National Taras Shevchenko University of Kyiv
Department of Astronomy and Space Physics

17th Young Scientists' Conference on Astronomy and Space Physics

Abstracts

Kyiv, 2010

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Preface

This year Young Scientists' Conference on Astronomy and Space Physics is held for the seventeenth time. We all have been looking forward to the annual meeting of astronomers at National Taras Shevchenko University of Kyiv. Now it has friendly opened its doors for participants from all over the world.

Young Scientists' Conference has a long history. The first meeting was organized by Physics faculty of National Taras Shevchenko University of Kyiv as a students' conference in 1994. Since 1996 our conference has welcomed young researchers from other universities and scientific institutions. During 1994-2009 participants from Ukraine, Russia, Poland, France, Germany, Spain, Sweden, Libya, Egypt, Japan, Finland, Turkey, China, Slovakia, Armenia, USA and other countries participated in Young Scientists' Conference.

The conference is aimed at strengthen the position of astronomy and promote space physics research. The lectures and reports presented by the participants traditionally reflect modern trends and actual problems of the science, the sessions facilitate informational exchange about the latest innovations and achievements.

On behalf of the organizing committee we would like to express our gratitude to the invited lecturers and participants for contributing lectures and reports. We are especially grateful to Prof. V.M. Ivchenko for the help in conference organization.

Grygorii Polinovskyi and
Local Organizing Committee

PROGRAMME

Monday, April, 26

10.00-14.00 - Registration
14.15-14.35 - Official opening.

Section 'Solar System & Extrasolar Planets'

14.35-15.20 Siegfried Franck *How Many Habitable Planets Are There in the Milky Way?* **(invited)**

15.20-15.50 Tea-break

15.50-16.05 Joanna Drazkowska, M. Hanasz, K. Kowalik *Particle Module of Piernik MHD Code* **(12+3)**

16.05-16.20 Anna Rozenkiewicz *Modeling of Stellar Radial Velocities with the Genetic Algorithms* **(12+3)**

16.20-16.35 Beata Deka *Ecospheres around Binary Stars* **(12+3)**

16.35-16.50 Wieńczysław Bykowski *The Monitoring of the Transiting Exoplanet WASP-12 b* **(12+3)**

16.50-17.05 Nadiia Kostogryz *Vertical Distribution of Scattering Optical Depth in the Uranus' Atmosphere* **(12+3)**

17.05-17.20 Sergii Zaitsev *The Phase-Angle and Longitude Dependence of Polarization for Iapetus near Opposition* **(12+3)**

17.20-17.35 Sergey Karashevich, I. A. Verestchagina, E. N. Sokov, V. Yu. Slesarenko, A. V. Devyatkin *Observations and Research of Minor Solar System Bodies* **(12+3)**

17.35-17.50 Remigiusz Pospieszynski *Design Process of Ion Optics for Laplace's Plasma Dynamics Analyzer* **(12+3)**

17.50-17.55 Alexey Koltsov, A. V. Ivantsov *Search of New Asteroids and TNO's Using Observations of the Short Period of Time* **(poster)**

17.55-18.00 Olexandr Baransky, K. I. Churyumov, V. O. Ponomarenko *Some Results of Investigation of Eighteen Fragments of Comet 73P Schwassmann-Wachmann 3 Nuclues* **(poster)**

18.00-18.05 Vasyl Ponomarenko, K. I. Churyumov, O. R. Baransky *Exploration of Bright Comet C/2007 N3 (Lulin) Observed in February 2009* **(poster)**

18.05-18.10 Vasyl Ponomarenko, K. I. Churyumov, O. R. Baransky, V. V. Kleshchonok, I. V. Lukyanyk, L. S. Chubko *Spectral Observations of Two Comets C/2006 W3 (Christensen) and 22P Kopff* **(poster)**

18.10-18.15 Oksana Tvorun, A. A. Berezhnoy *The Chemistry of Meteor Events on Mars* **(poster)**

18.15-18.20 Alex Tudorica, O. Vaduvescu, M. Birlan *EURONEAR – The First 200 NEA's Observed* **(poster)**

18.30-21.00 Excursion to the Main Astronomical Observatory of NAS of Ukraine

Tuesday, April, 27

Section 'Stellar Astrophysics'

09.30-09.45 Daria Teplykh, V. M. Malofeev, O. I. Malov *Pulsed Radio Emission from Two XDINS at Low Frequencies* **(12+3)**

09.45-10.00 Elena Nikitina, I. F. Malov *Estimations of Angles between Some Axes in Radio Pulsars from the Catalog at 1000 MHz* **(12+3)**

10.00-10.15 Maxim Kuznetsov *New Spectral Classification of Ultracool Dwarfs* **(12+3)**

10.15-10.30 Julia Solomennyk, B. Hnatyk, V. Marchenko *Analytical Description of Relativistic Shock Wave Dynamics in Stellar Envelopes* **(12+3)**

10.30-11.00 Tea-break

11.00-11.45 Nikolay Samus *Discovery and Study of New Variable Stars Using Digitized Plates from Moscow Stacks* **(invited)**

11.45-12.00 Wieslaw Zajiczek *Lie Symmetries of Relativistic Equations of Stellar Structure for Radiative Energy Transport* **(12+3)**

12.00-12.15 Dmitry Nasonov *Spectroscopy of Post-AGB Star IRAS01005+7910* **(12+3)**

12.15-12.30 Taisiya Kopytova, V. V. Krushinsky, E. Gorboskoy et al. *Polarimetry of GRB-091020 and GRB-091127* **(12+3)**

12.30-12.35 Svjatoslav Smerechynskyj, M. V. Vavrukh, N. L. Tyshko *Relation "Energy-Radius" in the Chandrasekhar Model and Degenerated Dwarfs Distribution by Radii* **(poster)**

12.35-12.40 Oksana Stelmakh, M. V. Vavrukh *Calculation of the Ionization Balance in the Photosphere of Stars with Allowance for Screening Interactions* **(poster)**

12.40-12.45 Andrew Simon *The First Spectra for the RX J0440.9+4431 from 2-m Terscol Telescope* **(poster)**

12.45-12.50 Andrew Simon, N. Metlova, V. Reshetnyk *Photometric Investigation of the 1H1935+55 and the Nearest Sky Field* **(poster)**

15.00-18.00 City tour (by bus)

18.00-22.00 Kyiv by night (walking tour)

Wednesday, April, 28

Section 'Extragalactic Astrophysics'

09.30-09.45 Salomé Pereira de Matos *Selection of Luminous Galaxies at the Edge of the Universe* **(12+3)**

09.45-10.00 Evgeniya Shaldenkova *Atomic Hydrogen Deficiency in Spiral Galaxies in Clusters* **(12+3)**

10.00-10.15 Vasiliy Vitrishchak, D. C. Gabuzda, I. N. Pashchenko *Circular Polarisation of AGNs on the Parsec VLBI Scales* **(12+3)**

10.15-10.30 Ilya Pashchenko, S. V. Pilipenko, V. M. Vitrishchak *Seyfert Galaxies and "Unified Scheme"* **(12+3)**

10.30-11.00 Tea-break

11.00-11.45 Svitlana Zhukovska *Dust Formation and Cycle in Galaxies* **(invited)**

11.45-12.00 Maryna Mykhailova, V. M. Kontorovich *Influence of Low-Frequency Quasar 3C 273 Radio Spectrum on X-ray Emission of Its Kiloparsec Jet* **(12+3)**

12.00-12.15 Juan-Pablo Perez-Beaupuits, M. Spaans, R. Gusten, K. Wada, H. W. W. Spoon *Structure and Dynamics of Galaxy Nuclei – Imaging and 3-D Modelling* **(12+3)**

12.15-12.30 Daniela-Adriana Lacatus, Madalina Badea, Alin Razvan Paraschiv *Peculiar Morphologies of Extended Extragalactic Radio Sources from Numerical Simulations* **(12+3)**

12.30-12.45 Daria Dobrycheva, O. Melnyk *Color Indices and Morphological Properties of Galaxies in Pairs* **(12+3)**

12.45-13.00 Igor Zinchenko *The Redshift Evolution of Oxygen and Nitrogen Abundances in Emission-Line SDSS Galaxies* **(12+3)**

13.00-13.05 Kateryna Agienko *WR-Galaxies in SDSS DR7* **(poster)**

13.05-13.10 Denis Sokolov, V. Marchenko, E. Sukach *The Structure of Jets in AGN from Radio and X-ray Data* **(poster)**

13.10-13.15 Anna Saburova *On the Possibility of Massive Discs in Low Surface Brightness Galaxies* **(poster)**

Section 'Gravitation & Cosmology'

14.00-14.45 Yakiv Pavlenko *Grants and Science in Europe and Ukraine* **(invited)**

14.45-15.00 Dmytro Iakubovskyi *Hunting for Dark Matter Particles* **(12+3)**

15.00-15.15 David Sobral *The Clustering and Environment of Star-Forming Galaxies at $z = 0.84$: the HiZELS-Hα View* **(12+3)**

15.15-15.45 Tea-break

15.45-16.00 Grygorii Polinovskyi, G. Ivashchenko *Mean Transmitted Flux in the Lyα Forest from a Sample of 2QZ Quasars* **(12+3)**

16.00-16.15 Olga Sergijenko, B. Novosyadlyj *Perturbed Recombination and CMB Anisotropy: Linear Effect* **(12+3)**

16.15-16.30 Olga Nasonova *Blueshifted Galaxies in the Virgo Cluster* **(12+3)**

16.30-16.45 Szymon Sikora *Static, Spherically Symmetric Gravitational Lens Filled with Perfect Fluid* **(12+3)**

16.45-17.00 Oleksandr Stefanyshyn *Highly Relativistic Spinning Particle in a Gravitational Field* **(12+3)**

17.00-17.05 Olga Sergijenko, B. Novosyadlyj, S. Apunevych *Observational Constraints on Minimally Coupled Dark Energy Models: WMAP7 + SDSS DR7* **(poster)**

17.05-17.10 **Iurii Babyk**, O. Melnyk *X-ray Emission in Galaxy Clusters* **(poster)**

17.10-17.15 **Ganna Ivashchenko**, V. I. Zhdanov, A. V. Tugay *Correlation Function of Quasars in Real and Redshift Space from SDSS DR7* **(poster)**

17.15-17.20 **Sajad Abbar**, S. Rahvar *Observational Constraints on Cosmic Snap Parameters in a Kinematical Approach* **(poster)**

18.30-22.00 Organ hall / opera hall / etc.

Thurthday, April, 29

Section 'High-Energy Astrophysics'

09.30-09.45 **Ievgen Vovk**, A. Neronov *Evidence for Existence of Extragalactic Magnetic Fields in Excess of* 10^{-16} *G from Fermi Non-Detection of Distant TeV Blazars* **(12+3)**

09.45-10.00 **Margaryta Sobolenko**, D. Iakubovskyi *Observation of X-ray Spectral Hysteresis in the TeV BL Lacs Objects BL Lac and 1ES 1959+650* **(12+3)**

10.00-10.15 **Mykola Malygin**, D. Iakubovskyi *Search for Cyclotron Absorptions from Magnetars with XMM-Newton* **(12+3)**

10.15-10.30 **Taras Kuzyo**, O. Petruk *Magnetic Field Strength from Nonthermal Images of SN 1006* **(12+3)**

10.30-10.35 **Ekaterina Sukach**, V. Marchenko, D. Sokolov *Image and Spectral Analysis of Jets in AGN from X-ray Data* **(poster)**

10.35-10.40 **Olga Kosenok**, Marina Prus, Dmytro Doroshenko, V. Marchenko *Image and Spectral Analysis of Jets in AGN from X-ray Data* **(poster)**

10.40-11.10 Tea-break

Section 'Astroparticle Physics'

11.10-11.25 **Vasyl Beshley**, O. Petruk *Images of Supernova Remnants in Gamma-Rays due to Pion Decays* **(12+3)**

11.25-11.40 **Nataliia Kondrashova**, B. I. Hnatyk *Modeling of TeV Gamma-Ray Radiation from Supernova Remnant IC443* **(12+3)**

11.40-11.55 **Maria Trylis**, B. I. Hnatyk *Hadronic Model of TeV Gamma-Ray Radiation from Supernova Remnant Vela Jr.* **(12+3)**

11.55-12.10 **Volodymyr Masliukh**, B. I. Hnatyk *High-Energy Cosmic Rays from GRB Progenitors – Hypernovae* **(12+3)**

12.10-12.25 **Oleh Kobzar**, B. Hnatyk, V. Marchenko, T. Bogdan *Propagation of Different Components of Cosmic Rays in the Galactic Magnetic Fields* **(12+3)**

12.25-12.40 **Oleksandr Sushchov**, B. Hnatyk, O. Kobzar, V. Marchenko, T. Bogdan *The Influence of Extragalactic Magnetic Fields on the Propagation of Cosmic Rays* **(12+3)**

12.40-12.55 **Demid Pekur**, B. Hnatyk, V. Marchenko *Neutrinos from Relativistic Shock Break-Out at the Surface of Hypernova* **(12+3)**

12.55-13.00 Tetyana Salivon, D. Iakubovskyi *Modeling of Gamma-Ray Emission for Fermi/LAT Supernova Remnants* **(poster)**

Section 'Interstellar Medium'

14.00-14.45 Alexey Berezhnoy *Chemical Evolution of the Universe* **(invited)**

14.45-15.15 Tea-break

15.15-15.30 Paweł Dobierski *Interstellar Atomic Lines* **(12+3)**

15.30-15.45 Yury Pakhomov, N. N. Chugai, A. F. Iyudin *Stellar Spectroscopy Methods for Study of Supernova Remnants* **(12+3)**

15.45-16.00 Ivan Litovchenko, A. V. Alakoz, I. E. Val'tts *Mapping of Class I Methanol Emission in the Environment of Masers Identified with SNR and Discovery of New Masers* **(12+3)**

16.00-16.15 Volodymyr Marchenko, B. Hnatyk, D. Pekur *Observational Signatures of Relativistic Shock Break-Out at the Surface of Hypernova* **(12+3)**

16.15-16.30 Nikolay Podorvanyuk *Kinematics and Structure of Gas in Star-Formation Regions: Supernovae and Stellar Wind* **(12+3)**

16.30-16.45 Roman Korytko, B. Ya. Melekh, V. V. Golovaty *Redetermination of the Oxygen Abundance in Orion Nebula* **(12+3)**

16.45-16.50 Ruslana Kozel, B. Ya. Melekh, I. O. Koshmak *Multicomponent Photoionization Modelling of Envelopes with Complicated Structure of Stellar Wind Bubble Surrounding Sturburst Region* **(poster)**

16.50-16.55 Davit Sargsyan, T. A. Movsessian *Morphological Study of Cometary Nebulas* **(poster)**

18.30-22.00 Conference dinner

Friday, April, 30

Section 'Solar Physics'

09.30-09.45 Sarah Jabbari, H. Safari *The Slow Mode Oscillations of Solar Coronal Loops* **(12+3)**

09.45-10.00 Anastasiya Boiko, V. N. Mel'nik, A. A. Konovalenko et al. *Frequency Drift Rate of Powerful Decameter Type III Bursts* **(12+3)**

10.00-10.15 Olena Andriets, V. G. Lozitsky *Magnetic Fields Evolution in the Weak Solar Flares* **(12+3)**

10.15-10.20 Olexandra Baran *Structure of the Convective Flows of Real Solar Granulation* **(poster)**

10.20-10.25 Anton Prihodko *Determination of the Chromospheric and Photospheric Matter Motion Velocity during a Solar Flare* **(poster)**

10.25-10.30 Antonina Klyueva, V. G. Lozitsky *Intriguing Zeeman Splitting of FeI 6094.419 Line in a Sunspot: Violation of ls-Coupling or Superstrong Magnetic Fields?* **(poster)**

10.30-10.35 Olga Botygina, V. G. Lozitsky *Magnetic Field in a Solar Prominence Measured in D3 HeI Line* **(poster)**

10.35-11.05 Tea-break

11.05-11.50 Klim Churyumov *Space Mission "Rosetta" and Its Main Target – Comet 67P* **(invited)**

Section 'Positional Astronomy and Astronomical Equipment'

11.50-12.05 Lyudmila Berdina, A. A. Minakov *"Generalized" Method of the Phase Screen for Medium Inhomogeneities of Different Spatial Scale* **(12+3)**

12.05-12.20 Ksenia Suchomska *First Observations with a New Echelle Spectrograph QSI 532s+* **(12+3)**

12.20-12.35 Anton Pomazan, A. V. Ivantsov, L. A. Gudkova *Automation of Telescope Time Scheduling* **(12+3)**

12.35-12.50 Boris Safonov *Lucky Image Performance Simulation on the Basis of Optical Turbulence Data Obtained on Shatjatmaz* **(12+3)**

12.50-13.05 Vitaliy Zhaborovskyy, V. Ya. Choliy *Kyivgeodinamic++: Software Package for Processing Satellite Laser Ranging Date* **(12+3)**

13.05-13.10 Vitaliy Zhaborovskyy, V. Ya. Choliy *Determination of Reference Frames Deflections from Optical Observations of GNSS Satellites* **(poster)**

13.10-13.15 Ivan Syniavskyi, A. P. Vidmachenko, Yu. S. Ivanov, O. O. Monsar, M. G. Sosonkin *The Equipment for Polarimetric Observations of Astronomical Objects* **(poster)**

13.15-13.20 Mislav Balokovic, D. Vinkovic *Using General Purpose Graphical Processing Units for Applications in Astronomy and Astrophysics* **(poster)**

13.20-13.25 Serhiy Pokhvala, B. Yu. Zhilyaev *Determination of the Sky Background in Kiev with Digital Camera Canon 350D* **(poster)**

13.25-13.30 Anastasiia Zolotukhina *Creation IR Database* **(poster)**

Section 'Space Geophysics & Physics of the Near Space'

14.30-15.15 Yuri Khotyaintsev *Particle Acceleration during Solar Flares and Magnetospheric Substorms* **(invited)**

15.15-15.30 Grzegorz Wiktorowicz, E. Słomińska, H. Rothkaehl, A. Krankowski *Main Ionospheric Trough – Dynamic Structures of Ionospere* **(12+3)**

15.30-15.45 Allawi Habeeb, A. Al-Sawad *Observation of the Location of CMEs Associated with ∼30–100 MeV SEP Events* **(12+3)**

15.45-16.00 Mariia Soloviova, I. O. Anisimov *Modes' Concurrence in Transversely Restricted Electron Beam Injected into Homogeneous Plasma* **(12+3)**

16.00-16.15 Daria Velykanets, S. M. Levitsky *Longitudinal Acceleration of Plasma Electrons during the Beam-Plasma Interaction* **(12+3)**

16.15-16.30 **Tetiana Skorokhod**, G. Lizunov *Morphology Structure of Atmosphere Gravity Waves According to the in Situ Satellite Measurements* **(12+3)**

16.30-17.00 **Łukasz Gruszka**, E. Wnuk, I. Wytrzyszczak, J. Gołębiewska, A. Rożek *Predictions of Space Debris* **(12+3)**

17.00-17.05 **Artur Durajski**, M. Szczęśniak, R. Szczęśniak, M. W. Jarosik *The Secondary Radiation of the Earth Ionosphere* **(poster)**

17.05-17.10 **Polya Dobreva**, D. K. Koitchev, V. I. Keremidarska, M. D. Kartalev *Numerical Modeling of the Magnetosphere with Data Based Internal Magnetic Field and Arbitrary Magnetopause* **(poster)**

17.10-17.15 **Dmytro Salyuk**, O. Agapitov *Nonlinear Anticyclone Structures in the Earth Atmosphere* **(poster)**

17.15-17.20 **Andriy Voshchepynec**, O. Agapitov *Dynamic Magnetic Structures near the Quasi-Parallel Earth Bow Shock* **(poster)**

17.20-17.25 **Valentyn Bovchaliuk**, V. M. Reshetnyk *Coronal Mass Ejections Dynamics on the Small Heliocentric Distances* **(poster)**

17.25-18.15 Poster Section + Tea-break

18.15-18.30 Official closure

Saturday, May, 1

10.00-14.00 Excursions to Museum of Folk Architecture and Life of Ukraine / Kyiv-Pechersk Lavra / M. M. Gryshko National Botanic Garden

INVITED LECTURES

How Many Habitable Planets Are There in the Milky Way?

Siegfried Franck

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The famous Drake equation with its estimates of habitable planetary systems, origins of life, evolution of technology etc. is a traditional tool to discuss extraterrestrial intelligence. Although several factors are highly speculative, a subset of them, describing the number of habitable planets, can now be stated more precisely with the help of our new knowledge about extra-solar planetary systems. Probabilistic estimations of the first factors provide about 50 millions habitable planets in the present Milky Way. A second approach is based on an integrated Earth system analysis. Combining the formation rate of Earth-like planets with estimations of extra-solar habitable zones gives the number of habitable planets in the Milky Way over cosmological time scales. An extension of this method allows to calculate the number of habitable planets that are likely to have developed primitive (unicellular) and complex (multicellular) life. So we can find answers to the question "How rare is complex life in the Milky Way"

Discovery and Study of New Variable Stars Using Digitized Plates from Moscow Stacks

Nikolay N. Samus

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Plate stacks of many observatories possess large numbers of sky photographs covering a time span of many decades. To facilitate access to vast information these photographs contain, it is necessary to digitize observatory plate stacks. Such projects are under way at several observatories. The Moscow plate archive contains tens of thousands of high-quality sky photographs since 1895. Using scanners with resolution of 2500 dpi, we are digitizing the archive. Our team is working on algorithms of semi-automatic search for new variable stars using digitized plates. So far, we have been able to discover and study about 500 new variable stars. To our knowledge, our digitization project is so far the most productive one from the point of view of variable-star discoveries in the world. I will discuss the hardware and software approaches we use and present some details on the most interesting variable stars we have discovered.

Dust Formation and Cycle in Galaxies

Svitlana Zhukovska

Max-Planck Institute for Astronomy, Heidelberg, Germany

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Dust is one of the most important factors influencing physical and chemical conditions in the ISM. Dust grains formed in stellar winds and SN explosions cycle in the ISM, where they are efficiently destroyed in a warm medium by SN shocks and accrete refractory atoms in cold phase. In this talk I will present models of evolution of multicomponent dust mixture in the ISM of galaxies. I will also discuss the contribution of different dust sources to the ISM dust budget in the Solar neighborhood and how it changes for low metallicity environment.

Grants and Science in Europe and Ukraine

Yakiv Pavlenko

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Different issues of the western and ukrainian grant systems are discussed. Very personal view on the grant management systems are presented.

Chemical Evolution of the Universe

Alexey A. Berezhnoy

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All important steps of the chemical evolution of our Universe are considered. Formation of elements in the early Universe and in interiors of stars is discussed. The chemistry of molecular clouds is considered. Complex organic molecules are already detected in the dense cores of the molecular clouds and in some classes of meteorites. Requirements for Earth-type life (liquid water, stable atmosphere, Sun-type star) are proposed. Detection of primitive types of life in subsurface water layers on Mars and Europa is still possible. Simple molecules are already detected in the atmospheres of Jupiter-like extrasolar planets. Perspectives of detection of Earth-type extrasolar planets are given. General properties of our Universe are suitable for complex chemical and biological evolution. Drake equation and several kinds of anthropic principle are discussed.

Space Mission "Rosetta" and Its Main Target – Comet 67P

Klim Churyumov

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On March 2, 2004 Rosetta space mission successfully started from the Kourou cosmodrom to comet 67P/Churyumov-Gerasimenko. Upon entering orbit around the nucleus observations will be made as the comet becomes more active as it journeys towards the Sun. A lander, named Philae, will be deployed and attempt to make the first ever controlled landing on a comet. Rosetta passed near asteroid 2867 Steins in Sept. 2008 and will pass near another asteroid 21 Lutethia in July 2010. Rosetta will be the first spacecraft to orbit a comet's nucleus. It will be the first spacecraft to fly alongside a comet as it heads towards the inner Solar System. Rosetta will be the first spacecraft to examine from close proximity how a frozen comet is transformed by the warmth of the Sun. Shortly after its arrival at Comet 67P/Churyumov-Gerasimenko, the Rosetta orbiter will despatch a robotic lander for the first controlled touchdown on a comet nucleus. The Rosetta lander's instruments will obtain the first images from a comet's surface and make the first in situ analysis of the relict matter of the Solar system. Selected information about discovery and exploration of comet 67P with the help of ground-based and space devices is presented.

Particle Acceleration during Solar Flares and Magnetospheric Substorms

Yuri Khotyaintsev

Swedish Institue of Space Physics, Uppsala, Sweden

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Magnetic reconnection is an important process in most astrophysical plasma environments leading to efficient, fast and often explosive-like conversion of magnetic energy into kinetic energy of plasma particles and rapid reconfiguration of magnetic topology. The most detailed studies of this process at the moment are possible using in situ measurements in the near Earth space, remote solar corona observations, numerical simulations and laboratory observations. There are limitations and advantages associated with each of these approaches. In situ observations can give a detailed single-point picture of local electromagnetic fields and particle distribution functions but they cannot provide the overall context and integral properties of the process. In contrast, remote observations reveal the large-scale properties and context of the process but inherently suffer from line-of-sight limitations as well as have insufficient spatial resolution. Both communities have reached a high level of understanding about the details of magnetic reconnection. We review the fields of reconnection near the Earth, in the solar wind and in the solar corona and identify the most important questions where synergies can bring new important understanding and insights. In particular we focus on mechanisms of energetic particle acceleration and compare in detail solar flares to substorms in the Earth's magnetosphere.

SOLAR SYSTEM & EXTRASOLAR PLANETS

Particle Module of Piernik MHD Code

Joanna Drazkowska, M. Hanasz, K. Kowalik

Centre for Astronomy of Nicolaus Copernicus University, Toruń, Poland

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Piernik is a multi-fluid grid magnetohydrodynamic (MHD) code based on the Relaxing Total Variation Diminishing (RTVD) conservative scheme. The original code has been extended by addition of a dust componennt described in the fluid and particle approximations. The particles can interact with gas, which is described as a fluid. In my lecture I will present a comparison between test problem results obtained for the dust component treated as fluid and as system of interacting particles.

Modeling of Stellar Radial Velocities with the Genetic Algorithms

Anna Rozenkiewicz

Centre for Astronomy of Nicolaus Copernicus University, Toruń, Poland

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Over 400 extrasolar planets are known today, and this area of astronomical research attracts more and more scientists. To detect extrasolar planets, new observational techniques like star's pulsation timing and direct imaging are developed. Many new massive photometric and radial velocity surveys are in progress. All planetary candidates detected should pass stability and "sanity" tests. I use the KFIT program to verify some recent discoveries by the radial velocity method and, using available observations published in the literature, to establish orbital parameters of these new multi-planet systems. The quasi-global optimization method relying on the Genetic Algorithms and some results of such independent analysis will be presented.

Ecospheres around Binary Stars

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Scientific researches concerning ecospheres are very important for understanding the possibilities of existence and evolution of extraterrestrial life. For last several years astronomers have been discovering hundreds of extrasolar planets. Knowledge of star's ecospheres can be very helpful for selecting those planets which could be inhabited. In this matter most scientists concern on single stars but ecospheres around binary systems may also provide valuable information.

The monitoring of the transiting exoplanet WASP-12 b

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I would like to present my search for transit timing variations (TTV) of the transiting extrasolar planet WASP-12 b. The TTV method allows to discover additional exoplanets in known transiting systems. My work is a part of the international cooperation between numerous observatories in the world.

Vertical Distribution of Scattering Optical Depth in the Uranus' Atmosphere

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In the visible and near infrared the spectra of the Jovian planets are complicated by methane absorption features, which allow probing a variety of levels of their atmospheres. Interpretation of most data in this wavelength range requires an understanding of methane absorption features. Methane plays an important role in the heat balance in the Jovian atmosphere. This spectral region is highly useful for determining the vertical cloud structure, since in regions of strong methane absorption only reflection from upper level hazes is observed, while in regions of low absorption reflection from cloud layers as deep as near 10 bars may be seen.

Analyzing observational data of geometric albedo needs a good model of atmosphere, but the choice of this model is ambiguous. Therefore, it is important to have the simple method which even qualitatively demonstrates deviation scope of real vertical structure from the homogeneity. The main idea of this method is decreasing of probability of light quantum penetrations in the deep atmospheric layers depending on the single scattering albedo decreasing. It means, the diffusely reflected radiation is formed at different effective depths in the atmosphere, namely: more strong absorption bands are formed at higher depths, than weaker ones. The same is for separate absorption lines and bands: their centers are formed at higher atmospheric layers than other points of band or line contours. For the estimation of single scattering albedo, it is averaged through all depths of the formed absorption band. For us it is more suitable to use such values as methane absorption amount and scattering component of optical depth on the line of sight. So, this method allows us to obtain the data about vertical cloud structure and methane mixing ratio, i.e. that information which is impossible to obtain from traditional analysis of observations.

The Phase-Angle and Longitude Dependence of Polarization for Iapetus near Opposition

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We present results of polarimetric observations of Iapetus at phase angle ranging from 1.45° to 3.18°. The observations were carried out using 125-cm telescope equipped with the UBVRI double image chopping photoelectric polarimeter and 2.6-m telescope equipped with one-channel photoelectric photometer-polarimeter on the Crimean Astrophysical Observatory on 7-8 March, 2008, and on 20 April, 2009. Observed longitudes range from 275° to 317° and correspond to the bright trailing side of the satellite. The phase-angle dependence of polarization and longitude dependence of polarization of Iapetus were obtained using results of our observations and all the data available. The separation of the phase-angle and longitude dependences was made. The obtained results show what the satellite surface is polarimetrically heterogeneous.

Observations and Research of Minor Solar System Bodies

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The Laboratory of Astrometrical Observations has two full automatic telescopes: mirror astrograph ZA-320M, located in Pulkovo observatory, and MTM-500M, located in Pulkovo Mount Astronomical Station near Kislovodsk, North Kaukaz. These telescopes have been used to observations of minor Solar System bodies such as asteroids and comets. Special attention was payed to binary asteroids and Near-Earth Objects (including Potentially Hazardous Asteroids). In this work we have presented results of researching of several binary asteroids and near-Earth asteroid 2008 TC3 which had impacted with Earth at the territory of the North Sudan in October 6-7, 2008.

Design Process of Ion Optics for Laplace's Plasma Dynamics Analyzer

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Plasma Dynamics Analyzer (PDA) is an instrument that is being designed for the upcoming joint NASA/ESA mission Laplace (The Europa Jupiter System Mission). The instrument will be placed on-board the probe and will reach its target in the late 2020s. The design process and further optimization of the PDA's ion optics is being presented. The optical part will be combined with time-of-flight (TOF) section during more advanced design. The ion optics consists of number of electrodes with potentials from 0 V to 5000 V of which two geometries have been built and investigated in detail. Currently the focus shifts to the second geometry which design is less complicated and uses less space.

Search of New Asteroids and TNO's Using Observations of the Short Period of Time

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Search of new asteroids and TNO's can be executed from comparison either of direct images (matching, and than making differences for each pixel), got in a short interval of time or objects lists containing measured coordinates. The last method as compared to the first one assumes simple automation of search of new objects, and also classification of objects using a reference catalogue. At short exposures (less than 10 seconds), typical for the modern CCD-observations, the track from a moving asteroid or TNO can be insignificant, and the object looks star-shaped. For the interval of time in 1 minute between observations, the asteroids of the Main belt are displaced for $0''.18 - 0''.38$, and TNO's – $1''.2$, the displacement of the lasts caused mainly by the orbital motion of the Earth. These values can be used for identifying moving objects. If the object coordinates are different less than $1''.2$ per minute, then the moving object can be identified as an asteroid or TNO on different images. It is

clear that the motion of TNO's is caused, mainly, by orbital motion of the Earth. Objects, not present analogues on other images, are written down in the total. Comparison of the measured coordinates of objects is made using various ε-distances. These objects can be either new objects or bugs. The problems of search using this algorithm are discussed.

Some Results of Investigation of Eighteen Fragments of Comet 73P Schwassmann-Wachmann 3 Nuclues

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Some preliminary results of observations and investigation of 18 secondary fragments of splitting primary nucleus of short period comet 73P Schwassmann - Wachmann 3 which were observed in May – June 2009 with the help of the 0.7-m reflector of Astronomical observatory of Kyiv University Kiev comet station - MPC 585 are presented. Astrometric observations of all cometary secondary fragments were used for improvement of their orbital elements and calculation of more precise ephemerides for observations of these fragments in the nearest comet apparition in 2011. We observed in real time, the outburst of brightness and the fragmentation of the secondary nucleus B in two new secondary fragments B1 and B2 which had at first the same magnitudes. Also we observed fragmentation of secondary nuclei G, H, M with formation of new fragments which passed the stage of their fast disintegration. Exploration of splitting of cometary nuclei is very important for best understanding of internal structure and chemical and mineralogical composition of cometary nucleus. Various physical mechanisms of splitting of cometary nuclei are discussed.

Exploration of Bright Comet C/2007 N3 (Lulin) Observed in February 2009

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Results of study of seven middle-resolution optical spectra of comet 2007 N3 (Lulin) observed in Feb. 2009 with the help of the 2-m Zeiss reflector and echelle-spectrograph of the High-mountain astronomical station of Institute of Astronomy of Russian Academy of Sciences and Main Astronomical Observatory of National Academy of Sciences of Ukraine at Peak Terskol are presented. Four spectra of comet 2006 N3 (Lulin) were obtained with expositions by duration 40 min every spectrum on Feb. 23-24, 2009 and two spectra with the expositions 60 min and one spectrum with the exposition 40 min were obtained on Feb. 24-25, 2009. The comet was at heliocentric distance 1.4 A.U. and geocentric one 0.4 A.U. and had 4.5 mag. The detailed identification of the spectral emission lines in spectra was made. Physical parameters of the neutral coma of comet (velocities of gas expansion, lives times of some molecules and other parameters) were calculated.

Spectral Observations of Two Comets C/2006 W3 (Christensen) and 22P Kopff

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We present a preliminary results of study of high-resolution optical spectra of comets 2006 W3 (Christensen) and 22P Kopff observed in Aug. 2009 with the help of the 2-m Zeiss reflector of the High-mountain astronomical station of Institute of Astronomy of Russian Academy of Sciences and Main Astronomical Observatory of National Academy of Sciences of Ukraine at Peak Terskol. 14 spectra of comet 2006 W3 (Christensen) were obtained during observational interval Aug. 4-15, 2009 and 5 spectra of comet 22P Kopff were obtained in temporal interval Aug. 10-15, 2009. The energy distributions in the near nucleus regions of both comets are built and detailed identification of the spectral emission lines in spectra was made. Physical parameters of the neutral comas of comets (velocities of gas expansion, lives times of molecules C2, C3 and CN and other parameters) were calculated using the Shulman's and Haser's models for neutral cometary atmospheres. Comparison of spectral peculiarities of two comets is made.

The Chemistry of Meteor Events on Mars

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Bright meteor was already detected in the atmosphere of Mars by Selsis et al. (2005). Study of Martian meteors is useful for estimation of properties of meteoroids colliding with the red planet. The elemental composition of the impact-produced fireball was taken to be that of a mixture of CI chondrites and the Martian atmosphere. The air-to-meteoroid mass ratio is taken to be 30. Thermodynamic calculations based on quenching theory were conducted in order to estimate the chemical composition of the fireball as it adiabatically cooled to the point where chemical reactions effectively stopped. We are considering fireball temperatures from 1500 to 6000 K with step of 500 K and pressures of 0.006 and 0.00004 bar. All this calculations were made with CHET program. It was assumed that chemical reactions end when the chemical and hydrodynamic time scales became comparable. Quenching of chemical reactions occurs at about 2000 K for big meteoroids reaching the surface of the planet. Chemical composition of impact-produced fireballs is estimated. The brightest lines in meteor spectra on Earth are lines of Na, Mg, and Fe. The relative intensities of these lines are comparable for Martian and Earth's meteors.

EURONEAR – The First 200 NEA's Observed

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The European Near Earth Asteroids Research (EURONEAR) is a project which envisions to establish a coordinated network to follow-up, recover and discover Near Earth Asteroids (NEAs), Potentialy Hazardous Asteroids (PHAs) and Virtual Impactors (VIs). Within this network, more than 200 VIs, PHAs and NEAs have been observed during the first three years using 1m and 2m class telescopes in about 12 observing runs in visiting mode taking place in France (Pic du Midi 1m telescope and Haute Provence 1.2m), Chile (La Silla 1m and 2.2m telescope, Cerro Tololo 1m, Cerro Campanas 1m and Cerro Armazones 0.84m), Romania (Bucharest, using a small 0.3m telescope) and Spain (La Palma, Isaac Newton Telescope 2.5m). About 1700 astrometric positions of VIs, PHAs and NEAs and their photometry have been reported promptly to Minor Planet Center and included in NEODyS database, contributing to the recovery of new objects and improvement of the orbits. Additional to NEAs, about 650 known Main Belt Asteroids (MBAs) were measured with the ESO/MPG 2.2m and the Isaac Newton telescopes, while more than 630 other MBAs have been discovered (only 55 official in the present, number subject to increase in time) by a team working in a distributed network which included professionals, students and amateur astronomers.

STELLAR ASTROPHYSICS

Pulsed Radio Emission from Two XDINS at Low Frequencies

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X-ray Dim Isoleted Neutron Stars (XDINS) are small groups of exotic neutron stars. We present the detection and new data on radioemission of two XDINSs (1RXS J2143.7+065419 and 1RXS J130848.6+212708).

The observations were perfomed using two sensitive transit radio telescopes of the Puschino (Russia) at frequencies: 111, 87, 61 and 42 MHz. The pulse profiles, the flux densities and the dispersion measures are presented, as well as, the estimations of distance, spectral indices and integral luminosities. The barycentric periods and period derivatives during the interval 3 and 2 years have been calculated. The comparison of our data and X-ray data showed large differences in the mean pulse widths and luminosities.

Estimations of Angles between Some Axes in Radio Pulsars from the Catalog at 1000 MHz

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There are some known theoretical models used for investigations of pulsars at present. One of the most important parameters for the check of existing pulsar models is the angle BETA between an axis of an emission cone (a direction of a magnetic moment vector) and a pulsar rotation axis. Some results of calculations of this angle are presented. For such calculations the sample of pulsars from the paper of Van Ommen, Alessandro et al. "Polarimetric observations of southern pulsars at 800 and 950 MHz" has been used. The estimations of the angle BETA have been carried out by three ways The first two ways are based on some statistical relationships. The third way uses observable values of positional angles and shapes of average profiles for individual pulsars only. The distributions of angles BETA obtained by three methods and some results of their comparison are discussed.

New Spectral Classification of Ultracool Dwarfs

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We present the overview report on the spectral classification of ultracool dwarfs. Ultracool dwarfs form low mass populations of objects more massive than giant planets but less massive than M dwarf stars ($T_{eff} < 2600$ K). The recent investigations of ultracool stars have productid a need for an extension of the system of stellar classification. This review gives a brief description of the classification of objects beyound the bottom of the conventional Main sequence.

Analytical Description of Relativistic Shock Wave Dynamics in Stellar Envelopes

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The analytical approximation methods of relativistic shock wave dynamics are considered. The motion of relativistic shock waves in stellar envelopes is analyzed. The comparative analysis of different analytical methods are made.

Lie Symmetries of Relativistic Equations of Stellar Structure for Radiative Energy Transport

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A system of differential equations describing relativistic static stars in radiative equilibrium is considered. I found that the equations admit an infinite parameter group of quasi-homologous symmetries. From the existence of this group it is possible to formulate the theorem about families of solutions. It provides us with the method for construction of new solutions from the known ones.

Spectroscopy of Post-AGB Star IRAS01005+7910

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Infrared source IRAS01005+7910 is identified with an 11-mag. peculiar star which has been previously found to be post-AGB star of spectral type $B1.7 \pm 0.5$ with $T_{eff} \approx 21500$ K. There is significant spectral variability detected earlier. The observations were obtained at the 6-m telescope of the Special Astrophysical Observatory of the Russian Academy of Sciences between 1999 and 2008 with high resolution (15000–60000). There are 32 spectra, 22 of them were taken with S/N ratio above 60. Spectra reveal absorption lines of C II/III, N II, O II, Al III, Si II/III/IV, S II, Ne I and an emissions of Si II, O I, [Fe II], [N I/II], [S II]. Both absorption and emission components are present in H I, He I, Na $D_{1,2}$, Mg II (λ4481 Å), C II (λ4267 Å) and Fe III. The detailed analysis of radial velocities was carried out. Radial velocities derived from different absorption lines show variability within the same spectrum. Significant variability of radial velocities is demonstrated on the scale of one day. The variability of line profiles is present. The hydrogen Balmer lines from $H\alpha$ to $H\gamma$ have asymmetric single-peaked emission profiles with constant blue wing. Profiles are complicated and variable. The constant radial velocity -51 ± 1.4 km/s of forbidden lines was detected. Shell expansion velocity of 14–21 km/s is estimated from widths of forbidden emission profiles. The resonance Na I lines show 5 constant absorption components at a resolution of $R = 60000$. Some spectra show emission components of Na I D_2 in blue and red wing. Assuming common nature of both emissions, the radial velocity of common emission is estimated as -33 ± 6 km/s.

Polarimetry of GRB-091020 and GRB-091127

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GRB-091020 and GRB-091127 were detected by Swift satellite. Optical observations were provided on telescope MASTER-II (Kislovodsk solar station of the Pulkovo observatory of Russian Academy of Science) in two orthogonal polarazing filters. Steering to GRB-091020 coordinates was made in 3422 seconds after the GRB time. There were taken 65 images in each filter with 180 seconds exposure. GRB-091127 images were taken in period from 92 to 630 seconds after the GRB time with exposures from 20 to 160 seconds. There were made 9 images in each polaroid. Photometry reduction was provided in IRAF-DAOPHOT using reference and check stars from USNO-B catalog. GRB-091020 images were summarized in 5 items before the reduction. There is no polarization discovered on 3σ upper limit for GRB-091020 and on 1σ upper limit – for GRB-091127.

Investigation is supported by Federal Agency on Science and Education, Federal Program "Scientific and Pedagogical Cadres of Innovative Russia for 2009-2013", Governmental Contract N02.740.11.0249. "Optical monitoring of close and distant cosmic space by robotic network of telescopes MASTER".

Relation "Energy-Radius" in the Chandrasekhar Model and Degenerated Dwarfs Distribution by Radii

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As known, the standard Chandrasekhar model of cold dwarfs have two parameters x_0 – relativistic parameter in star centre and $\mu_e = A/Z$ – effective molecular electron mass ($\mu_e \approx 2.0$). The physical characteristics (mass, radius, energy, number of electrons) was calculated as functions of parameters x_0, μ_e on the base of mechanical equilibrium equation solutions. We evaluate parameters x_0, μ_e for real dwarfs using observed values of radii and masses of real dwarfs obtained from "Hipparcos" mission (1997). For most of dwarfs $0.5 \leq x_0 \leq 1.5$ that correspond to average density. Full energy that takes into account the rest electron energy is positive non monotonic function of x_0. The energy function has the maximum near to $x_0^{(1)} \simeq 2.57...$ that correspond to $R_1 \approx 0.7 \cdot 10^{-2} R_\odot$ and $M_1 \approx 1.06 M_\odot$. From calculated relation "energy-radius" follows energetically inefficient of dwarfs in neighbourhood of R_1. Dwarfs with small radii (masses $> M_\odot$) are isolated from main stars group with energetical barrier. The observed degenerated dwarfs distribution by radii (masses) proved our conclusions. Hypothetical radius limit obtained by us R_{lim} (correspond to $x_0 \cong 13.9...$) is approximately equal $0.22 \cdot 10^{-2} R_\odot$. Dwarfs with R_{lim} being instability due to effects of the general theory of relativity. Upper radius limit $R_{max} \approx 1.6 \odot 10^{-2} R_\odot$ was obtained from condition that nondegenerate surface layer size is equal to half of star radius.

Calculation of the Ionization Balance in the Photosphere of Stars with Allowance for Screening Interactions

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In frames of the reference system approach a way of a selfconsistent allowance for the screening environment influence on the ionization balance in photosphere of stars is suggested. It is made with the purpose of a further calculation of the continuous absorption coefficient in the wide temperature region. A hydrogen-like and hydrogen-helium atmosphere models are investigated. The ionization balance calculation is based on the expression for the free energy of the partly ionized plasma in Debye approach which leads to Saha's relationships. Here the partition functions of atoms and ions are used being calculated with the help of averaging procedure over the electron variables on the base of Schroedinger equation with screening potential. The dimensionless screening parameter $\xi = \frac{a_o}{r_d}$ (a_o is the Bohr radius, r_d is Debye radius) is defined selfconsistently. In the hydrogen model it is the solution of the equation

$$(4\pi)^{3/2}\left(\frac{\xi}{4\sqrt{\pi}}\right)^4 t^{1/2} U_H(\xi,t)\exp\left[-\frac{\varepsilon_{1,0}(\xi)}{t}\right] + \left(\frac{\xi}{4\sqrt{\pi}}\right)^2 t = n^*,$$

where

$$U_H(\xi,t) = 1 + \sum_{n\geq 2}\sum_{l\geq 0}(2l+1)\exp\left\{\frac{1}{t}[\varepsilon_{1,0}(\xi) - \varepsilon_{n,l}(\xi)]\right\}.$$

Here $t = 2k_BTa_oe^{-2}$ is the dimensionless temperature (in Ry), $\varepsilon_{n,l}(\xi)$ – the energy levels (Ry) for the electron in the hydrogen atom with the screening potential of the electron-proton interaction, $n^* = \frac{\rho}{m_H}a_o^3$ is the dimensionless concentration of the heavy particles. The numerical calculations for the hydrogen and hydrogen-helium models are carried out. The temperature dependence of concentration $10^{-8} \leq n^* \leq 10^{-6}$ of the heavy particles (atoms, ions, protons and electrons) is investigated in the wide temperature region from $5\cdot 10^3$ K to $3\cdot 10^4$ K.

The First Spectra for the RX J0440.9+4431 from 2-m Terscol Telescope

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We have took the first spectra from 2-m Ritchey-Chretien-Coude telescope with Cassegrain Multi Mode Spectrometer ($R = 14000$) on the Terskol observatory for the Be/X-ray binary RX J0440.9+4431. The Hα profile indicated that the new episode of the V/R variability is present in the system. Hα line profile was analyzed and EW was measured. We have compared our Hα line profile with the previous spectral parameters and have estimated V/R variability period about 14 years.

Photometric Investigation of the 1H1935+55 and the Nearest Sky Field

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We provide the UBVR-band photometry for the Be/X-ray binary 1H1935+55 using the 70-cm telescope with BVR filter wheel (Lisnyky station of the KAO, National Taras Shevchenko University of Kyiv) and 60-cm telescope with UBV Lyuty's photometer (Crimean Laboratory of the SAI MSU). The data from the two summer observing seasons (2008 and 2009) was analyzed. The reference stars with magnitudes in the range ±2 from the object's magnitude were chosen around the object. Among these stars we have found some local standards for the further investigation as also the directly variable stars. We have obtained photometric light curve of the 1H1935+55.

EXTRAGALACTIC ASTROPHYSICS

Selection of Luminous Galaxies at the Edge of the Universe

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The study of distant galaxies is crucial for the understanding of the very first stages in galactic evolution, however the criteria to select these objects are vast. The Australia Telescope Compact Array (ATCA) 1,4 GHz survey of the Chandra Deep Field South (CDFS), using the Advanced Camera for Surveys (ACS) of the Hubble Space Telescope (HST) for the identification of the objects, served the purpose of looking for powerful radio-sources at very high z. Galaxies strongly emitting in the radio frequencies are promising candidates since these can be detected in the most recent deepest surveys to essentially any distance. Since the best high-z radio-galaxy candidates may be weakly or even not detected in other wavelengths, the identified radio sources in the ATCA survey were searched for in the optical surveys from Galaxy Evolution from Morphology and SEDs (GEMS) and the Great Observatories Origins Deep Survey (GOODS) as well as in the infrared Spitzer data from SIMPLE. Among the 94 radio-sources singled out in the ATCA survey, on morphological basis, 14 had an infrared counterpart, of which only 7 correspond to a likely infrared galaxy emitting two radio jets; 40 were within the area covered either by GEMS or GOODS and of those only one was identified at optical wavelengths. The resulting sample of high-z powerful radio source candidates need further study, and will be pointed out for future observations with new telescopes and instruments, such as the Atacama Large Millimetre Array (ALMA).

Atomic Hydrogen Deficiency in Spiral Galaxies in Clusters

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We applied a new method of estimation of atomic hydrogen deficiency in spiral galaxies, which is based on the relation between total HI mass and specific angular momentum of a disk for isolated galaxies. The results generally agree with those obtained by classical method first proposed by Haynes and Giovanelli. We estimated HI deficiency for Virgo and Coma cluster galaxies and for Local Volume galaxies. For galaxies in the Local Volume we do not obtain any appreciable HI deficiency as compared with isolated galaxies, though substantial part of these galaxies belongs to groups. For Virgo and Coma cluster galaxies we confirmed the existence of relation between HI deficiency and the distance from cluster center. We found that the substantial HI deficiency takes place up to nearly 2 Mpc from the cluster center in Virgo and up to 3-4 Mpc in Coma, although the majority of galaxies in both clusters have normal hydrogen content at all distances. We also demonstrated that the ram pressure is not sufficient for sweeping the considerable amount of gas at such virgocentric distances where substantial HI deficiency is observed. Hence, these galaxies either have already passed through the dense core of the cluster, or HI deficiency is caused by the other reasons, such as starvation effect or galaxy interaction with gas, which is more cold than the X-ray gas. At least partially HI deficiency can be caused by the enhancing of star formation due to compression of interstellar gas by the outer pressure.

Circular Polarisation of AGNs on the Parsec VLBI Scales

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Faraday effects possibly play the major role in generation of circular polarisation (CP) observed on VLBI scales. Multi-frequency CP measurements can become the desired breakthrough in understanding the AGN jets physics and the only possibility to estimate some of their vital parameters. We review the likely mechanisms of CP generation and their connection to the jet parameters. We throw a glimpse on the methods of data reduction and finally discuss our current observational progress and its possible interpretation.

Seyfert Galaxies and "Unified Scheme"

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According to 'Unified Scheme" (US) observational properties of Active Galactic Nuclei (AGN) depend on inclination of AGN to the line of sight that determines the possibility of Broad Line Region (BLR) observation at small viewing angles. BLR is obscured by circumnuclear dusty torus with high extinction in optical band. Provided US is correct and AGN with and without broad emission lines differ only in inclination angle the isotropic properties of this populations (such as richness of the environment on different scales, host galaxy morphology type) must be the same. Some results appeared that apparently contradict with US. Namely, the frequency of close neighbor for Seyfert galaxies with (type I) and without (type II) broad permitted lines is found to be different. We conduct research on the possible environment difference on scales from $\sim$30 kpc to $\sim$10 Mpc between Seyfert galaxies of types I and II based on SDSS data and their observational properties in IR and X-Rays. We present cross-correlation function analysis, minimal spanning tree algorithm and direct neighbor counts to quantify the environment.

Influence of Low-Frequency Quasar 3C 273 Radio Spectrum on X-ray Emission of Its Kiloparsec Jet

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From a simple estimation it is clear that the energy density of emission of the central source with luminosity $L \sim 10^{47}$ erg/s becomes comparable with the energy density of the cosmic microwave background at the distance of a few tens kiloparsec, that takes place for the jet of the quasar 3C 273. Therefore, the inverse Compton scattering of the quasar emission is a possible mechanism that produce X-rays from the nearest to the core jet knots. In this report the X-ray emission spectrum from first knot has been found by kinetic equation method. We assumed the power-law electron energy distribution with spectral index $\gamma \approx 2.6$ based on the radio and optical observed results. Correspondingly, the scattering on the most high-energy electrons (with Lorentz-factor $\sim 10^7$) gives the main contribution to X-ray radiation of the Chandra range. Hence, the low radio frequency quasar photons with

frequencies $\omega \sim 10^{-5}$ s^{-1} (and lower) are scattering in this process. It is shown that X-ray spectral index coincides with the spectral index of scattered low-frequency radiation. The low-frequency break of the synchrotron spectrum is possible at this frequency range. Thus, we can obtain information about low-frequency quasar spectrum by analyzing the X-ray data. Deflection of the low-frequency radiation spectrum from the power law have been considered in this connection. Significance of receiving observational data at low frequencies has displayed.

Structure and Dynamics of Galaxy Nuclei – Imaging and 3-D Modelling

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Intense star formation, black hole accretion and the coalescence of active galactic nuclei are crucial phases in galaxy evolution. How these processes interact and feed back in galaxy centers, and the impact that they have on the (mostly dense, molecular) interstellar medium and star forming gas, is far from understood. In order to advance the understanding of feedback processes in galaxy nuclei, essential to constrain theoretical scenarios of galaxy evolution, current and future ground & space based observations of, for instance, warm and hot ($T_K > 100$ K) gas with high-J CO lines (e.g. J=6–5, J=12–11), fast shocks (> 20 km/s) with SiO, and dense gas ($n(\mathrm{H_2}) > 103$ cm^{-3}) with e.g. HCN and HCO$^+$, on sources like the starburst NGC 4945, or the prototypical Seyfert galaxy NGC 1068, can be used to constrain theoretical models based on high resolution (pixel size of approx. 0.25–20 pc in diameter) 3-D hydrodynamical simulations of galactic nuclei and galaxies. These hydrodynamical models can be combined with molecular abundances obtained from chemical models for different ambient conditions. A 3-D radiative transfer code can then be used to estimate the intensity of the various transitions of several molecular and atomic species. The resulting line intensity maps can in turn be used to guide and interpret future extra-galactic observations performed with observatories like APEX, Herschel, SOFIA and ALMA. Early results of the 3-D models, as well as recent Spitzer/IRS and APEX/CHAMP$^+$ images of NGC 4945 and M17SW will be shown during the oral presentation.

Peculiar Morphologies of Extended Extragalactic Radio Sources from Numerical Simulations

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Among the extragalactic radio sources there are objects with unusual morphologies. We investigate the possibility that the propagation of jets in a stratified distribution of density may produce such effects. A numerical setup was devised and hydrodynamical 2D and 3D simulations were performed using the PLUTO code. We conducted a parametric study regarding the dependence of the morphologies on the relative orientation of the mass distribution and the jets. Aspects on emission estimations from such simulations will be approached.

Color Indices and Morphological Properties of Galaxies in Pairs

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It is well known that morphological properties as well as color indices of galaxies depend on their environment. In our work we have considered morphological and color distinction of two kinds of galaxy samples: galaxies in pairs and isolated galaxies. We have found that the fraction of early type galaxies in pairs is larger than in isolated galaxies. From the other side, elliptical, lenticular and early spiral galaxies in pairs are redder in color than isolated galaxies.

The Redshift Evolution of Oxygen and Nitrogen Abundances in Emission-Line SDSS Galaxies

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The oxygen and nitrogen abundance evolutions with redshift and galaxy stellar mass in emission-line galaxies from the Sloan Digital Sky Survey (SDSS) are investigated. This is the first such study for nitrogen abundances, and it provides an additional constraint for the study of the chemical evolution of galaxies. We have devised a criterion to recognize and exclude from consideration active galactic nuclei (AGNs) and star-forming galaxies with large errors in the line flux measurements. To select star-forming galaxies with accurate line fluxes measurements, we require that, for each galaxy, the nitrogen abundances derived with various calibrations based on different emission lines agree. We found that the galaxies of highest masses, those with masses $> 10^{11.2} M_{\odot}$, have not been enriched in both oxygen and nitrogen over the last $\sim$3 Gyr. The galaxies in the mass range from $\sim 10^{11.0} M_{\odot}$ to $\sim 10^{11.2} M_{\odot}$ do not show an appreciable enrichment in oxygen, but do show some enrichment in nitrogen. This suggests that stars with lifetimes of $2-3$ Gyr, in the $1.5-2\ M_{\odot}$ mass range, contribute to the nitrogen production. Finally, galaxies with masses $< 10^{11} M_{\odot}$ show enrichment in both oxygen and nitrogen during the last 3 Gyr: they have undergone appreciable star formation and have converted up to $\sim$20% of their mass into stars over this period. Both oxygen and nitrogen enrichments increase with decreasing galaxy stellar mass in the mass range from $\sim 10^{11} M_{\odot}$ to $\sim 10^{10} M_{\odot}$.

WR-Galaxies in SDSS DR7

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We analyze spectras of blue compact dwarf galaxies from Sloan Digital Sky Survey Data Relise 7 with fluxes in Hβ λ over 100 counts. Nearly all galaxies in our sample show broad WR emission in the blue region of the spectrum (the blue bump) consisting of an unresolved blend of NIII λ4640, CIII λ4650, CIV λ4658 and HeII λ4686 emission lines. Broad CIV λ5808

emission (the red bump) is also detected in few galaxies.We derive the numbers of early WC (WCE) and late WN (WNL) stars from the luminosities of the red and blue bumps, and the number of O stars from the luminosity of the Hβ emission line. It is found that the relative number ofWR stars N(WR)/N(O +WR) decreases with decreasing metallicity, in agreement with predictions of evolutionary synthesis models.

The Structure of Jets in AGN from Radio and X-ray Data

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The image analysis of AGN jets is investigated. The jet structure and profiles are estimated. The results from radio and X-ray data are compared.

On the Possibility of Massive Discs in Low Surface Brightness Galaxies

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Some investigations of low surface brightness (LSB) galaxies led to the conclusion, that their discs may be significantly more massive than it is predicted by stellar population models (see for example Fuchs 2002). In this case, the commonly used point of view that LSB galaxies are systems of low stellar surface density where a dark halo dominates at all radii, appears doubtful. To verify the possibility of high density of stellar discs of LSBs, I considered four galaxies of this type for which radial distributions of velocity dispersion and rotation curves of stars and gas were obtained by Pizzella et al 2008. These data allowed me to fulfill the independent estimation of masses of LSB discs using the Toomre criterion of gravitational stability. I came to the conclusion, that either the surface densities of stellar discs of LSBs and their light-to-dark mass ratios are quite typical (the same as for normal spiral galaxies), or, unlike the discs of most of spiral galaxies, the LSB discs are dynamically overheated.

GRAVITATION & COSMOLOGY

Hunting for Dark Matter Particles

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Many independent observations of different classes of cosmic objects indicate that, in addition to ordinary "visible" matter in our Universe there is huge amount of "hidden", gravitationally-interacting substance, possibly contributing to a "Dark Matter". Interestingly, the major part of Dark Matter cannot be explained within the Standard Model of elementary particles which poses a serious challenge for particle physicists. On the other hand, several well-motivated extensions of the Standard Model are supposed to contain the viable Dark Matter particle candidate. The overview of the basic properties of the most popular Dark Matter candidates, including neutralinos, sterile neutrinos and axions, as well as the possibilities of their direct detection by existing and planned Earth-located experiments, will be presented. After that, I critically review the existing methods of constraining the parameters of Dark Matter particles using the properties of distant Dark Matter halos, and present the recent robust updates. Finally, I discuss the possibilities for direct and indirect detection of different types of Dark Matter particles in the nearest future.

The Clustering and Environment of Star-Forming Galaxies at $z = 0.84$: the HiZELS-Hα View

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I will present the clustering and environment properties of a sample of ≈ 103 Hα emitters at $z = 0.845 \pm 0.015$; these have been obtained from a deep narrow-band survey covering 1.4 deg^2 in two fields as part of the Hi-z Emission Line Survey. The Hα emitters present a real-space correlation length of $r_0 = 2.8 \pm 0.1\,h^{-1}$ Mpc. The effect of cosmic variance is measured for 0.05-0.8 deg^2 areas, showing that it can have a tremendously limiting effect for small areas (< 0.4deg^2), but only leads to ≈ 10 per cent maximum changes by ~ 1deg^2. The clustering is strongly dependent on Hα luminosity: galaxies with star-formation rates (SFRs) of $> 9\,M_\odot\,yr^{-1}$ yield $r_0 = 4.9 \pm 0.2\,h^{-1}$ Mpc, and are thus much more clustered than the typical galaxies in the sample presenting SFRs of 4-6 $M_\odot\,yr^{-1}$ ($r_0 = 1.9 \pm 0.1\,h^{-1}$ Mpc). The clustering is also strongly dependent on stellar mass (M_K) and B luminosity. Galaxies with Hα SFRs of > 3 $M_\odot\,yr^{-1}$ at $z \sim 1$ reside in dark-matter haloes of $M \approx 10^{12}\,M_\odot$ and are likely progenitors of milky-way type galaxies. Star-forming galaxies at $z \sim 1$ avoid the lowest density regions and their fraction relative to the general population at the same redshift increases with density, doubling from the lowest densities to $\Sigma \sim 30\,Mpc^{-2}$ – but then falls sharply to 0 at densities 10 times larger. Higher densities are linked with a median and average enhancement of star-formation These results clearly show that the environment plays a key role in galaxy formation and evolution and that the star-formation-density relation is inverted at $z \sim 1$ for star-forming galaxies.

Mean Transmitted Flux in the Lyα Forest from a Sample of 2QZ Quasars

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The power spectrum of transmitted flux in Lyα forest in spectra of distant quasars gives us an information about matter power spectrum on the smallest spatial scales which is very important for testing of different models of dark matter. Only two different samples of quasar spectra are used for today for this purpose: SDSS and LUQAS, thus using additional independent sample is useful for verification of these data. We propose to use spectra from 2QZ survey, which has spectral resolution similar to SDSS. After visual inspection and rejection of spectra with broad absorption lines, damped Lyα systems and low signal-to-noise ratio our final sample contains 731 quasar with redshift range $2.3 < z < 3.2$. We present the results on primary sample selection, calculation of mean geometric composite spectra for different redshift ranges and determination of continuum level and mean transmission as a function of redshift. These results will be used for calculation of flux power spectrum.

Perturbed Recombination and CMB Anisotropy: Linear Effect

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The evolution of perturbations of Hydrogen and Helium ions number densities during the cosmological recombination epoch is analysed for the case of adiabatic matter density perturbations. The equations for relative perturbations of ionization fractions were derived from the system of equations for accurate computation of the ionization history of the early Universe. We have taken into account the new effects and metric perturbations. The power spectra of matter temperature and free electron number density perturbations are obtained for the epoch of cosmological recombination of Hydrogen. The linear effect of perturbed recombination on the CMB anisotropies is estimated.

Blueshifted Galaxies in the Virgo Cluster

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We consider a sample of 65 galaxies in the Virgo Cluster that have negative radial velocities with respect to the Local Group. Some properties of the sample are noticed. All the objects reside compactly within the 6-degree virial radius, but their centroid is displaced at 1.1 degree towards NW from the dynamical cluster center, M87. Surprisingly, dwarf galaxies of the sample exhibit a clumpiness on a scale of 10 arcmin (50 kpc). The observed NW asymmetry of the blueshifted galaxies may be interpreted as evidence for merging of the M86 subcluster with the main Virgo Cluster body (Binggeli et al. 1993). A new attempt is made by us to explain this phenomenon taking into account the tangential motion of the Local group regarding to the Virgo Cluster caused by its pushing from the Local Void.

Static, Spherically Symmetric Gravitational Lens Filled with Perfect Fluid

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Gravitational lensing is a powerful method of measuring mass of an astrophysical objects. Often it is assumed that gravitational field is relatively weak, so it can be described in a linearised theory. In this presentation the more general situation of static, spherically symmetric spacetime filled with perfect fluid is shown in context of weak lensing measurements of galaxy cluster mass distribution. The deflection angle in such spacetime is compared with predictions of the linear theory for a given Navarro-Frenk-White density profile.

Highly Relativistic Spinning Particle in a Gravitational Field

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The motions of a spinning test particle in general relativity are described by the Mathisson-Papapetrou equations. We study the effects of the gravitational field of a Schwarzschild black hole on the trajectories of a highly relativistic spinning particle. It is shown that under certain conditions these trajectories can significantly differ from the trajectories of a spinless particle with the same initial values. The typical graphs and the numerical estimates for the elementary particles are presented. The effects of the considerable repulsions caused by the gravitational spin-orbit interactions are discussed.

Observational Constraints on Minimally Coupled Dark Energy Models: WMAP7 + SDSS DR7

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The dark energy is treated as a minimally coupled scalar field, both classical and tachyonic Lagrangians have been considered. For these scalar fields the equation-of-state parameter is assumed to vary in time in such a way that the adiabatic sound speed c_a^2 is constant. For such case the equations for evolution of scalar field density and velocity perturbations in synchronous gauge have been implemented into the code CAMB in order to test such models of dark energy with observational data using the Markov Chain Monte-Carlo code CosmoMC. Using the 7-year WMAP data on CMB anisotropies, the SDSS DR7 data on LRG power spectrum, BAO and data on supernovae, we have determined the best fitting values of dark energy parameters as well as of other main cosmological parameters.

X-ray Emission in Galaxy Clusters

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Clusters of galaxies are the largest virilized structures in the Universe. They contain a significant amount of hot gas which is detected in X-ray energy range. Using the modelling of surface brightness profile of hot gas emission we can estimate the total mass of the cluster and mass-to-luminosity ratio. In our work we consider the dark matter content of two galaxy clusters.

Correlation Function of Quasars in Real and Redshift Space from SDSS DR7

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We analyze the quasar two-point correlation function (2pCF) within the redshift interval $0.8 < z < 2.2$ using a sample of 52303 quasars selected from the recent 7th Data Release of the Sloan Digital Sky Survey. Our approach to 2pCF uses a concept of locally Lorentz (Fermi) frame for determination of the distance between objects and permutation method of the random catalogue generation. Assuming the spatially flat cosmological model with given $\Omega_\Lambda = 0.726$, we found that the real-space 2pCF is fitted well with the power-low model within the distance range $1 < \sigma < 35\ h^{-1}$ Mpc with the correlation length $r_0 = 5.85 \pm 0.33\ h^{-1}$ Mpc and the slope $\gamma = 1.87 \pm 0.07$. The redshift-space 2pCF is approximated with $s_0 = 6.43 \pm 0.63\ h^{-1}$ Mpc and $\gamma = 1.21 \pm 0.24$ for $1 < s < 10\ h^{-1}$ Mpc, and $s_0 = 7.37 \pm 0.81\ h^{-1}$ Mpc and $\gamma = 1.90 \pm 0.24$ for $10 < s < 35\ h^{-1}$ Mpc. For distances $s > 10 h^{-1}$ Mpc the parameter describing the large-scale infall to density inhomogeneities is $\beta = 0.63 \pm 0.10$ with the linear bias $b = 1.44 \pm 0.22$ that agrees with the linear theory of cosmological perturbations. We discuss possibilities to obtain a statistical estimate of the random component of quasars velocities (different from the large-scale infall). We note rather slight dependence of quasars velocity dispersion upon the 2pCF parameters in the region $r < 2$ Mpc.

Observational Constraints on Cosmic Snap Parameters in a Kinematical Approach

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In our work, we employ the kinematical approach to cosmological dark energy studies. We construct a three parameter model in terms of dimensionless second, third and forth derevatives of the scale factor $a(t)$ with respect to cosmic time t, namely the present day values of declaration factor q_0, jerk parameter j_0 and cosmic snap parameter s. To constrain our model, we used data from observations as Supernova Type Ia (SNIa) Gold sample and Union Sample data, size of baryonic acoustic peak from SDSS, gas mass fraction in cluster of galaxies and Hubble parameter data. In the best fits, we put the constraint of $s = -0.7^{+0.85}_{-2.40}$, $q_0 = -1.2^{+0.50}_{-0.23}$ and $j_0 = 3.32^{+0.24}_{-0.31}$.

HIGH-ENERGY ASTROPHYSICS

Evidence for Existence of Extragalactic Magnetic Fields in Excess of 10^{-16} G from Fermi Non-Detection of Distant TeV Blazars

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Magnetic fields in galaxies and galaxy clusters are produced via amplification of extremely weak "seed" magnetic fields of unknown nature. These seed fields, which might exist in their initial form in intergalactic medium, have escaped detection so far. Existing observational upper limits on the strength of the seed fields ($\sim 10^{-9}$ G), which come from observations with radio telescopes, are much above typical theoretical predictions. Here we report a lower bound on the strength of magnetic fields in intergalactic medium, which stem from non-observation of GeV energy band emission from electromagnetic cascade initiated by multi-TeV γ-rays emitted by distant active galaxies and absorbed on their way through extragalactic medium.

Observation of X-ray Spectral Hysteresis in the TeV BL Lacs Objects BL Lac and 1ES 1959+650

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BL Lac objects belong to the extreme sub-class of radio-loud AGNs. Their spectra usually reveal two broad components, the low energy one peaking in the IR to X-ray range, and the high energy one peaking in the MeV – TeV range. The light curves in the soft X-ray and the spectral hysteresis at soft X-ray energies can be used as a powerful diagnostic the nature of the high-energy emission from BL Lac objects. The spectral hysteresis has been found out for the first time in HBLs (such as Mrk 421) which as a whole are brighter X-ray sources. The observations of a spectral hysteresis in low- and intermidiate-peaked BL Lacs objects were not caried out earlier because of their small luminosity in a X-ray band.

We report results from a search a two low-frequency peaked BL Lacs and 1ES 1959+650, during 2002-2009 years, using public data from the XMM-Newton/EPIC, Swift/XRT and RXTE/PCA instruments. Our analysis shows for the first time the presence of a spectral hysteresis at each of these objects.

Search for Cyclotron Absorptions from Magnetars with XMM-Newton

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Magnetars are believed to be neutron stars embedded with ultrastrong magnetic fields. There are several indirect indications of the presence of such vast fields in Anomalous X-ray Pulsars (AXPs) and Soft Gamma-ray Repeaters (SGRs). On the other hand, there is very little evidence about the direct detection of magnetic fields in these objects, in contrast to ordinary pulsars. It has been suggested that protons and ions located in superstrong

magnetic field should produce visible absorption features in X-ray spectra. The aim of the present research was to provide the model-independent study of complete sample of quiescent magnetar spectra deeply observed by XMM-Newton and to find out whether sharp cyclotron absorptions are present there. Our analysis revealed almost complete absence of significant cyclotron lines in the quiescent spectra, but in several observations of three different objects. Obtained results provide a material for further theoretical investigations.

Magnetic Field Strength from Nonthermal Images of SN 1006

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One of important factors which influences the nonthermal radiation from SNRs is interstellar magnetic field (MF). We propose a new method for determination of MF strength from the inverse-Compton gamma-ray map of SNR. Namely, we demonstrate that the ratio between gamma-ray brightness of the two bright limbs in SN 1006 depends on the strength of MF in SNR and suggest to use this property for estimation of an average MF strength in this SNR. We model three-dimensional SNR in uniform media including evolution of MF and relativistic electrons inside the whole volume of SNR. Then we synthesize a number of gamma-ray images of this SNR for different values of strength of MF and calculate the ratio of the surface brightness of the two regions covering the limbs. The values of brightness are obtained by integration along the line of sight and over these regions. The ratios are compared with the observational data from H.E.S.S. experiment. Unfortunately, large errors in the preliminary H.E.S.S. data prevent us to give preference to any strength of MF, allowing it to be between 1 and 200 microGauss. However, we believe that suggested method will be useful in the future when experiments provide increased accuracy.

Image and Spectral Analysis of Jets in AGN from X-ray Data

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The image and spectral analysis of AGN jets are investigated. The spectra of different parts of jet are obtained. The comparative analysis of spectra from different parts of jet are made.

X-ray emission from jets in AGN

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The X-ray emission from AGN jets are modeled. The different emission mechanisms from different parts of jet are considered. The comparative analysis of different emission mechanisms in AGN jets are made.

ASTROPARTICLE PHYSICS

Images of Supernova Remnants in Gamma-Rays due to Pion Decays

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H.E.S.S and MAGIC experiments are the first to produce images of supernova remnants (SNRs) in the very-high energy gamma-ray range. Since 2004 there are more than 10 SNRs with known pattern of surface brightness distribution in TeV gamma-rays. The main sources of this radiation are electrons (due to inverse-Compton scattering) and protons (due to pion decays). Analysis of the broad-band spectra of SNRs showed that both electrons and protons may be responsible for TeV gamma-rays. Observed images of SNRs, in addition to the spectra, might provide criteria to distinguish between these two scenarios. We present a method to synthesize gamma-ray images of SNRs due to hadronic emission. It includes a classic model of accelerations of protons and hydrodynamics of shocks in uniform interstellar medium. The synthesized maps of surface brightness distribution of SNRs are analysed and compared with the leptonic gamma-ray images.

Modeling of TeV Gamma-Ray Radiation from Supernova Remnant IC443

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Supernova remnants (SNRs) are believed to be the most promising accelerators of ultra-relativistic particles (cosmic rays) in our Galaxy. The most plausible mechanism to realize this idea was proposed by Fermi in 1949 and is known as "diffusive shock wave acceleration". IC443 (G189.1+3.0) is a middle-age shell-type SNR interacting with a molecular cloud. Observations of IC443 with MAGIC and VERITAS have detected TeV gamma-ray emission with power-law energy spectrum $FMAGIC^{obs} = 5.8 \cdot 10^{-13} E_{TeV}^{-3.1}$ TeV^{-1} cm^{-2} s^{-1} in the energy band $0.1 \leq E_{TeV} \leq 1.6$ (Albert et al., 2007) and $FVERITAS^{obs} = 8.38 \cdot 10^{-13} E_{TeV}^{-2.99}$ TeV^{-1} cm^{-2} s^{-1} in the energy band $0.3 \leq E_{TeV} \leq 2.0$. We elaborate a hadronic model of TeV gamma-ray radiation of IC443 via unelastic proton-proton collisions and show that for the hydrodynamical model of IC443 proposed by Hnatyk & Petruk, embedded in SNR molecular cloud of mass about $M_{cl} = 10^3 \mathrm{M}_\odot$ can provide observed gamma-ray flux. We evimate also the size and mean number density of the cloud.

Hadronic Model of TeV Gamma-Ray Radiation from Supernova Remnant Vela Jr.

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Supernova Remnants (SNRs) are among the most promising galactic candidates for the Cosmic Ray (CR) accelerators up to the energy of $1015 - 1017$ eV. The evidence for effective acceleration of electron (leptonic) component of CR in SNRs is synchrotron emission with broad spectrum from radio to X-rays. But still there is no direct evidence for acceleration of proton (hadronic) component. One of the possible signature of hadronic component in SNRs is hard GeV-TeV gamma-ray radiation from decay of pions, created in unelastic proton-proton collisions. Additional analysis of spectum is needed in order to distinguish between hadronic and leptonic (inverse Compton)mechanisms of hard gamma-ray radiation. One of the few SNRs with observed hard gamma-ray flux is Vela Jr. In our work we elaborate hydrodynamical model for this SNR under assumption that it is middle-age at transition stage of evolution and show that this model explains the observed TeV gamma-ray flux and surface brightness by hadronic mechanism.

High-Energy Cosmic Rays from GRB Progenitors – Hypernovae

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There is a wide consensus that the sources of cosmic rays of energy below the first "knee" are Galactic supernovae remnants, and that the sources of cosmic rays above the "ankle" are extra-Galactic. But there is no consensus regarding the sources of cosmic rays in the energy range between the "knee" and the "ankle". In our work we investigate acceleration of cosmic rays during the transition deceleration stage (stage between reaches the surface of prehypernova star and beginning of Sedov-Tailor regime by shock wave) of expansion shock wave in surrounding medium – Wolf-Rayet stellar winds in Hypernovae explosion.

Propagation of Different Components of Cosmic Rays in the Galactic Magnetic Fields

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Propagation of UHECR in the Galactic magnetic fields was simulated by back-tracking method. Different models of the regular Galactic magnetic field were being assumed. The influence of magnetic field on the propagation of different components of cosmic rays, protons as well as nuclei, was investigated. Especially we studied the dependence of UHECR trajectories on its energy and the arrival directions.

The Influence of Extragalactic Magnetic Fields on the Propagation of Cosmic Rays

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Propagation of UHECR in the Galactic magnetic fields was simulated by back-tracking method. Different models of the regular Galactic magnetic field were being assumed. The influence of magnetic field on the propagation of different components of cosmic rays, protons as well as nuclei, was investigated. Especially we studied the dependence of UHECR trajectories on its energy and the arrival directions.

Modeling of Gamma-Ray Emission for Fermi/LAT Supernova Remnants

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Despite significant progress, the problem of cosmic ray acceleration stays among the most important unsolved problems in high-energy astrophysics. According to current paradigm, the bulk of cosmic rays at energies lower than 1 PeV is accelerated inside the supernova remnants (SNRs). Several SNRs having inside the massive compact hydrogen targets (molecular clouds) have been recently detected by Fermi/LAT as gamma-ray emitters. We model the phase-space distribution of accelerated protons at these SNRs, solving the kinetic equation for unmodified shock with the presence of molecular cloud (therefore, both energy loss and particle escape are taken into account). After that, we calculate the expected gamma-ray emission, and compare it with observed signal.

Neutrinos from Relativistic Shock Break-Out at the Surface of Hypernova

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The generation of neutrinos from relativistic shock break-out at the surface of Hypernova explosion is considered. The parameters of neutrino flash that appears from pions decay as a result of inelastic collisions between accelerated particles and circumstellar environment are estimated. The detectability of neutrino flash are calculated.

INTERSTELLAR MEDIUM

Interstellar Atomic Lines

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Huge database of high resolution echelle spectra O and B stars let us do measurements in a statistically significant sample of weak interstellar atomic lines of iron, potassium and neutral calcium. Their intensity is weak, so equivalent width stays in proportions with column density. With this information we can calculate abundance of this atoms in interstellar clouds and check if there is any correlation between them.

Stellar Spectroscopy Methods for Study of Supernova Remnants

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Vela Jr. is one of the youngest and likely nearest among the known galactic supernova remnants (SNRs). It was detected in X-rays, the ^{44}Ti γ-line, and radio. We obtain and analyze medium resolution spectra of 14 stars in the direction towards the SNR Vela Jr. in an attempt to detect broad absorption lines of unshocked ejecta against background stars. Spectral synthesis is performed for all the stars in the wavelength range of 3740-4020 Å to extract the broad absorption lines of Ca II related with Vela Jr. SNR. We do not detect any broad absorptions and set a 3σ upper limit on the relative depths of <0.01 for the broad Ca II absorption produced by the SNR. We detect narrow low and high velocity absorption components of Ca II. High velocity $|V_{LSR}| \sim 100 - 140$ km/s components are attributed to radiative shocks in clouds engulfed by the old Vela SNR. The upper limit of absorption line strength combined with the width and flux of the ^{44}Ti γ-ray line 1.16 MeV lead us to conclude that SNR Vela Jr. was probably originated from an energetic SN Ic explosion.

Mapping of Class I Methanol Emission in the Environment of Masers Identified with SNR and Discovery of New Masers

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The new program of study of the interstellar medium is formulating: invited to begin a systematic search for class I methanol maser emission, in which the collision is the dominant pumping mechanism, in the direction of SNRs. The idea is based on the fact that the OH maser emission at the frequency of 1720 MHz, that is also due by the collisional pumping, is an obvious sign of the interaction of SNRs with molecular clouds, and the search for methanol emission towards SNRs specifically has never been conducted. A proposal for observations at 20-m radio telescope in Onsala (Sweden) has been constructed, which was supported by the program committee of the Observatory. In December 2009 mapping of the methanol maser was conducted, which is formed in the vicinity of a supernova G27.4-0.16. At the frequency of 44 GHz this maser was observed for the first time. In addition, simultaneously was conducted the survey of the regions of massive-star formation, a number of new masers were discovered. The results of observations are discussed in this report.

Observational Signatures of Relativistic Shock Break-Out at the Surface of Hypernova

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The hydrodynamics and observational signatures of a relativistic shock break-out at the surface of Hypernova are investigated. The characteristics of hydrodynamically accelerated external layers of star are considered. The interaction of accelerated particles with the particles of circumstellar medium is calculated.

Kinematics and Structure of Gas in Star-Formation Regions: Supernovae and Stellar Wind

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According to modern investigations, Irr galaxy is optimal for studying the structure and kinematics of interstellar medium in star-formation regions. In my talk I present the results of the observations of star-formation regions in two irregular galaxies.

Redetermination of the Oxygen Abundance in Orion Nebula

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The electron temperatures and densities followed by ionic abundances derivation were obtained using emission lines diagnostic method DIAGN on the base of Orion Nebula observed spectra from 12 apperture positions. The Lyman continuum spectra of the ionizing sources were obtained using method NLEHII on the base of diagnostics result and observed spectra. These data were used for photoionization models grid calculation for each of Orion Nebula observed part. The grid free parameters were the ionization parameter and the heavy elements abundance. The new calibration relationships between $12 + \log \mathrm{O/H}$ and $\log R_{23}$ parameter were obtained from grid calculation results. The comparative analysis of the above obtained calibration with previous ones results from other authors was done.

Multicomponent Photoionization Modelling of Envelopes with Complicated Structure of Stellar Wind Bubble Surrounding Sturburst Region

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Photoionization modelling method of HII regions around starburst was developed by complicated structure of stellar wind cavity obtained in Weaver et al. (1977). Input spectrum of ionizing radiation was obtained from sturburst model with parameters typical for blue compact dwarf galaxies. The first and second inner components of such modelling correspond to the supersonic stellar wind zone and the region of shocked stellar wind correspondingly. The gas density distribution in these components is derived from bubble structure obtained from system of equation of continuity and energy transfer including heat conductivity. The third component is a thin envelope of high density gas, compressed by superwind shockwave. The gas density in this component was obtained from isobaric condition at contact discontinuity between second and third components. It changes the energy distribution of ionizing radiation and gives a gap in wavelength range $\lambda 912 - 504$ Å. The fourth component represents "ordinary" HII region with power-law gas density distribution. The evolution grid of multicomponent photoionization models at different thickness of third component was calculated. The sensitivity of important diagnostic ratios between emission line intensities to the bubble presence into HII region (fourth component) was investigated.

Morphological Study of Cometary Nebulas

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In 50-s of XX century V. Ambartsumian showed in his works that cometary nebulas genetically associated with their core-stars. Further works done in this field shown that the most of morphological peculiarity of cometary nebulas are related to the dust-disc surrounded the core-star, because of this effect the Hubble's low disturb. Big velocities there show that there is a material massive outflow from the star. In 1980s at the first time by the group of Mundt optically outflows were discovered. This work is presented morphological study of the four cometary nebulas & also the mathematical model for demonstration morphological peculiarity of some cometary nebulas.

SOLAR PHYSICS

The Slow Mode Oscillations of Solar Coronal Loops

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Maganetohydrodynamic(MHD) waves, their propagation and damping are one of the beast models to explain solar corona heating. There is strong evidence for slow magneto acoustic modes in the solar corona. This modes are useful for extracting information about solar coronal structure. In this paper we investigated the standing slow modes of solar corona loops with low beta plasma. We studied the influence of stratification and non-adiabatic process on periods, their ratio and mode profiles. In zeroth order of correction we reduced MHD equations to a Klein-Gordon equation for possible motion of oscillations and argument with Ewan et. al (2006) and we have shown that in first order correction frequencies are imaginary (damping of oscillations). The departure from those of the homogeneous corona loops and adiabatic process can be used as a seismological tool to estimate solar corona parameter.

Frequency Drift Rate of Powerful Decameter Type III Bursts

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We report on the observations of powerful (fluxes are larger than 10^{-19} W m^{-2} Hz^{-1} solar Type III bursts at frequencies $10-30$ MHz. Recordings of 163 bursts, observed in July 2002 and of 231 bursts observed in August 2002 are investigated. The main properties of these Type III bursts are analyzed – frequency drift rate, duration, flux, frequency bandwidth. In present report we pay more attention to consideration of frequency drift rate. A great difference between the observed and the well-known empirical frequency dependences of Type III bursts drift rate is determined. A linear approximation for the drift rate versus frequency is found. It says that corona is exponential. We consider that drift rate is depending on the position of an active region on the solar disc.

Magnetic Fields Evolution in the Weak Solar Flares

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The magnetic fields of C-class solar flares have been discovered. Three flares of 25.07.1991, 18.07.2000, 28.07.2004 were investigated using photospheric and chromospheric lines, namely Fe 6301.5, Fe 6302.5, FeI 5250.2, FeI 5250.6, FeI 5247.1, Cr 5247.6, Cr I-22 433.945, VI 434.1013, Ti I-32 434.1369, HI 656.282, Hγ 434.047, D1Na 589.5923, D2Na 588.9953. All these line form on different heights in the solar atmosphere, that allows to determine vertical

magnetic field B distribution. The similar data could not be obtained from observations like SOHO (MDI). Besides, magnetic field evolution can be studied using our spectral data.

The synchronous magnetic field changes and Hα emission variations were found simultaneously. This effect was found firstly for weak flares of C-class. The sign-changing gradient of magnetic field has been obtained. In particular, magnetic field comparison in Hα, D1, D2 and FeI has shown that B(Hα)$\approx$B(D2)$<$B(D1) and B(D1)$>$B(FeI). This is direct evidence to non-monotonous vertical magnetic field gradient in area of flare and extraordinary situation for solar atmosphere with monotonous decreasing of pressure. Also, convincing evidences of existence of the strong kilogauss spatial unresolved magnetic field has been found by data comparison in FeI lines with different Lande factors.

Structure of the Convective Flows of Real Solar Granulation

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The physical conditions within the inhomogeneous solar atmosphere have been reconstructed by solving the non-equilibrium inverse radiative transfer problem using neutral Fe line $\lambda \approx 523,4$ nm profiles. Acoustic and gravity waves were removed by $k-\omega$ filtration.

The temperature and velocity fields within granular cells have been studied: the temperature maximum and the velocity one do not always coincide. The velocity distribution within the granules depends on the granular size: in smaller structures the maxima of velocities are located close to the granular barycentre whereas for larger granules the maxima are shifted towards the granular boundaries. The asymmetry in the distribution of temperature is also possible.

We found different types of formation (evolution of a small granule, fragmentation of a large granule and merging of smaller granules) and disappearance (fading into the background, merging a neighbouring granule or fragmentation) of granular cells.

Also the effect of finite resolution on spatial variations of the velocities and temperature in the solar photosphere has been estimated. The observed asymmetry of the velocity and temperature distribution within convective structures is due to thin structure of convective flows on the one hand and the spatial smearing on the other one.

Determination of the Chromospheric and Photospheric Matter Motion Velocity during a Solar Flare

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The solar flare on 5 June 1979 is investigated in this research work. The Fraunhofer spectra are used to study the line-of-sight velocity in the chromospheric and photospheric layers during the flare. The strong temporal variations of the velocity are revealed.

Intriguing Zeeman Splitting of FeI 6094.419 Line in a Sunspot: Violation of LS-Coupling or Superstrong Magnetic Fields?

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We present an analysis of spectral observations carried out on echelle spectrograph of Astronomical observatory of Taras Shevchenko National University of Kyiv. A great sunspot of 25 March 1991 of S polarity with magnetic field strength of 2500 G measured in FeI 5250.2 line was observed. Spectra were obtained with circular polarization analyzer. Our interest was focused on FeI 6093.66 and FeI 6094.419 with different Lande factors g, namely 0.33 and -0.22, respectively. Notice, these values of g correspond to case of LS coupling. Both lines have close heights of formation in atmosphere and temperature sensitivity. Surprisingly, it was shown that both lines have Zeeman splitting of the same sign of Stokes V parameter. We can point three possible causes of this effect: (a) violation of LS coupling; (b) different magnetic polarity on levels of formation of these lines, i.e. S polarity for FeI 6093.66 and N polarity for FeI 6094.419; (c) very strong ($\sim 10^5$ G) magnetic fields origing the Pashen-Back effect. We plan to discuss these hypothesis during our presentation.

Magnetic Field in a Solar Prominence Measured in D3 HeI Line

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The available data on magnetic fields in prominences are contradictory and fewness. The values of magnetic field in prominences are very different by different authors – from one-several tens gauss (G) to kilogauss. The low limit of this dispersion agrees with theoretic estimation for homogeneous untwisted magnetic tube, which is submerged in rare solar corona. As to possible kG fields, they could occur in any specific structures like twisted force-free configurations. At present this interesting problem is unsolved and needs an additional study.

In this work we investigate the 12 July 2004 prominence. Its spectrum was photographed with exposition 1 min (starting with 8:48:50 UT) on the echelle spectrograph of Kyiv University Astronomical Observatory. This instrument can record the solar spectrum simultaneously from 3800 to 6600Å with a spectral resolution of nearly 40 mÅ in the D3 region and with a temporal resolution of about several seconds for observations related to solar disk. All spectra were made with ORWO WP3 photoemulsion. The analyze of Stokes I±V profiles shows that splitting of bisectors are different on the various distances from line's center. As a rule, the bisectors have maximum splitting at the line's core, and minimum – at far line wings. This products specific "V-effect" in shape of bisectors; its value was found various for line profiles on different distances from solar limb. The maximum splitting of bisectors correspond to magnetic field of 400–600 G, although splitting of "center of gravity" of whole profiles correspond to field strength about 100 G. Likely, this indicates two- (or more) component magnetic field structure in horizontal direction. According to simulations, a simple two-component model is acceptable, with practically zero field in background component and 1.0–1.6 kG field in spatially unresolved magnetic tubes.

POSITIONAL ASTRONOMY AND ASTRONOMICAL EQUIPMENT

"Generalized" Method of the Phase Screen for Medium Inhomogeneities of Different Spatial Scale

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Radioastronomy and astrophysics often have problems connected to the radiation propagation in media with two spatial scales. This can be local inhomogeneity in the magnetosphere, ionosphere, solar corona or microlenses in the galaxy, pulsars in globular clusters etc. The analysis of radiation focusing, as a rule, is performed within the framework of a method of the phase screen. However, this approach causes considerable difficulty of accounting extensive medium in which there is local heterogeneity. In the present work, a generalization of the phase screen method for the medium with two spatial scales on the basis of Sobolev method was obtained. The results are used to analyze the focusing of radiation in the gravitational field of a star situated inside the gravitational field of a galaxy. In the present work, the solution on the basis of "generalized" method of the phase screen was obtained that allowed difference of focusing scales on separate regions of the path to be taken into account.

First Observations with a New Echelle Spectrograph QSI 532s+

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After purchasing the QSI 532s+ Scientific CCD camera for the Observatory in Piwnice,lots of testing images have been taken in order to establish basic parameters. This presentation is about how the new spectrograph performed during testing and if it met the manufacturer specifications. The next step was to find out how the CCD camera performed on the stars.

Automation of Telescope Time Scheduling

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A software for efficient scheduling of observations of asteroids at a given time moment has been developed to optimize the observational process at the telescope AZT-8 (Evpatoria) operating in automatic mode. The schedule of observations is calculated with the specific conditions of visibility of objects for the given telescope. The next conditions which correspond to astrometric observations of asteroids have been chosen to constrain scheduling at the given time moment: 1) observations of objects should be made as close as possible to the meridian; 2) observations should be made for the maximum number of objects. The software uses technical characteristics of the telescope and camera, ephemerides, calculated with the HORIZONS system, and a given SNR for each object for scheduling of observations. The theoretical extinction value, phase and position of the Moon relatively to the observational objects and horizon are also used for the calculation of exposure time. The algorithm schedules observations of photometric calibration fields. The result of algorithm depends on

a ratio number of the objects planned for observation to the maximum number of objects which can be observed at night, i.e. the algorithm will provide changes to the list of objects in dependence of the previous run (it is necessary to avoid a situation, when the algorithm systematically skips a certain class of objects all the time).

Lucky Image Performance Simulation on the Basis of Optical Turbulence Data Obtained on Shatjatmaz

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Lucky imaging is a method allowing to achieve diffractional resolution on a moderate ground-based telescopes at the cost of limiting magnitude. To adequately evaluate capabilities of this technique for a given place (Mt. Shatjatmaz) we performed a numerical simulation taking into account properties of optical turbulence measured on the site. For this purpose we have developed a Monte Carlo simulation code based on principles described in Lane et al, 1992; Baldwin et al, 2008. Turbulence data obtained with MASS/DIMM device on the site in 2007-2009 years was used as a basis for this simulation. Statistics of lucky imaging main characteristics – isoplanatic angle and optimal exposure was evaluated on the basis of this data. Optimal conditions for lucky imaging was derived. The necessity of dynamic planning of observation was shown.

Kyivgeodinamic++: Software Package for Processing Satellite Laser Ranging Date

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Modernized software package KG++ is presented. It is subjected to be used for processing SLR data with the purpose to derive Earth's rotation parameters, station coordinates, time and others model parameters. We present package history, methods and results of refactoring, first scientific result and discussion.

Determination of Reference Frames Deflections from Optical Observations of GNSS Satellites

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In summer seasons of 2007–2010 five sets of optical observations of GNSS satellites were taken at Terskol observatory. GPS and GLONASS satellites were photographed among stars during their crossing of celestial equator. Optical coordinates were determined and used as reference values for intercomparison of dynamical reference frame of GPS satellites against the dynamical reference frame of GLONASS satellites. Possible differences of two dynamical reference frames may cause additional errors during joint processing of GNSS satellites observations and should be taken into account.

The Equipment for Polarimetric Observations of Astronomical Objects

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The developments of polarimetric and spesctropolarymetric devices for astronomical observations are carried out in the Main Astronomical Observatory of NAS of Ukraine. We ca offer layouts of increased-efficiency astronomical spectropolarimeters: an onboard spectropolarimeter and a ground based spectropolarimeter.

The spectropolarimeter with low spectral resolution ($20-50$ elements in the spectrum) is develoved in MAO of NAS of Ukraine together with the Space Research Institute of Russian Academy of Sciences. The aim of device is spectral and polarimetric studies of planetary atmospheres and surfaces of atmosphereless bodies in the Solar system in the range $230-400$ nm.

The device is designed to equip the telescope T-40 installed on board the International Space Stations. The optical scheme of the device is compact. It has a minimum number of elements (a deformed Wollaston prism, a dispersing element and a focusing mirror). Tests of the laboratory model of the device were made.

The ground based spectrometer-polarimeter for spectral range $350-1050$ nm also was developed. The basic efforts in device designing have been directed on maintenance of its high efficiency in a wide spectral range. The developments of MAO NAS of Ukraine namely manufacturing techniques of superachromatic phase plates and designing of prism systems with quasi-linear dispersion have allowed to receive efficiency of the device in a range $350-1050$ nm close to theoretically possible.

The optical layout of the instrument was made under a traditional scheme with a collimator, a disperse block, a chamber objective and it has a minimum quantity of free surfaces that provides cleanliness of a spectrum and minimizes regular errors of measurements. The first observations using the spectrometer-polarimeter established on a telescope AZT-2 (MAO NASU) were performed and the spectra of Saturn were received.

Using General Purpose Graphical Processing Units for Applications in Astronomy and Astrophysics

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Due to high demand of the commercial sector, Graphical Processing Units (GPUs) that drive state-of-the-art graphical accelerators have become more advanced than regular CPUs for certain applications. Graphical processors are highly optimized for calculations in 2D and 3D environments in which a single instruction has to be repeated for a large number of data points (e.g. pixels). Although hardware differences from general CPU architecture and massively parallel operation make them superior in terms of speed, the new programming paradigm is not yet well know and exploited in science applications. We present our first Graphical Processing Unit (GPU) applications for general use in astronomy and astrophysics based on the Compute Unified Device Architecture (CUDA), a programming engine published by NVIDIA. The applications were extensively tested, benchmarked and used for example astronomical problems on our experimental CPU-GPU cluster in order to demonstrate their capabilities. The cluster was constructed recently at the Physics Department of the University of Split and consists of 16 NVIDIA Tesla S1070 GPUs.

Determination of the Sky Background in Kiev with Digital Camera Canon 350D

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The results of the background sky photometry in Kiev are presented. The observations were made with a budget camera Canon 350D. Camera enables to get images of the stars with glittering to 7.3m. Photometric method of images processing allows to do photometry with accuracy ∼0.05m. The transition from the laboratory system RGB to the standard astronomical system BVR is realized. During the images processing the value of the background sky in Kyiv was obtained which is 17m, and compared with images from Boguslav, where the sky background is 20m. The results show that the usage of the budget camera Canon 350D allows to get the exact value of the photometric observations, to explore the bright celestial bodies. While further work the photometry of some variable stars and exploration of the background sky brightness changes with time are planned.

Creation IR Database

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This paper considers the problem of improvement of positions IR catalogues by identifications them with their optical counterparts from contemporary precise catalogues. On the base of such identification the IR Reference Catalogue contained precise position and proper motions may be compiled.

SPACE GEOPHYSICS & PHYSICS OF THE NEAR SPACE

Main Ionospheric Trough – Dynamic Structures of Ionospere

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Main ionospheric trough is a region of big importance in science of ionosphere itself. A lot of very interesting physical processes take place here. These concern plasma convection, ion chemistry, plasma drifts, wave particle interaction, etc. The aim of this presentation is to show the large scales structures and dynamic of main ionospheric trough. Our investigations are based on data gathered on board of low orbiting satellite DEMETER and data registered by the system of GPS satellite. In order to have insight into global ionospheric instabilities and time evolution of troughs global maps of in situ plasma parameters and TEC value were constructed. These can be used for future studies of several aspects of near Earth environment and for application purposes, as well.

Observation of the Location of CMEs Associated with ∼30–100 MeV SEP Events

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We analyzed 25 Solar Energetic Particle (SEP) events, with energies $\sim 30-100$ MeV, observed with the Energetic and Relativistic Nuclei and Electron instrument (ERNE) onboard Solar and Heliospheric Observatory (SOHO) and found that all of the SEPs were associated with Coronal Mass Ejections CMEs, Observed with LASCO/SOHO. The observation data suggests that the associated CME located at $\sim 18-53$ solar radii from the onset till the maximum intensity of the low energy events < 30 MeV, and at $\sim 6-28$ solar radii of the high energy events > 30 MeV.

Modes' Concurrence in Transversely Restricted Electron Beam Injected into Homogeneous Plasma

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Dynamics of the modulated electron beam in plasma is of interest in electron beams' usage as emitters of electromagnetic waves in ionosphere, transillumination of the plasma barriers for electromagnetic waves using electron beams, inhomogeneous plasma diagnostics via transition radiation of electron beams and electron bunches etc. Main objective of this investigation is to study dynamics of transversely restricted modulated electron beam into homogeneous supercritical plasma via computer simulation using PIC method. 2D-simulation of transversely restricted beam's dynamics demonstrated the concurrence between non-resonant beam-plasma instability on a modulation frequency and resonant instability on the Langmuir

frequency of background plasma (as it was observed earlier in 1D simulation). Modes' concurrence completed by trapping of the beam electrons by resonant mode and suppression of the signal mode on modulation frequency. These findings correspond to laboratory experiments' results. In comparison with 1D simulation new effects were obtained such as beam's swelling in transversal direction caused by its uncompensated electric charge and beam's transversal filamentation.

Longitudinal Acceleration of Plasma Electrons during the Beam-Plasma Interaction

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Interaction of electron beams with plasma is one of the most interesting problems of plasma physics. Interest to this problem is caused particularly by various instabilities excited in the beam-plasma systems. The aim of this work is to study the longitudinal acceleration of plasma electrons under the influence of impulse, transmitted by the electron beam during it's deceleration in plasma, i.e., the collective acceleration of plasma electrons in the direction of electron beam motion. The uncompensated positive charge of plasma ions keeps back plasma electrons and causes the formation of the spatial electric field. The estimation of this field's value has been carried out. The flow of plasma electrons induced by electron beam was found out via computer simulation using the modified PDP1 code. It was shown that total average velocity of the plasma electrons without electron beam was nearly zero during the simulation time, so there was no ordered motion of plasma electrons. But the average velocity of plasma electrons in the presence of the electron beam is substantially non-zero, so there is the flow of plasma electrons, caused by the impulse of the electron beam.

Morphology Structure of Atmosphere Gravity Waves According to the in Situ Satellite Measurements

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This work deals with investigation of acoustic gravity waves (AGW) using in situ data measured by the Dynamics Explorer 2 satellite. The analysis of neutral atmosphere species concentration at the altitudes 250-500 km demonstrated evident signatures of AGW formation. The global distribution of AGW appeared to be pattern-like. Its morphological form was also described. Such a distribution is characterized by local wave forms at low altitudes, which appear as islands on the background of the latitudinal AGW distribution. Possible relation between observed perturbations of upper atmosphere and surface cataclysms (such as hurricanes and earthquakes) was analyzed.

Predictions of Space Debris

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Since 1957, when the first russian satellite Sputnik was launched, the intense exploration of space brought about new problems. There are thousands of remnants of satellites or launch rockets circulating over our heads. Monitoring of space debris is crucial for space crash prevention. Collisions with defunctional satellites or other space debris is a serious threat to running missions. We propagate satellite orbits using SGP4 programme. We will show how the program can be maintained and applied to space debris monitoring. We will present sample results obtained for the chineese Fengyun satellite debris.

The Secondary Radiation of the Earth Ionosphere

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In the paper we analyzed the radio waves emitted by the Earth's ionosphere at frequency of 40 kHz. In our research we used the radio telescope "KLAUDIA". It consists of the long-wire antenna, the high-frequency ground module, the VLF modernized receiver and the PC computers. In the paper we detail discussed the modernization of the VLF receiver and the structure of the high-frequency ground module.

Numerical Modeling of the Magnetosphere with Data Based Internal Magnetic Field and Arbitrary Magnetopause

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We present a new global model of the magnetospheric magnetic field. Using the finite element method, Chapman-Ferraro problem is solved numerically in the considered approach. The whole magnetic field is a sum of: the dipole field, the field, produced by the internal current systems (cross-tail, Birkeland, ring currents) and the field, due to the magnetopause currents. In contrast to similar earlier models, the internal magnetospheric magnetic fields are taken from Tsyganenko data-based model. The magnetosphere boundary could be arbitrary (generally non-axisymmetric). Input model parameters are the solar wind parameters, the Dst index and the dipole tilt angle. We discuss some results, obtained in the three dimensional solution of the Neumann-Dirichlet problem, corresponding to the closed magnetosphere.

Nonlinear Anticyclone Structures in the Earth Atmosphere

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We propose the study of the nonlinear vortex formation in the Earth's atmosphere known as a blocking-anticyclone. It is shown that synoptic-scale structure can be considered in the geostrophic approximation in terms of the equation Charney-Obukhov. The numerical scheme based on the total reduction method is proposed for study dynamics of the initial

perturbations. The dominant role of the vector nonlinearity for the vortex structures stability is shown. In the absence of the nonlinearity vortex structure are unstable and quickly decompose to the linear Rossby waves.

The differences between linear and nonlinear anticyclone structures were studied basing on the data from Atmospheric Research NCEP / NCAR (pressure, geopotential, temperature, wind velocity). Blocking-anticyclones exist during a long time (typical lifetime is from 5 days to a month), while linear anticyclone exist a few days (up to 5 days). Blocking-anticyclones can stay for a long time on same place. Conventional synoptic anticyclone usually move eastward but blocking-anticyclones usually moving westward. It was also found that blocking-anticyclones have larger amplitude of temperature and pressure perturbation, so the impact of the blocking-anticyclone on the formation of weather is greater.

Dynamic Magnetic Structures near the Quasi-Parallel Earth Bow Shock

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Collisionless plasma shock waves with quasi-parallel geometries, for which the average magnetic field direction upstream of shocks is close to the shocks normal reveal temporally varying characteristics with magnetic structures convecting in a solar wind plasma flow. These results can be considered if the shock can be viewed as an extended region containing three-dimensional Short Large Amplitude Magnetic Structures (SLAMS) which represent individual semi-cycles of the ambient upstream low frequency waves associated with diffuse ions in the ULF foreshock. As SLAMS convect with the flow they grow to large amplitudes and entrain inter-SLAM region to form inhomogeneous down stream state. We have conducted a detailed analysis of a set of such events observed near the quasi-parallel bow shock by THEMIS satellites during 2007. Spacecraft configuration and the solar wind condition were favorable for the case study presented here. Multi spacecraft measurements allow evaluating of the spatial and temporal characteristics of the observed magnetic structures.

Coronal Mass Ejections Dynamics on the Small Heliocentric Distances

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Coronal mass ejections (CMEs) are large-scale outbursts from the solar corona that propel typically $2 \cdot 10^{16}$ g of material into the interplanetary space at large speeds. CME-driven shocks can form in the low corona ($\sim 1.5 R_{\odot}$ from the center of the Sun) and propagate far into interplanetary space. CMEs evolve as they propagate outward from the Sun. They interact with and eventually equilibrate with the ambient solar wind. Our study is based on the data captured onboard SOHO and STEREO spacecraft by SECCHI (STEREO) and LASCO (SOHO) instruments. Three points measurement allows evaluation of the CMEs kinematical parameters such as velocity vector, acceleration vector and spatial scale dynamics.

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