options lets you to be sure of results.

NUCLEAR MAGICS AT MAGNETOROTATIONAL SUPERNOVA EXPLOSION

Kondratyev V.N.¹, Korovina Yu.V.²
¹Physics Department, National Taras Shevchenko University of Kyiv, Ukraine
²Moscow Institute of Open Education, Moscow, Russia
<vkondrat@univ.kiev.uam>

Strong magnetization due to magnetorotational instability is considered as noticeable pressure component triggering supernova (SN) explosions. Nuclides produced

in such processes contain information on matter structure and explosion mechanisms. In this contribution we analyze possibilities for radionuclides to probe the internal regions of SNe, cf. [1]. Magnetic modification of nuclear structure is shown to enhance production of ^{44}Ti while volume of ^{56}Ni changes slightly.

I. V.N. Kondratyev et al., EPJ A 50, 7 (2014), JETP Letters 102, no.3 (2015)

NONTHERMAL ELECTROMAGNETIC RADIATION FROM STARS

Kryvdyk V.G.

Faculty of Physics, Taras Shevchenko National University of Kyiv, kryvdyk@gmail.com

The results of the astrophysical observations and the mechanisms generation of the nonthermal electromagnetic radiation from stars of different spectral classes on the different stages their evolution are present. Results of observations allow to calculate the plasma parameters and magnetic fields in areas around stars where is generated given radiation and their change during stellar evolution.

A STUDY OF MASS LOSS AND DUST FORMATION NEAR HOT STARS

K.S.Kuratov, A.S. Miroshnichenko, A.V.Kusakin, N.Sh.Alimgazinova, A.K.Kuratova
National center of space exploration and technologies, Almaty, Kazakhstan

Department of Physics and Astronomy, University of North Carolina at Greensboro, Greensboro, NC 27402-6170, USA

The Kazakh National University named after Al-Farabi, Almaty, Kazakhstan

At present dust formation is well studied only near cool stars. It's significantly more difficult to explain dust formation near hot stars because of their high temperatures. For dust formation near such stars the presence of stellar wind of high density is necessary. Such conditions may exist in very massive stars (supergiants with masses over 25 Solar masses). The theory of stellar evolution predicts that less massive stars don't provide matter densities sufficient for dust formation. Nevertheless, dust exists near dwarfs with the B[e] phenomenon and cooler giants of A-G spectral types which do not belong to star formation regions.

Among stars with B[e] phenomenon (the presence of forbidden emission lines and strong infrared excess due to radiation from circumstellar dust) a large group of objects with extremely strong emission-line spectra that are neither young nor highly evolved has been recently defined. They were called FS CMa type objects. Their infrared excesses imply a large amount of recently created dust.

Therefore, these objects can noticeably contribute to the Galactic dust content. Until recently it was thought that the major amount of Galactic dust, which forms near stars (up to 90%), is produced by M and S types cool giants at the Asymptotic Giant Branch stage of evolution, while hotter dwarfs and giants were not taken into consideration from this perspective.

Despite recent progress in understanding of stellar evolution, there are still remained not well understood phenomena, especially in intermediate-mass stars with masses from 2 to 20 Solar masses. These stars on main sequence have spectral types from B to G (temperatures from 6000 to 30000 K). Properties of most such stars are not fully explained by theory, in particular, the fact that they exhibit very strong spectral lines and non-spherical envelopes. Recently obtained data show that most such stars exist in binary systems that may explain the presence of circumstellar matter around them. However, the number of such well-studied stars, especially with circumstellar dust is still insufficient for confident determination of their evolutionary status and mechanisms of dust formation.

This project is devoted to determining fundamental parameters and establishing the evolutionary status of stars of the FS CMa type and A-G giants with circumstellar dust.

IRAS 22150+6109: A POORLY STUDIED YOUNG STAR

Kuratov K.S.^{1,2}, Zakhochay V.A.³, Miroshnichenko A.S.^{1,4}, Zakhochay O.V.⁵

¹ *National center of space exploration and technologies, Kazakhstan*

² *The Kazakh National University named after Al-Farabi, Kazakhstan*

³ *V.N. Karazin Kharkiv National University, Ukraine*

⁴ *Department of Physics and Astronomy, University of North Carolina at Greensboro, USA*

⁵ *Main Astronomical Observatory, National Academy of Sciences of Ukraine, Ukraine*

Many young stellar objects have been discovered in the course of the InfraRed Astronomical Satellite (IRAS) mission, which observed almost the entire sky in four photometric bands between 12 and 100 microns in 1989. These discoveries led to constraining the evolution of stars of various masses and the material that was left from the proto-stellar clouds. Investigation of young stars are important because they allow us to learn more about star and planet formation modes as well as better understand processes of the proto-stellar debris dispersal.

Nevertheless, despite different strategies used to identify young stars have been used, not all optical counterparts of such objects have been revealed or studied in detail. The subject of this study is an infrared source IRAS 22150+6109 which we identified with a $V = 11$ mag star. The object is located in the direction of an active star-forming region L1188 in the constellation Cepheus. Although no emission from CO molecules or masers typical for young stars has been found in the object's line of sight, it exhibits a strong infrared excess that is indicative of an intermediate-mass star in transition from pre-main-sequence to main-sequence stage of evolution.

We report our multicolor optical photometric observations of IRAS 22150+6109 obtained at the Tien-Shan Astronomical Observatory near Almaty, Kazakhstan, as well as preliminary results of our analysis of the spectral energy distribution. Fundamental parameters of the star are estimated under an assumption that it has zero-age main-sequence luminosity and a spectral type of B3. We also discuss infrared data obtained for the object in recent surveys and implications for the properties of circumstellar dusty disk around it. Our plans on further observations and modeling of the object are outlined.

RESEARCHES OF LONG-TERM VARIATIONS IN SPECTRA OF URANUS AND NEPTUNE

Yu.Kuznyetsova¹, A.Vidmachenko¹, O.Matsiaka², Y.Shliakhetskaya², V.Krushevska¹

¹ *Main astronomical observatory of National Academy of Science of Ukraine,*

27 Akademika Zabolotnoho ave. 03680 Kyiv, Ukraine

² *Taras Shevchenko University of Kyiv,*

64/13, Volodymyrska Street, Kyiv, Ukraine, 01601

We present the results of long-term spectral observations of Solar System giant planets Uranus and Neptune. Data were obtaining in period 2001- 2014 at peak Terskol Observatory (Northern Caucasus, Russia) using 2-meter Ritchey-Chretien telescope Zeiss-2000 and high resolution coude echelle spectrograph.

The main aim of our work is registration and researching of Raman light scattering of solar photons by hydrogen molecules in the atmosphere spectra of Uranus and Neptune. We carried out long-term monitoring of Raman light scattering variations in cloudy surface spectra to use in calculations of vertical structure parameters of these planets.

Raman scattering makes contribution to spectra because of prevailing content H_2 molecules (85%) in giant planet atmospheres. Raman effects in such powerful atmospheres arise in visual and UV spectral ranges. Our data were obtained in visual wavelength region. It is possible to register Raman effects only with high resolution and sufficient ratio signal/noise. There are analyzed deepest depressions at 398.9, 402.6 and 406.3 nm. They are "ghosts" of Fraunhofer lines K&H CaII.

Also variations of central intensities and equivalent width for most pronounced CH_4 lines (441, 543, 619, 727, 865 nm) are done.

SPECTRAL VARIABILITY OF THE STAR HD142983 (48 LIB)

Y.M.Maharramov

Shamakhly Astrophysical Observatory named after N.Tusi, Azerbaijan National Academy of Sciences y_meherramov@rambler.ru

Spectral observations of the star HD142983 in 2011, 2014 and 2015 were carried out using the echelle spectrometer in the Cassegrain focus of the 2-m telescope of the Shamakhly Astrophysical Observatory with CCD detector. The spectral resolution $R=15000$ and the spectral range was $\lambda\lambda 4700-6700 \text{ \AA}$. The Echelle spectra were processed by the standard technique using the DECH20 and DECH20t software. The signal-to-noise ratio was $S/N=150\pm 200$.

Profile variations in the H_α , H_β , $\text{HeI } 5876\text{ \AA}$, $\text{NaI } (D_1, D_2)$ and $\text{FeII } 5317\text{ \AA}$ lines in the spectra are investigated. The spectral observations showed that the most variability in the spectra of HD142983 is found in the intensity and profiles of the H_α and H_β lines.

It has been determined that profile of the H_α line are consist of two changeable emission with double peak and absorption in its. The values of the V/R (ratio of continuum-subtracted fluxes in violet and red peak, respectively) ratio changes from 2011 to 2014 and are quite homogeneous and are comprised between 0.47 and 0.65.

Hence, central reversal of emission lines can also be produced by self-absorption of line radiation in a disk.

This is suspected to take place in the so-called "Be-shell" stars and during shell phases of certain Be stars.

The intensity and shape of the H_β line changes quickly. In 2011 our observations showed that H_β is observed in the shape emission and absorption components. But, in 2014 and 2015, H_β appeared in double emission with a deep central shell absorption. And the profiles of HeI lines show fairly complex profiles with more broadly absorption components. The depth of this line is very small ($R\sim 0.06\pm 0.11$).

It has been revealed that additional components are observed in the NaI doublet profiles in the spectra of HD142983 star. These components move on the contour of the line, becomes weaker and in 2015 they disappeared.

In addition, in the spectra in the violet and red wings of FeII lines were observed that emission component forms, weakens and becomes stronger again.

We suppose that all of these changeability are explained with the characteristic feature of the supergiant star 48 Lib which this peculiarity is nature of the Be type stars. However, it remains questionable that whether it included to supergiants class or not. Therefore, further studies from observational as well as theoretical sides are desirable.

PERIOD CHANGES OF B LYRAE ECLIPSING-VARIABLE STARS

Marsakova V.¹, Tvardovskiy D.², Andronov I.³

¹ *Odessa National University named after I. I. Mechnikov,*

² *Richeliue lyceum with the Odessa National University named after I. I. Mechnikov,*

³ *Department "High and Applied Mathematics", Odessa National Maritime University vmarsakova@onu.edu.ua, it_ari@ukr.net*

The photometric data from AAVSO (<http://www.aavso.org/>) and NSVS (<http://skydot.lanl.gov/nsvs/nsvs.php>) databases were used for building of light curves, determination and correction of periods of the sample of beta Lyrae eclipsing variables. New moments of minima were determined and used to O-C analysis together with the data from BRNO (<http://var.astro.cz/ocgate/>) database of minima. Period changes were detected and classified. The mass transfer rates were obtained in the case of parabolic O-C changes. The model of the third body was suggested to explain the periodic changes of the periods and the minimal masses of the third component as well as dependencies of these masses on orbital inclination were obtained.

SULFUR ABUNDANCES BEHAVIOUR IN THE STARS OF GALACTIC DISC

T.Mishenina, O.Paramonova

Astronomical Observatory, Odessa National University, Shevchenko Park, 650014, Odessa, Ukraine

The sulfur abundances in the atmospheres of the F-G-K-type dwarf stars that belong to the thin and thick disc populations (in the metallicity range $-1.0 < [\text{Fe}/\text{H}] < 0.3$) were determined. The observations were conducted using the 1.93 m telescope at Observatoire de Haute-Provence (OHP, France) equipped with the echelle type spectrograph ELODIE ($R = 40000$). The abundances were derived under the LTE approximation; the synthetic

spectrum for the sulfur lines in the region of 6743-6762 Å was computed accounting for the hyperfine structure. The correlation between the abundance of some elements and metallicity [Fe/H] in the Galactic thin and thick disc stars was analyzed. To discuss the sources of sulfur production the comparison of the sulfur trend with the current theoretical computations of chemical evolution was made.

MAGNETOROTATIONAL SUPERNOVAE: MAGNETO-DIFFERENTIAL ROTATIONAL INSTABILITY, EXPLOSION ASYMMETRY

S.G.Moiseenko, G.S.Bisnovatyi-Kogan
Space Research Institute
Moscow, Russia

We discuss results of 2D simulations of magnetorotational (MR) core-collapsed supernovae. During the development of MR explosion we have found that the Magneto-Differential-Rotational instability develops, what leads to the exponential growth of all components of the magnetic field. We discuss also violation of the mirror symmetry and formation of one-sided kicks and recoil effect in MR supernova explosion.

THREE-DIMENSIONAL NUMERICAL HYDRODYNAMICAL SIMULATION OF ON- AND OFF-STATES IN ACCRETION DISCS OF MICROQUASARS AND QUASARS ON BASE OF INDEFINITE PRECESSION

V.V.Nazarenko, S.V.Nazarenko
Astronomical Observatory of I.I.Mechnikov Odessa
National University

In this study, the models of driven precession and donor's radiative wind were performed using three-dimensional numerical astrophysical methods by the example of microquasar Cyg X-1. As is shown, in the course of precession of the accretion disc blown by the donor's wind the states with high and low temperature (low and high mass accretion rate, respectively) start being generated in the centre of disc. Our computations of disc precession performed on base of indefinite precession which means each point of rotation axis of accretion disc makes unclosed difficult curve instead of circle as it is in case of definite precession. In this case, the transition between states of high and low temperature take place irregularly and not depend on precession period. The duration of transition between these both states is less than intervals of states on several orders of magnitudes.

THE RELATIVE WAVELENGTH INDEPENDENCE OF IR LAGS IN AGNS: IMPLICATIONS FOR THE DISTRIBUTION OF THE HOT DUST

Oknyansky V.L.¹, Gaskell C.M.²
¹Sternberg Astronomical Institute, Moscow M.V. Lomonosov State University, Moscow, Russia
²Department of Astronomy and Astrophysics, University of California, Santa Cruz, USA

As seen from the central source, the dusty torus of AGNs has a puzzlingly high covering factor. If the torus consists of clouds of dust, each with a relatively unobscured view of the

higher energy photons from nearer the center of the AGN, the temperature of each dust cloud will fall off as roughly the inverse square root of the radius. Since the dust is heated by the central radiation, in such a model the Near- and Mid-IR lag would increase with the wavelength to a power of 2 to 2.8. We show that, contrary to this simple prediction, for a significant fraction of AGNs the lags of the *J*, *H*, *K*, and *L* bands with respect to the optical show at best only a small difference. This means that rather than there being an extended radial temperature gradient, the hot dust reprocessing the central radiation is effectively in a relatively thin shell. We show that this can be explained by the hot dust being on the surface of a cone that is approximately tangential to the paraboloidal isodelay surface.

We note that a number of the AGNs showing similar *J*, *H*, *K*, and *L* lags are also Seyferts that have changed between type 1 and type 2. It is not clear whether this is related or is merely a consequence of these objects being well studied for a long time.

DETERMINATION OF PROPER MOTIONS OF CIRCUMPOLAR STARS BY USING IMAGES FROM UKRVO PLATE ARCHIVES

*Protsyuk Yu.¹, Andruk V.², Mazhaev A.¹, Kovylianska O.¹,
Protsyuk S.¹, Golovnya V.²*
¹Research Institute: Nikolaev Astronomical Observatory
(RI NAO), Ukraine
²Main Astronomical Observatory (MAO) of National
Academy of Sciences (NAS), Ukraine
*yuri@nao.nikolaev.ua, andruk@mao.kiev.ua,
mazhaev@nao.nikolaev.ua, golov@mao.kiev.ua*

UkrVO plate archives contain information obtained at different years and in different observatories for the same regions of the sky. It allows us to carry out their joint processing and to receive new results for interesting objects. To obtain proper motions of stars in circumpolar areas, we selected 35 photographic plates from the RI NAO archive and 161 plates from the archive of the MAO NASU in declination zone of 65° to 90°. The mean first epoch of 35 plates is 1930.3. Total number of plates for the first epoch of observations of circumpolar stars in the RI NAO archive is 196. The mean epoch of 161 plates is 1985.7. Total number of plates obtained in MAO during FON program is 2000. Scanning was carried out by using single scan with a resolution of 1200 dpi in MAO and 6 scans with a resolution of 1200, 1500 or 1600 dpi for different plates in the RI NAO. The raw image processing at both observatories was carried out by using the same procedure and MIDAS/ROMAFOT package to obtain (X, Y) coordinates. Astrometric reduction in the Tycho-2 system was carried out by using different programs to compare their behavior near the pole. A catalogue of 265 thousand stars up to 15^m was compiled in the RI NAO. A catalogue of 565 thousand stars up to 16.5^m was compiled in MAO. Standard deviations of positions are $\sigma_\alpha = \pm 0.26''$ and $\sigma_\delta = \pm 0.24''$ for the MAO catalogue, and $\sigma_\alpha = \pm 0.11''$ and $\sigma_\delta = \pm 0.18''$ for the RI NAO catalogue. A comparison of positions for common stars from these catalogues was conducted. Positions of common stars were also compared with several astrometric catalogues. Dependencies of different parameters were obtained for catalogue accuracies. Proper motions were obtained for common stars. The obtained result suggests the advisability of processing of all observations to receive proper motions of stars up to 14-15^m in the declination zone of 65° to 90°.

CREATION OF LARGE CATALOGUES BY USING OF VIRTUAL OBSERVATORIES

Protsyuk Yu.I., Kovalchuk A.N.
Research Institute: Nikolaev Astronomical Observatory,
Mykolaiv, Ukraine
yuri@nao.nikolaev.ua

We developed an application program to search images in the registers and databases of Virtual Observatories and to download them to local computer. The program has the ability to process XML file in VO Table format to generate links to images, as well as to work directly with the astronomical servers. To improve the efficiency for downloading of large number of images, we used multi-threaded mode. The program runs under the Windows operating system. Using the program in 2014 year, we found and downloaded more than 145 thousand of images of open clusters, having total volume of about 300 GB. Total download time was about 7 days. To process the downloaded images, we created and configured a complex of 10 virtual machines on two PCs for parallel image processing by using Astrometrica program. Total processing time was about 14 days. An application program was also created to analyse the obtained results, which were used to create four catalogues of stellar coordinates at the average epoch of 1953 to 1998. The total number of stars in the catalogues is more than 35 million. The standard error is 0.04" to 0.07", and the average number of observations is 4 to 6. The catalogues are used to improve proper motions of stars in and around of open clusters.

DATA PROCESSING OF PLATES CONTAINING IMAGES OF URANUS AND NEPTUNE FROM UKRVO DIGITAL ARCHIVE: STRUCTURE, QUALITY ANALYSIS

*Protsyuk Yu.¹, Andruk V.², Kovylianska O., Protsyuk S.¹,
Yizhakevych O.², Kashuba S.³, Kazantseva L.⁴*
¹Research Institute: Nikolaev Astronomical Observatory,
Ukraine
²Main Astronomical Observatory, National Academy of
Sciences, Ukraine
³Astronomical Observatory, Odessa National University,
Ukraine
⁴Astronomical Observatory, Kyiv National University
named after T. Shevchenko, Ukraine
*yuri@nao.nikolaev.ua, andruk@mao.kiev.ua,
izhak@mao.kiev.ua, sv.kashuba@gmail.com,
kazl@ukr.net*

To use accumulated resources of UkrVO digital archive, analysis of the available photographic plates containing images of Uranus and Neptune was conducted. Data processing of selected plates was also carried out to provide an estimate of positional precision and accuracy. Archives of the Research Institute: Nikolaev Astronomical Observatory (NAO), Main Astronomical Observatory of National Academy of Science (MAO), Astronomical Observatory of Odessa National University (AO ONU), Astronomical Observatory of Kyiv National University (AO KNU) were used. Numbers of plates containing images of Uranus and Neptune are, respectively, the following: 220 and 218 plates in NAO, 64 and 33 plates in MAO, 54 and 44 plates in AO ONU, 3 and 1 in AO KNU. Plates of NAO and MAO have

2 or 3 exposures per plate, and other plates have only one exposure per plate. The epoch of observation for most plates is 1960 to 1998, and for only one plate is 1908.

All plates were scanned with the resolution not less than 1200 dpi. Each plate of NAO was scanned 4 to 6 times. Plates containing images of Uranus and Neptune were, respectively, scanned 850 and 1339 times in NAO. All plates of other observatories were scanned only once. Raw image processing for scans containing images of Uranus and Neptune was, respectively, conducted for 630 and 960 scans in NAO and for all scans obtained in other observatories. (X, Y) coordinates, (I) intensities and FWHM values were obtained for images of all objects.

Star identification for scans containing images of Uranus and Neptune was, respectively, conducted for 444 and 726 scans in NAO and for all scans in MAO. Coordinates of all objects were obtained. Positional accuracy of reference stars was estimated for 186 plates of NAO and 97 plates of MAO, and has value of 0.05"-0.30".

THE COMPILE CATALOGUE OF PHOTOVOLTAIC UBVR MAGNITUDES OF STARS IN THE TYCHO2 SYSTEM

Protsyuk Yu.I.¹, Andruk V.M.², Relke H.³
¹Research Institute: Nikolaev Astronomical Observatory,
Ukraine
²Main Astronomical Observatory of National Academy of
Sciences, Ukraine
³Walter Hohmann Observatory, Wallneyer St.159, 45133
Essen, Germany
*yuri@nao.nikolaev.ua, andruk@mao.kiev.ua,
helena_relke@yahoo.com*

In order to calibrate the images of astronomical photoplates from the archive of UkrVO was created the compiled catalog of photovoltaic UBVR magnitudes of stars. It was based on: the catalog of 13,587 WBVR magnitudes of stars by Kornilov V.G. at al. (1991), the catalog of 68,540 UBVR magnitudes of stars by Mermilliod J.C. (1991) and the catalog of 1,141 UBVR magnitudes of stars by Andruk V.M. at al. (1995). All original coordinates have the different epoch and equinox. We have made crossreference of these stars in the Tycho-2 catalog and received the new one on the epoch and equinox of J2000.0.

THE OBSERVATION V724 AQL IN THE KALINENKOV ASTRONOMICAL OBSERVATORY IN 2013 AND 2015

Sergienko O., Panko E.
Nikolaev National University, Kalinenkov Astronomical
Observatory, Nikolaev, Ukraine

We present the results of observations CBS V724 Aql in the Kalinenkov Astronomical Observatory at the seasons 2013 and 2015 in concordance with "Observational program for stars with varied periods" of the observatory. 21 minima times, were collected by Kreiner et al. [1] allow to assume apsidal motion as a reason for period varies. Our observations have been performed, using the 70-cm telescope at the Kalinenkov Astronomical Observatory of the Nikolaev State University, equipped with a SBIG ST-7 CCD camera in the instrumental

photometric band close to the standard V. The light curve and O-C variations of V724 Aql are discussed.

1. Kreiner J.M., Kim Ch-H, Nha I.-S. // An Atlas of O-C Diagrams of Eclipsing Binary Stars. Krakov, 2000. <http://www.as.ap.krakov.pl/o-c>

ANALYSIS OF THE FLARE ACTIVITY OF STARS FROM THE GTSH10 CATALOG

Shlyapnikov A.A.

*Stellar Physics Department, SRI "Crimean Astrophysical Observatory"
aas@crao.crimea.ua*

Some results of the analysis of the flare activity of stars from the GTSH10 catalog are presented. Based on the Catalina Real-Time Transient Survey data we studied the time series for 481 stars in V band and 1221 flares were detected for about 9 years in the period from MJD 2453466.12 to MJD 2456680.26. Examples of light curves and statistics of the flare activity are illustrated.

CAN A STAR BIRTH DESTROY THE HOST MOLECULAR CLOUD?

Shulga V.M., Antyufeev A.V.

Institute of Radio Astronomy, National Academy of Sciences of Ukraine

Formation of a new star in a molecular cloud is accompanied by well-known characteristic movements of molecular matter. The gravitation plays the basic role in star (protostar) forming process resulting in the birth of stars. At the early phases of its formation there are the molecular bipolar outflows carried out the gas from a host cloud. This phenomenon is a known attribute for star-birth process and consequently is widely studied now. The main problem for understanding of those processes comes from masses of bipolar outflows and their ratio to the total mass of the host cloud. Authors have been proposed a new approach to the analysis of the molecular emission from bipolar outflows and to estimation of their masses accounting the low-velocity molecular. As a result, it is revealed that masses of the bipolar outflows have been underestimated in tens/hundreds times without this approach. The analysis of observation data shows that in some cases molecular masses moving in outflows can be comparable with mass of host clouds and the birth of star could result in the dispersion of cloud in the interstellar medium.

REVISION OF THE PHENOMENOLOGICAL CHARACTERISTICS OF THE ALGOL-TYPE STARS USING THE NAV ALGORITHM

Tkachenko M.G.¹, Andronov I.L.¹, Chinarova L.L.²

¹*Astronomical Observatory, Odessa National University,
²Department "High and Applied Mathematics", Odessa National Maritime University
masha.vodn@yandex.ua, ii_ari@ukr.net,
lidia_chinarova@mail.ru*

Phenomenological characteristics of the sample of the Algol-type stars are revised using a recently developed NAV ("New Algol Variable") algorithm (1994OAP.....7...49A,

2003ASPC..292..391A). and compared to that obtained using common methods of Trigonometric Polynomial Fit (TP) or local Algebraic Polynomial (A) fit of a fixed or (alternately) statistically optimal degree (2012Ap.....55..536A, 2012arXiv1212.6707A). The computer program NAV is introduced, which allows to determine the best fit with 7 "linear" and 4 "non-linear" parameters and their error estimates. The number of parameters is much smaller than for the TP fit (typically 20 – 40, depending on the width of the eclipse, and is much smaller (5 – 20) for the W UMa and δ Lyrae – type stars. This causes more smooth approximation taking into account the reflection and ellipsoidal effects (TP2) and generally different shapes of the primary and secondary eclipses. An application of the method to two – color CCD photometry to the recently discovered eclipsing variable 2MASS J18024395 + 4003309 = VSX J180243.9+400331 (2015JASS...32..101A) allowed to make estimates of the physical parameters of the binary system based on the phenomenological parameters of the light curve. The phenomenological parameters of the light curves for the sample of newly discovered EA – type stars (UCAC3-191-085589, HD 26525, UCAC3 196-166827, VSX J222704.2+444559, 2MASS J11080308-6145589, USNO-B1.0 1455-0409575) and, for comparison of the effectiveness of the method, for the EW – type star UCAC3-190-083329 are listed.

CATALOG OF ASTRONOMICAL POSITIONS OF SATURN'S MOONS, OBTAINED BY PHOTOGRAPHIC OBSERVATIONS ON MAO NASU IN 1961-1991

*Yizhakevych O.M., Andruk V.M., Pakuliak L.K.
Main Astronomical Observatory (MAO) of National Academy of Sciences (NAS), Ukraine
izhak@mao.kiev.ua, andruk@mao.kiev.ua, pakuliak@mao.kiev.ua*

Catalog of astronomical positions of Saturn's moons based on photographic observational material collected in the Joint UkrVO digital archive. The observations were made using MAO NASU 4 telescopes during 1961-1991. (<http://194.44.35.19/vo-mao/DB/archivespecial.php>). The resulting catalog contains more than 800 positions of the six satellites of Saturn (S2, S3, S4, S5, S6, S8). Reduction of observations was made by the new method of digital images processing [V.M. Andruk et al: 2010, Kinematics and Physics of Celestial Bodies, 26, N3, 75] with TYCHO2 as reference. The internal accuracy of reduction is within $\pm 0.015'' \pm 0.150''$. By comparing the calculated position of the satellites with their IMCCE ephemeris data in online mode (<http://www.imcce.fr/langues/en/ephemerides/>), we got quite a good approval of our observations with the motion theory (Harper & Taylor, version DE431). The standard deviation of (O-C) α, δ from the mean value is $\pm 0.20'' \pm 0.40''$ in both coordinates.

THE SPECTRAL INVESTIGATION OF BETELGEUSE

*Yushchenko A.V.¹, Vasileva S.V.², Gopka V.F.²
¹Sejong University, Seoul, Korea
²Odessa National University, Odessa, Ukraine*

The red supergiant Betelgeuse (α Ori) is one of the brightest stars. It is accepted that its evolutionary stage is presupernova, but the chemical composition of the atmosphere was not investigated. We tried to estimate the at-

mosphere parameters and the level of spectral variability using the observations obtained at 8 meter telescope of ESO as well as at smaller telescopes. The calculations of synthetic spectra and the comparison with observed spectra allowed to find the values of effective temperature, surface gravity and metallicity of the star.

HIP 13962 – THE POSSIBLE FORMER MEMBER OF BINARY SYSTEM WITH SUPERNOVA

*Yushchenko V.¹, Yushchenko A.², Gopka V.¹, Shavrina A.³, Kovtyukh V.¹, Mkrtychian D.⁴, Hong K.S.⁵
¹Odessa National University, Odessa, Ukraine
²Sejong University, Seoul, S. Korea
³MAO, Kyiv, Ukraine
⁴NARIT, Chiang-May, Thailand
⁵KASI, Taejon, S. Korea*

Previous investigations of this star showed that it can be a former member of stellar binary system with Supernova. Another component of the system is observed as a pulsar in different constellation. We investigate the atmosphere parameters of HIP 13962 and the possible spectral variability. The new observations of this star were obtained at 1.8 meter telescope of Bohyunsan astronomical observatory (Korea) and 2.4 meter telescope of NARIT observatory (Thailand).

THE DESCRIPTION OF CASCADE FRAGMENTATION IN PROTOSYSTEMS WITH SMALL ANGULAR MOMENTUM WITH GRAPHS

*Zakhozhay V.A.¹, Kuratov K.S.², Maylybayev A.T.²
¹Kharkiv National University named after Karazin, Ukraine
²The Kazakh National University named after Al-Farabi, Kazakhstan*

The construction of oriented graph describing cascade fragmentation in protosystems [1-3] with extremely small

angular momentum (SAM) is presented basing on general view introduction of star systems evolution with graphs. The probability of key events necessary for calculating their fractional contents is written in general form. Spectra analysis of mass irregularities which can appear as a result of initial protosystem [4, 5] fragmentation with small SAM is carried out. Dependence of mass fraction passed from protosystem into system as the function of a number of N fragmentations is obtained. For the calculated maximum value $N_{max} \approx 70$ and the time of one fragmentation cycle which is realized at one-act star formation in stars galactic clusters – $\sim 10^7$ years, the time of full gas exhaustion in such star systems as elliptic galaxies, is expected to be equal to $\sim 7 \cdot 10^9$ years. Taking into account that the characteristic time to start galaxies formation is $\approx 12 \cdot 10^9$ years, the obtained result explains satisfactory the fact of star formation lack in elliptic galaxies in the last 5 billion years.

1. Zakhozhay V.A. // Astron. Astrophys. Transact., 1996. V. 10. P.321.
2. Zakhozhay V.A. // Izv. KRAO, 2009, V. 104, No. 6. P. 80.
3. Zakhozhay V.A. // Izv. GAO in Pulkov, 2009. No. 219, pub. 4. P. 105.
4. Zakhozhay V.A. // Astron. Astrophys. Transact., 1995. V. 6. P. 221.
5. Zakhozhay V.A., Minakov A.A., Shulga V.M. // Works of the 10th gammov astronomical conference -school, August 23-28, 2010. – Odessa, Ukraine. P. 115.

RADIOASTRONOMY

THE STUDY OF EXTRAGALACTIC SOURCES 3C 446 AND 3C 345 WITH USING THE SINGULAR SPECTRUM ANALYSIS AND WAVELET ANALYSIS

G.I. Donskykh¹, M.I. Ryabov², A.L. Sukharev², M.F. Aller³
¹ Department of Astronomy, I.I. Mechnikov Odessa National University, Ukraine
² Odessa observatory "URAN-4" of the Radio-astronomical institute NAS, Ukraine
³ Radio observatory of Michigan University, Ann Arbor, USA

We investigated the data of monitoring of flux density data of extragalactic sources 3C446 and 3C345, which was held on 26-meter radio telescope of University of Michigan at frequencies 14.5, 8 and 4.8 GHz.

The data of observations were investigated using singular spectrum analysis ("Caterpillar" – SSA). The basis functions, used in this method are based on the raw data themselves, unlike the Fourier and wavelet methods. "Caterpillar" – SSA is based on the transformation of the original series in the matrix, followed by its singular value decomposition as a result of which the original series are decomposed into additive components. Combining methods of "Caterpillar" – SSA and the short Fourier transform allows a better analysis of time series in different spectral bands.

Based on Fourier filtering method short-periodic and trend components of flux variability were allocated, and they were analyzed separately using the method of wavelet-analysis. According to the results of wavelet analysis for each year of observations, graphics of "spectra periods" were built to determine the contribution of individual periods in the activity of the radio source.

The results obtained with two different methods showed a good correlation between them. For a long time component of the flux the periods of ~ 5 – 9 years were found. For short term components the periods of ~ 1 – 4 years are presented.

The results obtained using two different methods were compared with VLBI radio maps, which were obtained by the program MOJAVE. The changes of periods over time are associated with certain physical processes in the system "core – accretion disk – jet" and appearing of new bright components (knots) in the jet.

MONITORING THE COMMUNICATION CHANNEL FROM PUSCHSHINO TO MOSCOW IN THE PROJECT OF SPACE RADIO TELESCOPE "RADIOASTRON"

Dumsky D.V.^{1,2,3}, Isaev E.A.^{1,2,3}, Samodurov V.A.^{1,2}
¹ Pushchino Radio Astronomy Observatory ASC LPI,
² National research university Higher school of economics,
³ Institute of Mathematical Problems of Biology, Russian Academy of Sciences
dumsky@prao.ru, is@itaec.ru, sam@prao.ru

The need for transmission and storage of large amounts of scientific data in the project space radio telescope "Radioastron" required us to organize a reliable communication channel between the tracking station in

Pushchino and treatment centers in Moscow. Network management data requires us to an integrated approach and covers the organization secure access to manage network devices, timely replacement of equipment and software upgrades, backups, as well as documentation of the network infrastructure. The reliability of the channel is highly dependent on continuous monitoring of network and server equipment and communication lines.

SECULAR DECREASE THE FLUX OF SUPERNOVA REMNANT CAS A ON MONITORING RESULTS TO TELESCOPE "URAN-4" IRA NASU

A.A. Gorbunov¹, M.I. Ryabov², S.K. Panishko²
¹ Astronomy Department of I.I. Mechnikov Odessa National University
² Odessa observatory "URAN-4" IRA NASU

This work is dedicated to the study of secular decrease of the flux of young supernova remnant Cas A according to observations by radio-telescope "URAN-4" of Odessa Observatory IRA NASU from 1987 to 2001 years on frequency of 25 MHz. On the investigation base there is a relationship analysis of flux CasA to the "stable" source – radio-galaxy Cyg A (CasA/Cyg A) which is located on a small angular distance. Results of the observations held on RT «URAN-4» show that there is no noticeable decrease of fluxes in the period 1987-1993, with the relationship ratio (CasA/Cyg A) = 1.5. While considering data from 1987 to 2001 manifested a slight decrease trend in flux equal to 8.4% for the all period. At the same time, according to various investigations the average value flux of Cas A in the interval of frequencies 38-2924 MHz is 0.8% per year. At the meantime in this frequency the range ratio (CasA/Cyg A) has become less than one. Thus, there is a noticeable contradiction of secular decrease of the flux Cas A on this radio frequencies in comparison with the predictions of the theory in 1.7% per year. The reason for the regime change from stability to flux decrease on decimeter waves can be the compact component in the center and features of angular structure of residue found in the x-ray space by telescope "Chandra". It should be noted that the observation results in range from decimeter up to decameter waves depend on the conditions of the ionosphere determined by the dynamics of the solar activity and seasonal and diurnal effects. Further research on observational data obtained on RT "URAN-4" until recently will allow making a more definitive conclusions about the nature of secular decrease of flux Cas A in the decameter range.

RAPID VARIATIONS OF GPS-COORDINATE ERRORS AND THE IONOSPHERE TURBULENCE

O. Lytvynenko, I. Lytvynenko, V. Derevyagin.
Observatory URAN-4, Institute of Radio Astronomy of NASU

It is known that the coordinates, which were measured by GPS-receiver, contains an error that has ionosphere troposphere and interfering components. We are particularly interested to study of rapid errors variations

with the periods of a few seconds to ten minutes. Such variations may be caused by the influence of ionosphere irregularities, such as those that cause scintillations of cosmic radio sources, during radio astronomy observations at decameter waves. Combined observation of cosmic radio sources scintillations by radio telescope URAN-4 and registration of GPS-coordinates error variations were carried out. Data were analyzed.

SEASONAL VARIATIONS OF THE IONOSPHERE SCINTILLATIONS PARAMETERS OBTAINED FROM THE LONG OBSERVATIONS OF THE POWER COSMIC RADIO SOURCES AT THE DECAMETER WAVE RANGE

Lytvynenko O. A., Panishko S. K.
Observatory URAN-4, Institute of Radioastronomy NASU
Pushkinskaya str., 37, Odessa, 65125, Ukraine
spanishko@ukr.net

Observations of the four power cosmic radio sources were carried out on the radio telescope (RT) URAN-4 during 1987-1990 and 1998-2007 at the frequencies 20 and 25 MHz. Effects of ionosphere and in particular existence of intensity fluctuations on the cosmic radio sources records, or scintillations, are essential at the decameter wave range. Long series of the ionosphere scintillations parameters such as indices, periods and spectrum slopes were obtained after observation data proceeding. Behavior of the seasonal variations was investigated on this data. Obtained dependencies were compared with the indices of the solar and geomagnetic activity.

GALAXIES AND QUASARS WITH STEEP RADIO SPECTRUM AT RADIO LUMINOSITY-SIZE DIAGRAM

A.P. Miroshnichenko
Institute of Radio Astronomy of the NAS of Ukraine
Kharkov, Ukraine
mir@rian.kharkov.ua

Our data for sources with steep radio spectrum, detected with radio telescope UTR-2 at the decameter band give evidence on the great luminosities, linear sizes, characteristic ages of these objects. In connection with such peculiarities, we examine the luminosity-linear size relation of galaxies and quasars with steep radio spectrum at the decameter and high-frequency bands. It turns out, this relation has similar trends for considered radio sources with both spectral types: with linear steep spectrum and break steep spectrum. Also, we presented the luminosity ratio-linear size relation at different frequency ranges. We discuss the obtained evolution relations for galaxies and quasars with steep low-frequency radio spectrum.

THE DAILY 110 MHz SKY SURVEY (BSA FIAN): ON-LINE DATABASE, SCIENCE AIMS AND FIRST RESULTS OF DATA PROCESSING

Samodurov V.A., Rodin A.E., Kitaeva M.A.,
Isaev E.A., Dumskij D.V., Pugachev V.D.,
Churakov D.D., Manzyuk M.O.
PRAO ASC LPI

From 2012 on radio telescope BSA FIAN multi beams diagram was started. It capable at July 2014 daily observing by 96 beams in declination -8 .. 42 degrees in the frequency band 109-111.5 MHz. The number of frequency bands are from 6 to 32, the time constant are from 0.1 to 0.0125 sec. In receiving mode with 32 band (plus one common band) with a time constant of 12.5 ms (80 times per second) respectively produced 33x96x80 four byte real and so daily we produced 87.5 Gbt (yearly to 32 Tbt). These data are enormous opportunities for both short and long-term monitoring of various classes of radio sources (including radio transients) and for space weather and the Earth's ionosphere monitoring, for search for different classes of radio sources, etc. The base aims of our work are:

a) to obtain new scientific data on different classes of discrete radio sources, the construction of physical models and their evolution - obtained on the basis of the clock continuous digital sky radio monitoring at frequency 109-111.5 MHz and cross-analysis of data from third-party reviews on other frequencies;

b) launch the streaming data on various types of high-performance computing systems, including to create a public system of distributed computing for thousands of users on the basis of BOINC technology. The BOINC client for astronomical data from the monitoring survey of the big part of entire sky almost have not analogies. We have some first science results (new pulsars, and some new type of radiosources).

OBSERVATIONS OF PULSARS WITH THE URAN AT DECAMETER WAVELENGTHS

Shepelev V.A.¹, Vashchishin R.V.², Lozinsky A.B.³,
Lytvynenko O.A.⁴

¹ Institute of Radio Astronomy, National Academy of Sciences of Ukraine, Kharkiv;

² Gravimetric Observatory of IGP NASU, Poltava;

³ Physico-Mechanical Institute, National Academy of Sciences of Ukraine, Lviv;

⁴ URAN-4 Observatory of IRA NASU, Odessa

Pulsars are the most compact galactic radio sources. As a rule, their emitted energy decreases at frequencies lower than 100 MHz, thus they have negligible flux density in the decameter range that makes difficulties for low frequency observations of the sources. However, the most short-period – millisecond pulsars apparently do not show the low frequency turnover [1]. Under certain circumstances at low frequencies, the pulsars are observed as compact sources of continuum radiation with an angular size determined by scattering of radio waves by inhomogeneities of electron density of interstellar medium. With rare exceptions, these are quite weak radio sources but their steep spectrum allows observing them at

the decameter wavelengths with threshold sensitivity of the order of one jansky. The URAN interferometer network [2] has the maximum angular resolution of about 1", and the recent upgrade of its receivers [3] has improved the instrument sensitivity to a few Jy, thus this instrument can be used both for studying low-frequency spectra of the pulsars and measuring their angular dimensions. The first observations with the URAN of a sample of the millisecond pulsars are presented. The main target of the study was detection of the pulsar continuum emission at decameter wavelengths and determination of its characteristics. In addition, such compact sources can be used as calibrators of the interferometer network in case of sufficiently high flux density.

1. Kuzmin, A. D., Losovsky, B. Ya. *Astronomy and Astrophysics*, 2001, V. 368, P. 230-238.
2. Megn A. V. Braude S. Ya., Rashkovskiy S. L. et al. *Radio Physics and Radio Astronomy*, 1997, V. 2, № 4, P. 385-401, (in Russian).
3. Rashkovskiy S. L., Belov A. S, Shepelev V. A. et al. *Radio Physics and Radio Astronomy*, 2012, V. 17, № 3, P. 207-217, (in Russian).

GROUP OF SOLAR TYPE III BURSTS WITH HIGH-FREQUENCY CUTOFF

*A.A.Stanislavsky, A.A.Konovalenko,
Ya.S.Volvach, A.A.Koval*

Institute of Radio Astronomy, Kharkiv, Ukraine

We study a group of type III bursts, observed in 19 August 2012 and started at 8:23 UT, contemporaneously on three radio telescopes: the Ukrainian decameter radio telescope UTR-2 (8-33 MHz), Nancay Decametric Array (10-70 MHz) in France and San Vito RSTN (25-180 MHz) in Italy. This group consisted of eight bursts which followed each other. Their frequency drift rate was in the range of 1.7 to 3.9 MHz/s with a negative sign, which is typical for ordinary type III bursts. Durations of these bursts were determined. The main feature of the given bursts was the existence of high-frequency cutoff whose value varies in the group within the frequency range 31-37 MHz. The presence of high-frequency cutoff in a solar burst means that its recorded spectrum arises just with the cutoff frequency (far from ionosphere cutoff) at metric-decametric wavelengths. This is very unusual for the type III bursts, since usually they are observed in a wide range of frequencies (from tens kHz up to GHz). With the space vehicles SOHO, LASCO, STEREO the events, occurred on the Sun and in its corona on 19 August 2012, were considered. From this solar data analysis it follows that the unusual properties in this group of type III bursts are associated with coronal mass ejections (CME) and were due to the events occurring near and behind the solar limb.

VARIABILITY DYNAMICS OF THE QUASAR 3C454.3 AND FORECAST CHANGES IN THE RADIO FLUX BASED ON ITS QUASIPERIODIC OSCILLATIONS

Sukharev A.¹, Ryabov M.¹, Aller M.²

¹*Odessa observatory "URAN-4" of the Radio-astronomical institute NAS Ukraine*

²*Radio observatory of Michigan University, Ann Arbor, USA*

The data of 45 years monitoring, carried out on 26-meter radio telescope of the University of Michigan at frequencies of 14.5 GHz (1974 – 2011 years.) 8 GHz (1966 – 2011) and 4.8 GHz (1978 – 2011) were used for studies variability of the quasar 3C 454.3 radio flux.

Fourier filtering the original data were divided into O - C (short-period) and trend flux components which were analyzed separately. To study the variability of the radio source was used method of wavelet analysis of time series and Lomb-Scargle periodogram for series with irregular time-count.

The values of the main periods ~ 6 and 12 years, conformity the phase gain radio flux, which are replaced by a minimum phase (periods ~ 2 – 1 years), and a sharp flux increase in 2010. On the basis of the global wavelet spectra defined main phase change of the spectral power with time in the quasar 3C454.3.

A comparison between the dynamics of jets (Mojave VLBI image) and the local wavelet spectra of the investigated data. Changes over time periods or transitions from one value to another associated with changes in the structure of the quasar VLBI and the emergence of new bright spots in the jet, or a change brightness already visible spots in the jet.

Using bandpass wavelet filtration were identified flux components, corresponding to the bands of main periods in wavelet spectra, found the delay between the observation frequency (58.4 days (14.5 – 8 GHz), 204.4 days (14.5 – 4.8 GHz), 95.0 days (8 – 4.8 GHz)), and delays in the individual bands of periods.

Given the quasi-periodic oscillations of the radio flux from the quasar 3C454.3, a forecast of flux future changes using sinusoidal parametric time series model. The resulting forecast (2011–2015) compared with the control auto regression forecast and superimposed on part of the original series. There were obtained good agreement with the observational data and calculations.

ON THE ELECTRON-PROTON COSMIC RAYS AS MEDIATORS OF VISCOUS FORCES THAT CREATE SHOCK FRONT AND VORTEX STRUCTURES IN THE COCOON OF RADIO GALAXIES

Tsvyk N.O.

*Department of Radio Astronomy, Institute of Radio Astronomy of NASU,
natalitsv69@gmail.com*

There are for the galaxies of FR II type (like Cygnus A) studied the hydrodynamic processes to transport of magnetized plasma with cosmic rays, the kinetic effects of particle interaction with turbulence or radiation; a stratification of the cocoon and the jet because of the e-p cosmic

rays. We found that the jet and bow shock in radio galaxies are supported by the processes of acceleration e-p cosmic rays, the radiation processes of e-rays, and the effects of changes in viscosity inside the cocoon thanks to the p-rays (because of changing the magnetic field lines). Alfvénic waves, the eddies and the cosmic rays are working inside the "jet head" into the cocoon stratification: to the light caviton (with high kinematic viscosity) and to the heavy shock cover (with high magnetic viscosity). The post-jet-vortex is injected by diffusion of e-rays through the area of "jet head" MHD-turbulized, and it is flowing a caviton around. Alternatively, the bow shock accompanied super sound turbulent waves and flows of p-rays. It is predicted that a powerful radio emission in MHz-band distinguishes the areas where e-rays are pulled together into streams, due to the turbulence by viscous forces dumping, and e-rays cooling.

DIFFERENTIATION OF RADIO EMISSION AT DECAMETER WAVELENGTHS

Vasilenko N.M., Sidorchuk M.A.

Institute of Radio Astronomy, National Academy of Sciences of Ukraine

vasnat@rian.kharkov.ua, sidor@rian.kharkov.ua

We present the results of the separation of the observed radio emission at decameter wavelengths into components: extragalactic background component, halo and the disk components of the Galaxy. We used multi-frequency UTR-2 survey at decameter wavelengths for performance of the multifrequency T-T-plots. The differential spectral index of the halo and the disk of the Galaxy in the frequency range 14.7 – 25 MHz determined using pairwise all the above frequencies and then were averaged. We computed the integral brightness temperature of the extragalactic unresolved radio sources at decameter wavelengths. We have excluded contribution of the extragalactic background and zero level offsets from observed diffusion radiation of the sky and have defined value of the halo and disk components of the Galaxy.

THE FIRST RESULTS OF TRANSIENT SIGNAL PROCESSING IN DECAMETER PULSAR/TRANSIENT SURVEY OF NORTHERN SKY

Zakharenko V.V.¹, Kravtsov I.P.¹, Vasylieva I.Y.^{1,3}, Ulyanov O.M.¹, Shevtsova A.I.¹, Skoryk A.O.¹, Mykhailova S.S.², Konovalenko O.O.¹, Zarka P.³

¹*The Institute of Radio Astronomy of the National Academy of Sciences of Ukraine,*

²*V. N. Karazin Kharkiv National University, Ukraine*

³*LESIA, Observatoire de Paris, CNRS, UPMC, Université Paris Diderot, Meudon, France*

Radio telescope UTR-2 has recently accomplished a survey of the northern sky to find pulsars and transient sources of radio emission. On the one hand, studies in

such a low-frequency range are very difficult because of the extremely high influence of scattering in the interstellar medium, very strong radio interference and high temperature of Galactic background. On the other hand, large dispersion delay allows to determine the dispersion measure (DM) of broadband signals with a small characteristic length very accurately.

Parameters of the survey: DM range is $0 \div 30 \text{ pc cm}^{-3}$, declination range is $(-10 \div 90)$ degrees, time resolution is 8 ms. Search is held in a five-beam mode with recording of the sum, the difference and the product of signals of the "East-West" and "North-South" antennas. The recorded data's volume exceeds 80 terabytes.

The results are confident detection of known pulsars (signal/noise ratio is more than 1000) and detection of the large number of transient signals, the discovery and parameterization of decameter emission of the pulsar J0243+6257.

In fact, the single criterion to discriminate between wide-band short duration signals, coming from cosmic sources and interference of terrestrial origin is the dispersion law. That's why the utmost attention is paid to the precise definition of the dispersion delay of each transient signal.

Results of processing of the transient signals (after the exclusion of signals of the known pulsars [1]) are shown in the present work. Intensities and durations of the signals, distances and coordinates of candidates, their distributions with respect to different parameters (energy, distance, galactic latitude etc.) were obtained. We compared these distributions with distributions of the known nearby pulsars [2]. The analyzed similarities and differences were lead to a conclusion, that a large number of these signals are generated by sources in outer space. Results of the work are likely to give a new reference data for the neutron stars population synthesis and for studies of the nearest galactic surroundings.

1. Zakharenko V.V., Vasylieva I.Y., Konovalenko A.A. et al. Detection of decameter-wavelength pulsed radio emission of 40 known pulsars // *Monthly Notices of the Royal Astronomical Society*, 2013, vol. 431, Issue 4, p. 3624-3641.
2. Manchester R.N., Hobbs G.B., Teoh A. & Hobbs M., *AJ*, 129, 1993-2006 (2005).

SUN, SOLAR ACTIVITY AND ASTROBIOLOGY

CONNECTION BETWEEN THE CME VELOCITIES AND DECAMETER RADIO BURSTS PARAMETERS FROM URAN-4 OBSERVATIONS

Galanin V.V.¹, Isaeva E.A.^{1,2}

¹ Institute of Radio astronomy of NAS of Ukraine, URAN-4 observatory

² Astronomy observatory institute of I.I. Mechnikov ONU gvv@breezein.net, isaeva-ln@mail.ru

Radio telescope URAN-4 is the decameter instrument that work in 10-30 MHz band. Its antenna represents the phased array that consists from 128 vibrators. They allow selecting two linear polarized components of signal. Direction diagram width of this instrument is 2.7x22 degrees on 25 MHz frequency. In the long base radio interferometer regime there is 2 seconds resolution provided.

The work presents the results of research of connection between the coronal mass ejection (CME) velocities with the IV type continual decameter bursts parameters. The sample to be study has contained 26 events. As the parameters, that characterizes the CME velocities we used integral stream of radio bursts and background intensity on 20 and 25 MHz frequency. The comparative analysis showed that connection between CME velocity and IV type radio bursts is significantly increased if we used the intensity of radio bursts and background on two polarizations of the same frequency. In our case correlation between CME velocity and the studied parameters is equal to ~0.75.

EVALUATION OF CORONAL SHOCK WAVE VELOCITIES FROM THE II TYPE RADIO BURSTS PARAMETERS

Galanin V.V.¹, Isaeva E.A.^{1,2}

¹ Institute of Radio astronomy of NAS of Ukraine, URAN-4 observatory

² Astronomy observatory institute of I.I. Mechnikov ONU gvv@breezein.net, isaeva-ln@mail.ru

The work presents the results of research of connection between the coronal shock waves and the parameters of II type (mII) meter-decameter bursts in 25-180 MHz band for 66 solar proton events. The velocities of coronal shock waves for this two cases were determined. In the first case the velocities of the shock waves was evaluated according to the Newkirk model and in the second case – directly from the II type radio burst parameters. The calculated values of shock waves velocity was compared with the same velocity values that is published on NGDC site. The comparative analysis showed that precision of coronal shock waves velocity estimation which gets directly from II type radio bursts parameters was higher than the same one which used the Newkirk model.

Research showed that there is exist the sufficiently strong connection between the shock wave velocity and the delay of II type burst intensity maximum on the

second harmonica. Correlation coefficient between the studied parameters was equal to ~0.65.

THE REACTION OF PHOSPHORUS-CONTAINING INTRACELLULAR INCLUSIONS ON THE CHANGE OF SPACE WEATHER

Gromozova E.N., Kachur T.L., Voychuk S.I., Kharchuk M.S.
Institute of Microbiology and Virology of NAS of Ukraine,

Kyiv
gren.elen@gmail.com

The basement of the bio-astronomy-effect of Chizhevski-Velhover is a metahromazy reaction of polyphosphate-containing volutin granules of microorganisms. Results of daily monitoring of this indicator during 2001-2015 carried out in the Institute of Microbiology and Virology of NAS of Ukraine demonstrated the rhythmic of this process and its relation with some cosmophysical factors. Under the laboratory conditions it was able to induce the reaction of metahromazy of yeast cells by influencing the different stress factors (low temperature, anaerobiosis, etc.). Considering that the metahromazy reaction lay on the aggregation of dye's molecules on polyphosphate-matrix, some possible intracellular events driving this process were studied. Found that interaction of polyphosphate with protein and calcium salts block the adherence of dye molecules. At the same time addition into the reaction mixture of glucose at different concentrations did not affect the progress of the process. The appearance of a shift in the absorption spectrum of metahromazy was due primarily to reduction of the polyphosphate concentrations. Effects of low concentrations were more pronounced with higher degree of polymerization of phosphates. Thus, the reaction of the metahromazy caused by staining of polyphosphates with methylene blue dye can only be made on the protonated chain. These links are easily replaced by the dye molecules.

The inorganic phosphates are active participants of the defense reactions within microbial cells caused under various stresses. It is possible to suggest that the metachromatic color of the intracellular polyphosphate granules correlates with cosmophysical events also due to the stressful action of the last ones. However, the effect of known stresses is accompanied by polyphosphate accumulation that may not provoke metahromazy reaction. Therefore, this reaction can be caused both by the changes of conformation of chains where the distance between the reactionary groups become $5A^0$ or by sol-gel phase transformations, both of these require the additional researches. The next question remains open is if the metahromazy reaction of intracellular polyphosphate granules is a response on the space weather changes or if possessing the apparent similarity of the effects, they are of a different nature.

PECULIARITIES OF IONOSPHERE LAYERS PARAMETERS SEASON VARIATIONS DURING THE SOLAR ACTIVITY MAXIMUM

Kravetz R.O., Galanin V.V.

Institute of Radio Astronomy, NAS of Ukraine
krro@ukr.net, gvv@breezein.net

In radio astronomy, ionosphere represent some disturb factor because it is distort signals of the cosmic radio sources which is received by the overland radio telescopes. In this connection, study of ionosphere particularities and disturbances, is a very actual tusk. Ionosphere parameters are measured by number of ionosphere stations (ionosondes) and they are available for study and processing. It allows revealing the season variations of parameters of ionosphere layers.

In this work we study ionosphere parameters data that was obtained during the maximum of 24solar activity cycle. The data was measured by ionosonds network of European Digital Upper Atmosphere Server (DIAS) in 2014. We study time dependencies of critical frequencies of ionosphere layers E, F1, F2 and sporadic layer Es. Some peculiarities of this parameters season variations are revealed.

IONOSPHERE EFFECTS ON ST PATRICK'S DAY

Kravetz R.O., Galanin V.V.

Institute of Radio Astronomy, NAS of Ukraine
krro@ukr.net, gvv@breezein.net

Last time the grate attention is pay to space weather influence on the various processes on the Earth. Main indicators of space weather is geomagnetic indices' that measured by special stations.

In the work we examine connection between geomagnetic disturbances and parameters of Earth ionosphere. In particular, we study event that take place on St Patrick's day – march 17, 2015. This day Kp index amount it maximum and G4 geomagnetic storm is arise. We study ionosphere parameters on this day and some next days and attempt to reveal connection of these parameters with the geomagnetic disturbances. Ionosphere parameters were measured by European Digital Upper Atmosphere Server (DIAS). It is showed that such geomagnetic disturbances influence on high latitude ionosphere is much more then it influence on the middle latitude one.

DOUBLE MAXIMA 11-YEAR SOLAR CYCLES

Krivodubskij V.N.

Astronomical observatory of Kyiv Taras Shevchenko National University, Ukraine

We propose a scenario to explain the observed phenomenon of double sunspot cycle maximum, which is attended by five magnetism adjustment processes in the solar convection zone (SCZ): Ω -effect, magnetic buoyancy, macroscopic turbulent diamagnetism, $\nabla\rho$ -effect and meridional circulation. It was found that the reconstruction of magnetism in the high-latitude and equatorial domains of the SCZ occurs in different modes. A key role in the developed mechanism of double maxima play two tides of toroidal fields from the lower base of the SCZ bottom to the solar surface in the equatorial domain. Deep toroidal fields are

excited due to Ω -effect near the bottom of the SCZ at the beginning of the cycle. Then these fields are transported to the surface due to combined acting of magnetic buoyancy, macroscopic turbulent diamagnetism and magnetic $\nabla\rho$ -flow in the equatorial domain. Over time the magnetic fragments can be seen as bipolar sunspot groups in the middle latitudes in the "royal zone". This first wave of toroidal fields, which is directed up, gives the main maximum of sunspot activity. However, the underlying toroidal fields in the high-latitude polar domains at the beginning of the cycle are blocked near bottom of the SCZ by two antibuoyancy effects, directed downward turbulent diamagnetic transfer and magnetic $\nabla\rho$ -pumping. Deep meridional flow toward the equator replaces /transfers these fields to the low latitudes of the equatorial domain (where there are favourable conditions for magnetic floating) during about 1-2 years. Then "belated" magnetic fields float up /rise up to surface (second tide of toroidal field). This second portion of toroidal fields, coming to the solar surface at low latitudes, leads to second (repeated) sunspot maximum.

LONG-TERM CHANGES ASYMMETRY OF SOLAR ACTIVITY

U. M. Leiko

Astronomical Observatory of Taras Shevchenko Kiev National University, leikoum@ukr.net

We report the results of the analysis of the north-south asymmetry of solar activity, solar magnetic fields. The analysis is based on the greenwich sunspot data time series, 1875-2015 (<http://solarscience.msfc.nasa.gov/greenwch.shtml>) and large-scale solar magnetic field time series (solar mean magnetic field, SMMF), 1975-2015 (<http://wso.stanford.edu>). To study long-term changes asymmetry of solar activity applied analysis of cumulative sum. Cumulative sum adds the current value of the analyzed series with all previous, averages short-periodic changes and identifies long-term periodicity. If the cumulative amount increases, then dominated by positive values, if the cumulative amount decreases then dominated by negative values.

Minimum of cumulative sum of sunspot area mean monthly values time series occurs in 1902, maximum - in 1980. Perhaps this is branch growth long-term, about 160-year cycle south-north asymmetry of solar activity. Change of cumulative sum of SMMF time series has different character. There are take place alternating short intervals the predominance of positive and (or) negative polarity.

PROBLEM OF MISTAKES IN DATABASES, PROCESSING AND INTERPRETATION OF OBSERVATIONS OF THE SUN

Lozitska N.Y.

Astronomical Observatory of Taras Shevchenko National University of Kyiv,
Observatorna 3, Kyiv 01053, Ukraine
nloz@observ.univ.kiev.ua

In databases of observations sometimes meet unnoticed mistakes and misprints, which could occur at any stage of observation, processing and compilation of databases. The current detection of errors is complicated by the fact that the work of the observer, the compiler of da-

tabases and the researchers were divided. Data acquisition from a spacecraft requires bigger group of researchers than the ground-based observations (from founders of the equipment to the programmers who process information from spacecrafts). As a result, the probability of error is increasing. It is very difficult to keep track of all the errors on each stage, but it is possible to use a method of cross-comparison of data from different sources. We revealed some errors in the databases of sunspot areas and solar flare peak intensities using statistical investigation.

DIAGNOSTICS OF SPATIALLY UNRESOLVED MAGNETIC FIELDS IN SOLAR FLARES AND SUNSPOTS

V.G. Lozitsky¹ and M. Gordovskyy²

¹Astronomical Observatory of Taras Shevchenko National University of Kyiv,

Observatorna 3, Kyiv 01053, Ukraine
lozitsky@observ.univ.kiev.ua

²Jodrell Bank Centre for Astrophysics, University of Manchester, Alan Turing building,
Manchester M13 9PL, United Kingdom

Magnetic field in the solar photosphere can be very inhomogeneous at spatial scales comparable to the resolution of modern instruments. It is known, that the magnetic field can be measured directly only in umbras of large sunspots, where it is strong (up to about 3 kG) and the filling factor is close to unity. Outside sunspots, where filling factor can be substantially smaller than unity (due to spatially unresolved features), measurements based on the Zeeman effect yield spatially average field values, or, effectively, the magnetic flux. In solar flares, the picture of Zeeman splitting is even more complicated due to the presence of absorption as well as emission components, and due to temporal evolution of the magnetic field and thermodynamic conditions in flaring atmosphere. Furthermore, flares often exhibit mixed magnetic field polarity, which can make the field diagnostics even more difficult. Some aspects of these problems were discussed by Gordovskyy and Lozitsky (2014) and Lozitsky (2015).

In this talk, we will discuss the small-scale field and its inhomogeneity in sunspots and solar flares, and recent magnetic field measurements based on spectropolarimetric data from Kyiv Horizontal Telescope and Hinode SOT.

Gordovskyy M., Lozitsky V.G.: 2014, *Solar Phys.* 289 (10), 3681–3701.

Lozitsky V.G.: 2015, *Advances in Space Research.* 55, 958–967.

MAGNETIC FIELDS IN PROMINENCES AND LIMB FLARES ON THE SUN

Lozitsky V., Masliukh V., Botygina O.

Astronomical Observatory of the Taras Shevchenko National University of Kyiv

We present the results of measurements of magnetic fields in three active prominences, four quiescent prominences and two powerful limb flares. Anticorrelation effect of measured magnetic field in D3

HeI and Ha lines of two active prominences is detected for the first time. Also sufficiently strong magnetic field (50–80 mT) of powerful and slow M7.7 limb flare are measured for the first time. It is shown that the magnitude of local magnetic fields in active prominences and limb flares reaches to 200–400 mT, the magnitude of quiescent prominences is 3–5 times lower. Calculations in the framework of two-component model showed that small-scale emission elements with high optical depth and low temperature (5000 K) occurred in solar limb flare. Conclusion is argued that the most reasonable interpretation of the observations for the theoretical MHD model according to investigated strong fields are occur in layered force-free structures with the periodic alternation of magnetic polarities. Our results are consistent with Yakovkin's theoretical calculations of the helium and hydrogen emission in different parts of the prominence.

SIMULTANEOUS MAGNETIC FIELD MEASUREMENTS IN SUNSPOTS USING FIVE SPECTRAL LINES OF MnI, FeI AND NiI

S.N.Osipov¹ and V.G. Lozitsky²

¹Main Astronomical Observatory of National Academy of Sciences,

Zabolotnoho 27, Kiev 03680, Ukraine
osipov@mao.kiev.ua

²Astronomical Observatory of Taras Shevchenko National University of Kyiv,

Observatorna 3, Kyiv 01053, Ukraine
lozitsky@observ.univ.kiev.ua

We present magnetic field measurements in several sunspots observed in June–July 2015. Observations were carried out on horizontal solar telescope ATsU-5 of Main Astronomical Observatory of National Academy of Sciences of Ukraine. Spectra recordings were performed using the SBIG ST-8300 CCD camera. For observations of I+V and I–V spectra, the polarization mosaic made by V.I.Skomorovsky and quarter-wave plate were used. Measured spectra were corrected for flatfield, parasitic interference, and curvature of spectral lines. The Zeeman splitting in five spectral lines of MnI, FeI and NiI placed nearly FeI 5434.5 with Lande factors from 0.50 to 2.14 were compared. Our main conclusions are the following:

a) as rule, spectral lines with largest Lande factors give the strongest Zeeman splitting in sunspot umbra that can be interpreted as a result of blending the Zeeman pi- and sigma-components in case of non-longitudinal magnetic field.

b) there are essential differences between lateral field profiles by different spectral lines; for example, such profiles obtained by FeI-1143 5432.950 and NiI-70 5435.871 lines have different shape, with almost flat and sharp top, although both lines have close Lande factors (0.67 and 0.5, respectively).

We plan study named effects in detail and present our conclusion in our report.

PECULIARITIES OF A GROUP RESPONSE OF CARDIOVASCULAR SYSTEM OF VOLUNTEERS AT DIFFERENT LATITUDES TO CHANGES OF SPACE WEATHER PARAMETERS

Parshina S.S.¹, Samsonov S.N.², Manykina V.I.²,
Afanasyeva T.N.¹, Petrova P.G.³, Petrova V.D.¹,
Strekalovskaya A.A.³, Tokayeva L.K.¹, Kaplanova T.I.¹,
Potapova M.V.¹

¹V. I. Razumovsky Saratov State Medical University of the Russian Ministry of Health

²Yu.G.Shafer Institute of Cosmophysical Research and Aeronomy of Siberian Branch of the Russian Academy of Sciences

³Medical Institute of M.K.Ammosov North-Eastern Federal University

A simultaneous monitoring on estimation of response reaction of cardiovascular system of healthy volunteers to the change of space weather at the auroral (Tixie), subauroral (Yakutsk) and middle latitudes (Saratov) has been carried out. In all investigated groups the presence of effect of synchronization of re-polarization processes of a ventricle myocardium (by data of T-wave symmetry coefficient of the electrocardiogram - TSC) and geomagnetic disturbance (by data of Kp-index) has been revealed. The coincidence of maxima of TSC and Kp-index has implied a synchronization. During rest the effect of synchronization of a condition of myocardium with a change of geomagnetic disturbance has been observed in 36,6% - 46,1% of subjects which depends on a place of monitoring. The effect of synchronization is most expressed during rest. It is partially lost when carrying out emotional and physical activity and it is restored after the 10-minute rest. Peculiarities of effect of synchronization in separate groups of observation are analyzed.

This work has been carried out under a partial financial support by means of a joint Russian-Ukrainian grant No. 14-02-90424 ukr_a.

SUN'S POLAR MAGNETIC FIELD REVERSALS IN SOLAR CYCLE 24

M.I.Pishkalo, U.M.Leiko

Astronomical Observatory of Taras Shevchenko National University of Kyiv,

Observatorna vul., 3, Kyiv, 04053, Ukraine

It is known that polar magnetic field of the Sun changes its sign at the maximum of solar cycle. These changes were called as polar field reversals. We investigated dynamics of high-latitude solar magnetic fields separately in northern and southern hemispheres. Solar polar field strength measurements from the Wilcox Solar Observatory and low-resolution synoptic magnetic maps from the SOLIS project and from Helioseismic and Magnetic Imager (HMI) onboard Solar Dynamics Observatory were used. We analyzed total magnetic flux at near-polar zones, starting from 55, 60, 65, 70, 75, 80 and 85 degrees of latitude, and found time points when the total magnetic flux changed its sign. It was concluded that total magnetic flux changed its sign at first at lower latitudes and finally near the poles. Single polar magnetic field reversal was found in the southern hemisphere. The northern hemisphere was characterized by at least triple magnetic field reversal. Polar magnetic field reversals

finished in northern and southern hemispheres by CR 2150 and CR 2162, respectively.

FACTORS OF SPACE WEATHER AND BIOSPHERE: THE DYNAMICS IN 23–26 CYCLES OF SOLAR ACTIVITY

Rudenchik E.¹, Ragul'skaya M.¹, Obridko V.¹,
Hramova E.¹, Gromozova E.²

¹IZMIRAN, Moscow, Russia

²Institute of Microbiology and Virology of the NASU, Kiev, Ukraine

Different factors of the solar activity may influence the biosphere in different ways. Moreover, the relation can strongly change at different time scopes. Particularly, the impact of separated flashes is, probably, very important at short time intervals; and at the large time intervals one could expect more impact of global fields and their century evolution.

Daily monitoring of metachromatic reaction *Saccharomyces cerevisiae* was carried out in 2000 – 2013, Institute of Microbiology NASU. Statistical treatment of the monitoring data carried out by IZMIRAN. The IZMIRAN daily data base of physiological parameters dynamics for 2000–2013 years was analyzed simultaneously (25 people) [1]. Galaxy cosmic rays intensity variation insert the main contribution on the cell structures in Chizhevsky–Velkhover effect. The solar factors insert less contribution. The contribution of geomagnetic fields is indistinguishable from random.

The analysis showed significant simultaneous changes of the statistical parameters of the studied biological systems in 2004–2006 [2]. Similar simultaneously changes of adaptation strategies of human organism and the cell structures *Saccharomyces cerevisiae* during the 23–24 cycles of solar activity are discussed. This phenomenon could be due to a replacement of bio-effective parameters of space weather during changing from 23 to 24 solar activity cycle and nonstandard geophysical peculiarities of the 24 solar activity cycle. Proposed, that the observed likeness aroused as the evolution selection optimization of a lively- systems in expectation of probable prolonged period of low solar activity (2–4 cycles of solar activity).

The study is supported by the Russian – Ukraine grant RFBR Укр_a №14-02-90424.

- Obridko V., Ragul'skaya M., Rudenchik E., Khabarova O., Hramova E.// Solar activity 23-24 cycles and structure of biomedical monitoring data, *Tekhnologii zhivyykh sistem* (Technologies of live systems, ISSN 2070-0997), 2014, 11(3), 12-22, DOI: 10.13140/2.1.2980.4167.
- Ragul'skaya M.V., Rudenchik E.A., Chibisov S.M., Gromozova E.N.// Effects of Space Weather on Biomedical Parameters during the Solar Activity Cycles 23-24. *Bulletin of Experimental Biology and Medicine*, June 2015, Volume 159, Issue 2, pp 269-272 (<http://link.springer.com/article/10.1007/s10517-015-2939-0>).

THE MAIN PROPERTIES OF THE ACTIVITY OF THE NORTHERN AND SOUTHERN HEMISPHERES IN 23-24 SOLAR CYCLES

Ryabov M.I., Sukharev A.L.

Odessa observatory "URAN-4" Radio Astronomy
Institute of the National Academy of Sciences of Ukraine

We showed the basic properties of the cycles based on the application of wavelet analysis of daily ϵ values of indexes of the North (N) and South (S) hemispheres: WN, WS (the Wolf number), SpN, SpS (summary of sunspots groups) in comparison with data for all solar disk.

We received the main data 23-24 cycles: the start and end time, increase phase, maximum and decrease phase, global Wavelet spectra, prevailing processes of cycle formation, time of their existence, spotless periods. We showed the difference of these indicators for the studied indexes. On the basis of the daily index values we identified features of alternating predominance of activity of the northern and southern hemispheres.

Start and end times of the activity in each of the hemispheres of the Sun in each cycle are synchronized in a certain way. Application of the method of bandpass filtering results of wavelet analysis allows differentiating between the two cycles. The results obtained can be the basis for forecasting solar activity and should be taken into account in the theory of the formation and development of the activity cycle.

GALACTIC COSMIC RAYS AS ONE OF THE MAIN POSSIBLE FACTORS OF THE INFLUENCE OF SPACE WEATHER ON EARTH'S BIOSPHERE PROCESSES AT THE CELLULAR LEVEL

B.A.Shakhov¹, Yu.I.Fedorov¹, Yu.L.Kolesnyk¹,
H.N.Gromozova², V.V.Vyshnevsky³, A.S.Sychev³

¹ Main astronomical observatory of NASU
Kiev, Zabolotnogo 27

² Zabolotny institute of microbiology and virusology of NASU
Kiev, Zabolotnogo 152

³ Institute of mathematical machines and systems problems
of NASU
Kiev, prosp.akad.Glushkov 42

As it was known in there exists a correlation between the temporal course of the intensity of galactic cosmic rays (GCR) and the metachromasia reaction of the intracellular structures (of volutin granules). However, this correlation disappears during the maximum of solar activity. On the other hand the results were obtained.

Earlier indicating a correlation between the metachromatic reaction from one hand and the speed of the solar wind and the amount of interplanetary magnetic field (IMF), from the other hand. In this paper we consider the model of the GCR distribution in the heliosphere. Decrease of the intensity of GCR in the heliosphere is determined by the modulation parameter u_0/α where u - is the velocity of the solar wind α - is the diffusion coefficient of the GCR, defined by the structure and magnitude of the IMF, r_0 is the size of modulation region. But this in turn allows us to assert with high probability the determinant influence of the GCR on the processes occurring in the biosphere at cellular level. One should note the fact that high-energy GCR are not modulated, low-energy particles are not passed to the Earth's magnetosphere and ionosphere, at least for temperate zones. This leads us to conclusion that the biotropic impact of GCR occurs for specific range of energies. In this paper, based on analytical solutions of boundary problems of the theory of modulation of GCR we calculated the concentration of the GCR for different energy ranges and for various models of the IMF.

SOLAR SYSTEM

ELLIPTICAL POLARISATION OF THE EARTH'S POLAR MOTION EXCITATION

Bizouard Christian

Observatoire de Paris, SYRTE, 77 av. Denfert-Rochereau, 75014
christian.bizouard@obspm.fr

The polar motion of the Earth's rotation pole with respect to the crust is one of the most puzzling phenomenon affecting our planet. Many of its features are not fully understood, like the origin of its main component, a pseudo-harmonic cycle in 433 days. Polar motion is mostly excited by equatorial exchanges of angular momentum between the solid Earth and its surface fluid layer. This variation of angular momentum is called equatorial excitation. It can be decomposed into clockwise and counter-clockwise circular motions at given frequency, yielding an elliptical motion. We discovered that these ellipses tend to take an privileged orientation of 80° East as well a favoured ellipticity of 0.8. Equivalently the polar motion excitation has an elliptical polarisation. A geophysical interpretation is proposed in light of global hydro-atmospheric circular models.

THE PHYSICAL PARAMETERS OF THE GAS AND DUST IN COMETARY ATMOSPHERES

Churyumov K.I., Ponomarenko V.O., Kleschonok V.V.
Taras Shevchenko National University of Kyiv, Kyiv
04053, Ukraine, klivch@mail.ru, vasilyponomarenko@gmail.com

The results of observations and studies of comets on the basis of the optical spectra with an average resolution were presented. Spectral material was mainly produced in 2009–2012 and 2015 yy. with the help 2-m telescope Zeiss ($F_1 = 6.3$ m; $F_2 = 16$ m) to high mountain astronomical station "Terskol" of Main Astronomical Observatory of National Academy of Sciences of Ukraine and the Institute of Astronomy RAS. The resolution of the spectra $R \approx 1500$, $R \approx 4500$, $R \approx 14,000$; wavelength ranges $\lambda\lambda = 3850–8000$ Å.

Using the spectra of comets, based on the model Hazer, was performed the following work: carried out the identification of spectral emission lines, obtained physical parameters of the neutral gas atmosphere of comets (energy fluxes, the number of molecules of gas productivity). And also, physical parameters the dusty atmosphere (spectrophotometric gradient, relative dust productivity).

ON THE POSSIBILITY OF APPEARANCE OF HOT PHASE IN COMETS

Ibadov Subhon

Lomonosov Moscow State University, SAI, Moscow, Russia
Institute of Astrophysics, Tajik Academy of Sciences,
Dushanbe, Tajikistan

It is shown that in cometary atmospheres are being generated short-living quickly expanding hot phase, plasma clots/blobs, having the initial temperatures in the range 10^5

– 10^7 K, i.e., plasma that is capable to radiate X-rays, due to high-velocity collisions between cometary and interplanetary dust particles in the inner heliosphere, at heliocentric distances, R , around and less than 1 AU. Searches for soft X-rays, energetic 0.1–10 keV photons, at $R < 1$ AU, from dusty comets having retrograde orbital motion, using orbital X-ray telescopes like ROSAT and XMM, are of interest for studying dusty matter near the Sun.

KINEMATICS MOTION SOME BINARY NEAR-EARTH ASTEROIDS

N.Ivanenko, A.Bazyey

Astronomical Observatory of Odessa National University,
Ukraine
ivanenko.natali2012@yandex.ru, o.bazyey@onu.edu.ua

Made calculation resonances of binary asteroids near-Earth (<http://johnstonsarchive.net/>) with the planets of the Solar system: Venus and Mars. We consider the spin-orbital and orbital-orbital resonances.

Determined that asteroids: (5381) Sekhmet is in orbital-orbital resonance with Venus in the ratio of 4:6; (5646) 1990 TR - with Mars in the ratio 3:5 and (363599) 2004 FG11 - with the Earth at a ratio of 1:2.

Search spin-orbital resonances performed only asteroid systems reliably determined period of the satellite around the main asteroid. The system (5646) 1990 TR is simultaneously possible spin-orbital resonance with Venus 1:277, with the Earth 1:450 and with Mars 1:847.

Also identified possible spin-orbital resonances asteroids: (3671) Dionysus and S/1997 (3671) 1, (7088) Ishtar, (31345) 1998 PG, (65803) Didymos, (66063) 1998 RO1, (69230) Hermes, (85938) 1999 DJ4, (137170) 1999 HF1, (175706) 1996 FG3, (185851) 2000 DP107 and S/2000 (2000 DP107) 1, (285263) 1998 QE2, (399774) 2005 NB7, 1994 XD, 2005 AB with Venus, Earth and Mars.

SOME PHYSICAL PARAMETERS OF THE COMET 103P/HARTLEY2

Ivanova O.¹, Lukyanyk I.², Shubina E.², Kiselev M.¹,
Afanasiev V.³

¹Main Astronomical Observatory, NAS of Ukraine,

²Taras Shevchenko National University of Kyiv,

³Special astrophysical observatory of RAS

sandra@mao.kiev.ua, iluk@observ.univ.kiev.ua,
kiselev@mao.kiev.ua, vafan@sao.ru

We analyzed the narrow-band photometry and long-slit spectroscopy of the comet 103P/Hartley 2 taken in 2010 November, after the time of perihelion passage. The comet was 1.08 AU and 0.2 AU heliocentric and geocentric distances, respectively. The observations were made at the prime focus of the 6-m telescope BTA using the focal reducer SCORPIO. The narrowband filters were used for selecting the BC (4450/67 Å), RC (7128/58 Å) continuum and C₂ (5141/118 Å), CN (3870/62 Å), CO⁺ (4277/39 Å) and NH₂ (6630/34 Å). We analyze the 3800–7200 Å long-slit spectra of the comet and detected features of following molecules of CN, CH, CH⁺, CO⁺, C₃, C₂ and NH₂. We estimated gas productivity

of the comet using Haser Model and some physical parameters using Shulman's Model. Also we calculated dust production rate of the comet. We analyzed the morphology of the coma using different digital filters.

A TECHNIQUE FOR CALCULATING THE BASIC KINEMATIC PARAMETERS OF METEORS BASED ON THE SUPER-LONG STATION OBSERVATIONS (~ 152 km)

A.V. Golubuev

Institute of Astronomy, V.N. Karazin KhNU, Kharkiv, Ukraine

Alexandr_sky@mail.ru

Systematical study of the meteor events in Odessa are being carried out since 1953. In 2003 complete modernization of the observing technique was performed, and TV meteor patrol on the base of WATEC LCL902 cameras was created. Wide variety of mounts and objectives are used: from Schmidt telescope $F = 540$ mm, $F/D = 2.25$ (field of view $FOV = (0.68 \times 0.51)$ deg, star limiting magnitude $SLM = 13.5$ mag, star astrometric accuracy 1-2 arcsec) up to Fisheye lenses $F = 8$ mm, $F/D = 3.5$ ($FOV = (36 \times 49)$ deg, $SLM = 7$ mag).

Double-station observations during 2010 and 2011 in Odessa (Kryzhanovka station) and Serpents' Island are presented. The observations are carried out simultaneously from two points placed at the distance of 152 km. During 2010 (August) and 2011 (August) meteor events were registered (~150 meteor events). Some preliminary results are presented here.

Software was created for processing of meteor TV observations. It enables one to carry out the whole cycle of data processing: from image preprocessing up to orbital elements determination. Astrometry, calculation of meteor trajectory in Earth atmosphere and computation of heliocentric orbit are realized in developed software.

Error of determination of the meteor trajectory arc ~ (10-12) arcsec. Error of determination of the large circle pole of the meteor trajectory is ~ (3-13) arcmin. Error of determination of the meteor radiant ~ (0.5-1.5) deg. Error of determination of the meteor velocity atmospheric ~ 3 percent.

TELEVISION OBSERVATION OF STAR OCCULTATION BY THE MOON IN 2014

Kleshchonok V.V., Buromsky M.I., Mazur V.Jo.
AO of Taras Shevchenko National University of Kyiv, Ukraine

Description of TV observations of double and single stars occultations by the Moon in the Astronomical observatory of the Kyiv University in the 2014 years was given. During this period, more than 800 events disappear and reappear of stars were registered by the television complex set "Spalakh". The detailed analysis of observations of some interesting phenomena was given. Some improvement of the parameters of binary stars were obtain and new binaries were open on the basis on the analysis of the photometric curves of occultations.

PHOTOMETRY OF PLASMA TAIL OF THE COMET C/2014 Q2 (LOVEJOY)

Kleshchonok V.V.¹, Luk'yanyk I.V.¹, Gorbanev Yu.M.², Kashuba V.I.², Nyshenko R.O.³

¹ *AO of Taras Shevchenko National University of Kyiv, Ukraine*

² *AO of Odessa I.I. Mechnikov National University, Ukraine*

³ *National University of "Kyiv-Mohyla Academy", Ukraine*

Comet C / 2014 Q2 (Lovejoy) was observed February 7, 2015 at the observation station in v. Mayaki (№583). The observations were made with help the telescope RC-800 ($D = 80$ cm, $F = 214.0$ cm) using a CCD camera MicroLine 9000 in integral light. Basic reduction was made with taking into account the dark frame and flat-field frame. Photometry of comet tails performed using an interactive program by construction a set of transverse and longitudinal profiles for individual rays of the tail. Shulman diffusion model was used for the interpretation of the profiles. Comparison of theoretical and experimental model profiles allowed us to estimate the following physical parameters: acceleration, the lifetime of fluorescent ions, the longitudinal and transverse diffusion coefficients, the induction of the magnetic field.

STUDY OF QUASI-PERIODIC VARIATIONS IN DRAG OF ARTIFICIAL SATELLITE AND EFFECTS OF SPORADIC CHANGES DURING 23-24 SOLAR CYCLES

Komendant V.H.¹, Koshkin N.I.², Ryabov M.I.³, Sukharev A.L.³

¹ *Astronomy Department of Odessa I.I. Mechnikov National University*

² *Research Institute "Astronomical observatory" of Odessa I.I. Mechnikov National University*

³ *Odessa observatory of Radio astronomical Institute NANU*

The atmospheric drag dynamics of five artificial satellites with circular orbits and changes in motion of ten artificial satellites with elliptical orbits was consider by applying spectral time analysis. Apogee distance of satellites, moving in an elliptical orbit, changed in the range 2300-6400 km above surface of the Earth. Perigee distance of satellites with elliptical orbit changed in the range 260-650 km above surface of the Earth. Apogee distance of satellites, moving in a circular orbit, changed in the range 500-700 km; perigee distance in the 440-700 km (above surface of the Earth). Observation data includes ten years of observations which cover end of 23-rd (2005-2008) and rise and maximum phase of 24-th (2009-2014) solar cycles and minimum phase between them. In the atmospheric drag dynamics of circular orbit satellites clearly marked regular atmospheric drag effect with long periods: 2-4 years and the short time period effects with periodicities of less than one year. All this periodicities associated with the exhibition of solar activity. For elliptical orbit satellites found periodicity: quasi-

annual, four years and periodicities of less than one year – associated with active processes in the magnetosphere.

The analysis of major short atmospheric drag variations clearly showed the impact: UV emission of major solar flares, streams of charged particles from the coronal holes, coronal mass ejections (CMEs), shocks in the solar wind – on the investigated artificial satellites.

Time-frequency analysis of tides total potential from the Sun and the Moon, at several latitudes of the Earth, shown the offset of maximum amplitude from short-period components for low latitudes to long-period components for high latitudes. We used several packages of the statistical analysis for our estimations, which are: Origin Pro 8.1, STATISTICA 8 и PSELab.

REMOTE SENSING OF THE SATELLITE ROTATION AROUND CENTER OF MASS USING PHOTOMETRY

N.Koshkin, L.Shakun, E.Korobeynikova, S.Melikyants, S.Strakhova, V.Dragomiretsky, A.Ryabov, T.Golubovskaya, S.Terpan

*Research institute "Astronomical observatory" of Odessa I.I. Mechnikov National University
nikkoshkin@onu.edu.ua*

Traditional control of space objects (SO) in LEO carried out by means of radar systems. However, in recent years more and more put into operation the optical monitoring systems using cheap CCD detector and small size telescopes. In some cases, this is whole array of optical telescopes with sensors, such as MMT - Multi-purpose wide-field monitoring array of the Kazan University, Russia [http://astroguard.ru/mmt_satellites_info.html], or Ground-based optical observation system for LEO objects in Japan [<http://www.sciencedirect.com/science/article/pii/S0273117715000551/pdf?md5=417c2d79352ee5e17a063c59d0c74b8b&pid=1-s2.0-S0273117715000551-main.pdf>]. Such optical systems in addition to coordinate information let you receive the photometric information. The Astronomical Observatory of the Odessa University holds photometric monitoring of low-orbit satellites by means of TV-CCD camera since 2005 and already covers a period of 10 years. Atlas of SO light curves includes more than 5500 curves for almost 500 cataloged space objects in LEO.

At the same time, methods of use of the obtained photometric data need further development. The most obvious application of photometric data is use of them to determine the period of brightness variations and receiving evaluation of the SO rotation period. For complete extraction of information about the movement around the center of mass must be the attraction of computer optical-geometric modeling of light scattering by SO surface. However, in the favorable case, when the light curve shows numerous short-duration ("specular") flashes of brightness, to determine the orientation of the rotation axis in space sufficiently accurate timekeeping of moments of flashes and synchronization with the time scale UTC.

In this paper we describe the methodology of the analysis of the light curves of several SO's obtained by means the telescope KT-50 in Odessa. We determined the

orientation of the rotation axes and change of the sidereal rotation periods of the passive satellites Envisat and Cbers-2B (already in the status of space debris) on the interval of several years. The structure of the light curves of satellites with a large sail (Nanoseyl-D2 and Lightseyl-A) and the acceleration of the rotation under the influence of the Earth's atmosphere was determined. Analysis the slowdown of rotation speed and its variations associated with YORP effect, and the precession of the rotation axis of extra-atmospheric geodetic satellite EGP were performed.

THE COMPARATIVE ANALYSIS OF METEOR SPECTRA PROCESSING

Mozgova A.M.¹, Churyumov K.I.¹, Borovichka J.², Gorbanev Yu.M.³

¹ *Taras Shevchenko National University of Kyiv, Astronomical Observatory, Ukraine*

² *Astronomical Institute, 251 65 Ondrejov Observatory, Czech Republic*

³ *Astronomical Observatory, Odessa I.I. Mechnikov National University, Ukraine*

The results of the meteor phenomena systematic observations in the Earth's atmosphere allow to form an idea of the meteoric matter existence and its distribution in the near-Earth environment. It is also important to know a chemical composition of the meteoroid. Then we can explain the physical and chemical processes which occur during a meteor phenomenon and to determine some parameters of the meteoroid.

This paper presents the processing results of the meteor photographic spectrum obtained on August 2-3, 2011, at the Ondrejov Observatory (Czech Republic). It belonged to Perseid. The spectrum was obtained with using a 600 grooves/mm diffraction grating. The detailed identification of the spectral lines in the meteor spectrum was done. There are 107 identified spectral lines. Most of them belong to metals. The spectrum evolution along the meteor flight was investigated. The intensities of the spectral lines were determined. The light curves for the brightest of them were constructed.

For a comparative analysis the processing results of certain photographic meteor spectra which obtained in the period from 1953 to 1965 in Odessa, Simferopol and Ashgabat are presented. The spectra were obtained with using an optical prism.

The preliminary results of the meteor spectra processing which obtained in the period from July to December 2014 at the Odessa observation station Kryzhanovka A085 during a television spectral observations of meteors are presented. One of the four television cameras of the meteor patrol was equipped with a 500 grooves/mm diffraction grating.

On the basis of the meteor database and with using the images of meteor trajectories we defined the optimal characteristics and conditions for spectral observations. The spectrophotometric processing of the obtained meteor spectra was done.

On the basis of the obtained results analysis the conclusions about retooling the TV meteor patrol and the continuation of the meteor spectral observations are made.

THE RESULTS OF OBSERVATIONS OF MUTUAL PHENOMENA OF THE GALILEAN SATELLITES OF JUPITER IN 2009 AND 2015 IN NIKOLAEV ASTRONOMICAL OBSERVATORY

*A.V.Pomazan, N.V.Maigurova, V.F.Kryuchkovskiy
Research Institute "Nikolaev Astronomical Observatory",
Mykolaiv, Ukraine*

The Earth and Jupiter once in 6 years have simultaneous passage of the ecliptic plane due to their orbital movement around the Sun. This makes it possible to observe mutual occultations and eclipses in the Galilean satellites of Jupiter.

We have been carry out the observations during 2009 and 2014-15. The observations were made with a video camera WAT-902H at the telescope MCT (D = 0.115 m, F = 2.0 m) of the Nikolaev Astronomical Observatory. The light curves of mutual phenomena in the satellites of Jupiter were obtained as a result of processing photometric observations. Accurate time of start and end of the events, and the amplitude of the light variation have been determined from the analysis of the light curves.

The data set for light curves have been sent in the IMCCE (Institute de Mecanique et de calcul des ephemerides, France) that coordinates the PHEMU campaigns.

SYNCHRONIZATION OF TERRESTRIAL PROCESSES WITH FREQUENCIES OF THE EARTH-MOON-SUN SYSTEM

*N. S. Sidorenkov
Hydrometeorological Research Centre of the Russian
Federation, Russia*

It is established that the frequencies of the quasi-biennial oscillation (QBO) of atmospheric winds and the Chandler wobble (CW) of the Earth's poles are synchronized with each other and with the fundamental frequencies of the Earth--Moon--Sun system. The QBO and CW frequencies are resonance combinations of the frequencies of the Earth--Moon system's yearly rotation around the Sun, precessions of the lunar orbit, and the motion of its perigee. The QBO and CW frequencies are in a ratio of 1:2. The synchronizations between Mul'tanovskii's natural synoptic periods and tidal oscillations of the Earth's daily rotation rate, as well as between variations in climatic characteristics and long-time fluctuations of the Earth's rotation rate are described.

GEOMAGNETIC FIELD VARIATIONS IN THE AREA OF ODESSA REGIONAL MAGNETIC ANOMALY

*Sukharev A.L.¹, Ryabov M.I.¹, Orlyuk M.I.²,
Romenets A.A.², Sobitnyak L.I.¹
¹Odessa observatory "URAN-4" Radio Astronomy
Institute of the National Academy of Sciences of Ukraine
²Institute of Geophysics of the National Academy of
Sciences of Ukraine*

Odessa Regional Magnetic Anomaly (ORMA) is one of the largest and intensive magnetic anomalies of

Ukraine. ORMA is located within the Odessa region, the waters of the Black Sea and the surrounding area. Such magnetic anomalies can form their own "magnetosphere" and have their own response to external influences such as solar activity and various phenomena in the ionosphere.

In details, such features of magnetic anomalies can be studied based on digital measurements with high temporal resolution. We investigated the variability of the total induction vector of the geomagnetic field in the time interval 2008–2013. Digital data with every minute readout was received at the Geomagnetic Observatory "Odessa".

We used the method of short-term Fourier analysis (STFT) to search for periodicities and their time-frequency distribution. The obtained periods were isolated and analyzed separately using the Fourier-bandpass filter. There are periods of daily (24 hours), semi-diurnal (12 hours) and short-term fluctuations of the geomagnetic field with periods 8, 6, 5, 4 hours. In winter, the oscillation amplitude is low, it's increasing in spring, in summer it becomes maximal, in autumn the amplitude is lessening. During magnetic storms, period values can vary by several hours (~3.5-1 hour). Before and after the magnetic storm the amplitude oscillations with periods 6, 8 hours increase with a following slow decline. The amplitudes of the oscillations with periods of 4, 5 hours increase less and accurately during a magnetic storm. Analysis of the low-frequency component of geomagnetic field variations shows 10-84 days periods.

The comparison with observations on Geomagnetic Observatory "Kiev", which is located in weakly magnetic anomaly. Possible reasons which form periods of variability taking into account solar-terrestrial relations and tidal processes in the ionosphere are presented in the paper.

THEORY OF MOTION OF SELECTED SATURN'S SATELLITES

*V. Troianskyi¹, V. Andruk², A. Bazyey¹,
V. Kashuba¹, E. Yizhakevych², V. Zhukov¹
¹Astronomical Observatory of Odesa National University,
Ukraine
²Main Astronomical Observatory of National Academy of
Sciences, Ukraine
v.troianskyi@onu.edu.ua, andruk@mao.kiev.ua,
o.bazyey@onu.edu.ua, v.kashuba@onu.edu.ua, iz-
hak@mao.kiev.ua, v.zhukov@onu.edu.ua*

One of the main problems of celestial mechanics is the study of the motion of the planets natural satellites. In this work we have considered dynamics of the movement of twelve of twenty-four regular satellites of Saturn (<http://home.dtm.ciw.edu/users/sheppard/satellites/satsatd ata.html>).

The initial position vectors of Saturn's satellites (Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, Phoebe, Helene, Telesto, Calypso) are taken from (Robert A. Jacobson, The Astronomical Journal, 128:492-501) and then clarified by method of differential correction (Bazyey et al., OAP vol. 18, 2005) with additional observations.

As additional observations, we have been involved images of Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, Phoebe processed within Ukrainian Virtual Ob-

servatory project (<http://194.44.35.19/vo-mao/DB/archive/special.php>) from astro photo plates obtained in 1961-1990 and observations of Phoebe from MPC archive (<http://www.minorplanetcenter.net/iau/ECS/MPCAT-OBS/MPCAT-OBS.html>) obtained in 1898-2014.

We also used own observations of satellites Dione, Rhea, Titan, Iapetus, were carried out on the telescope OMT-800 in 2015.

Thus in this work we clarified orbits of Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, Phoebe, Helene, Telesto, Calypso. At this stage differences of ephemeris, calculated according to our clarified orbits and ephemeris obtained with elements borrowed from the Minor Planet Center in 50 years' time interval, amounts to 0,03° in right ascension and declination of 0,02°. Such significant differences related to the incompleteness of the model, which we used in the theory of satellites motion. We do not take into account the mutual perturbations of satellites, perturbations from Saturn's rings and the effect of higher-order harmonics in the expansions of the gravitational field of Saturn.

Accounting for these perturbations in the future will allow us to clarify the solution of obtaining accurate of satellites ephemeris data and to compare it with models proposed by MPC (<http://www.minorplanetcenter.net/iau/NatSats/NaturalSatellites.html>) and IMCCE (<http://www.imcce.fr/langues/en/ephemerides/>).

THE RESEARCH OF PHOTOMETRIC CHARACTERISTICS AND ORBITS OF COMETS AND ASTEROIDS APPROACHING THE EARTH

*Zh.Sh.Zhantayev, K.S.Kuratov, N.Sh.Alimgazinova,
A.S.Beisebayeva, A.Zh.Nauryzbayeva, A.K.Kuratova
National center of space exploration and technologies
Almaty, Kazakhstan
The Kazakh National University named after Al-Farabi
Almaty, Kazakhstan*

Work on discovery, study and regular observations of asteroids and comets approaching the Earth (AAE) orbit is carried out all over the world and directed, first of all, to defining AAE orbits elements, especially, potentially hazardous for the Earth, and on their cataloguing. Such observations are usually conducted with average size telescopes (with apertures from 50 cm to 1 m).

Currently photometric observations which are implemented at these bodies' brightest moments during their close approach with the Earth are the primary tool for obtaining data about asteroids physical properties, such as shape, size, surface properties and rotation parameters. The application of other methods, for example, carrying out radar or infrared observations doesn't enable to conduct their interpretation in a proper way with photometric observations results of the very celestial body.

Contemporary scientific problem in the field of small bodies research of adjacent space is drawn on the fact that the study of their physical properties is noticeably lagged from total amount of discovered AAE. Particularly, nowadays rotation periods for nearly 300 AAE are known while over 12 thousand of them were discovered. Knowing about asteroids physical properties is interesting not only from fundamental science point of view but it's necessary for developing and creating protection systems for preventing such bodies falling onto the Earth. Nearly 1500 of detected AAE are referred to "potentially hazardous asteroids" (PHA) group – the source of possible future catastrophes.

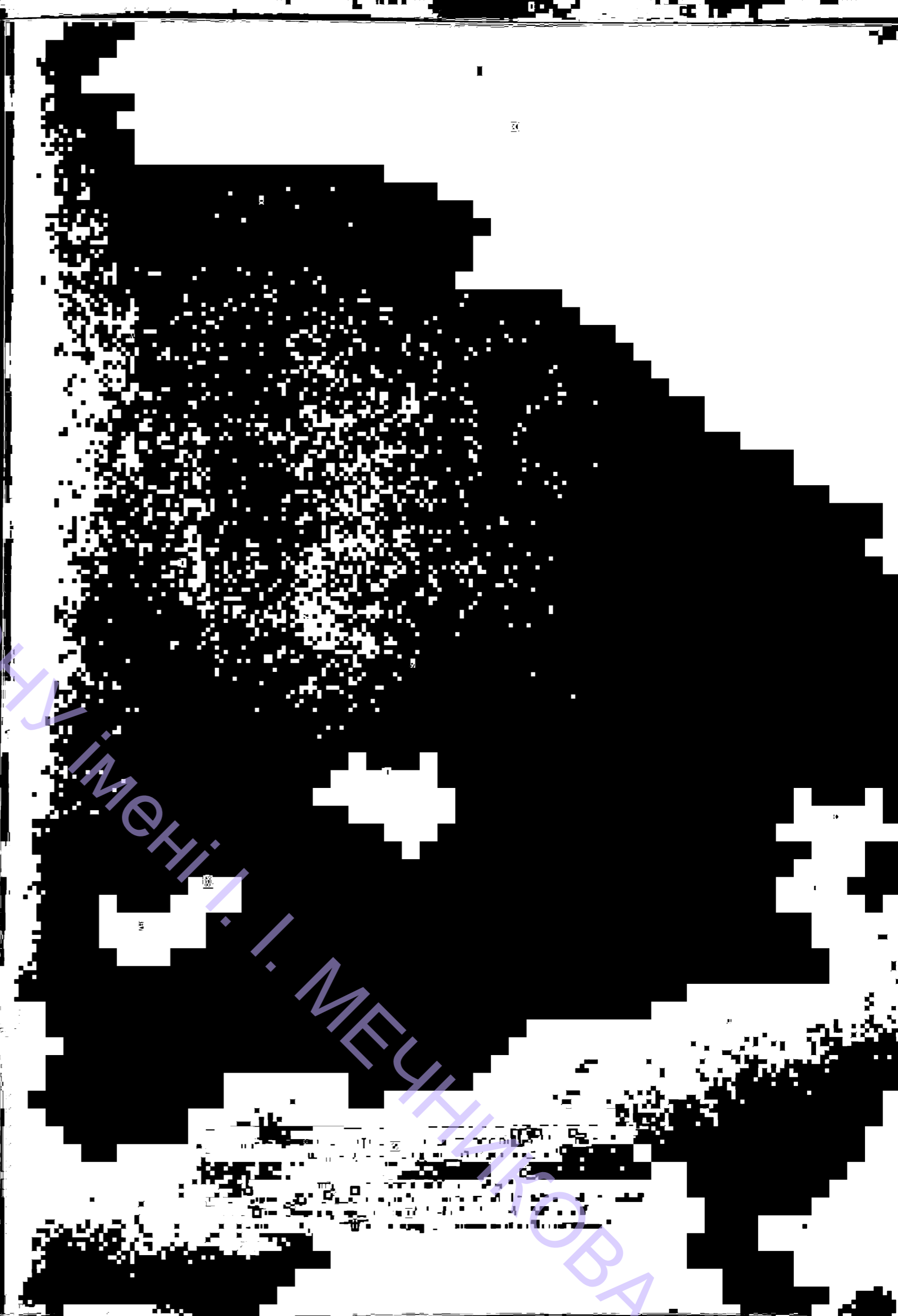
The Earth protection systems from hazardous collision with asteroids or comets must consist of some main parts: detection of hazardous object; object monitoring for defining its orbit and cataloguing; obtaining the body's physical parameters; working out the method for its destruction or orbit changing; astronauts and necessary equipment delivery to hazardous object.

The work is devoted to organization and conducting astronomical observations for the research of photometric characteristics and orbits of comets and asteroids approaching the Earth.

Технический проект
[Illegible text]

[Illegible text]

[Illegible text]



МЕЧНИКОВА

НАУКОВА БІБЛІОТЕКА ОНУ ІМЕНІ І. І. МЕЧНИКОВА

Формат 60×84/8. Папір офсетний. Гарнітура «Times». Друк офсетний.
Ум. друк. арк. 8,37. Тираж 180 прим. Зам. № 405.

Надруковано з готового оригінал-макета
Видавництво і друкарня «Астропринт». 65091, м. Одеса, вул. Разумовська, 21
Тел.: (0482) 37-07-95, 37-14-25, 33-07-17. astro_print@ukr.net
Свідоцтво суб'єкта видавничої справи ДК № 1373 від 28.05.2003 р.

Неї