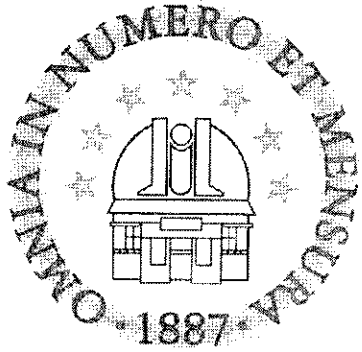
NATIONAL CONFERENCE OF XVII ASTRONOMERS OF SERBIA

XVII National Conference of Astronomers of Serbia

Belgrade, 23 - 27 September 2014

BOOK OF ABSTRACTS

Eds. S. Šegań, S. Ninković, A. Kovačević and B. Novaković



Faculty of Mathematics

Astronomical Observatory

Belgrade 2014

XVII NATIONAL CONFERENCE OF ASTRONOMERS OF SERBIA

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Invited Reviews

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Faculty of Mathematics and Astronomical Observatory, Belgrade, 2014

Invited Review

OBSERVING AND MODELING THE DUST IN NEARBY GALAXIES

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Dust grains are a crucial ingredient in the interstellar medium of galaxies. They are efficient at absorbing and scattering UV through NIR photons and then reradiating the absorbed energy in the infrared and submm wavelength range. The Herschel Space Observatory, operational between 2009 and 2013, has revolutionized our view on dust in nearby galaxies. I will review some of the spectacular results obtained with Herschel, with a particular focus on surveys of the Andromeda galaxy, the Virgo Cluster and samples of nearby galaxies. But infrared observations alone are not sufficient to understand the complex interplay between stars and dust; this requires 3D dust radiative transfer calculations. We have developed SKIRT, an efficient 3D Monte Carlo code designed to treat continuum radiative transfer problems in dusty systems. I will present a number of recent applications of the SKIRT code on different classes of dusty galaxies. We compare the infrared/submm fluxes predicted by our models to the actual values observed with Herschel. The implications of these findings on the dust energy balance, obscured star formation and the dominant heating sources of dust in nearby galaxies are discussed.

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Invited Review

PARTICLE ACCELERATION BY SHOCKS

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Astrophysical particle acceleration occurs on scales ranging from the heliosphere to clusters of galaxies. Particles can reach extreme energies measured in EeV. A number of different acceleration processes are possible but diffusive shock acceleration is widely invoked as the predominant mechanism. It operates on all these scales and probably to the highest energies. It is simple, robust and predicts a universal spectrum. However there are many unknowns and partial unknowns, especially regarding how acceleration operates in specific astrophysical contexts. Important questions are: what determines the maximum cosmic ray energy, how efficient is the acceleration, why does the observed spectrum not always match that predicted, how do cosmic rays escape the acceleration site, are protons accelerated beyond a few PeV in the Galaxy, what is the source of EeV cosmic rays, what is the balance between electron, proton and heavy ion acceleration? In this review I will show that the answers to these questions depend in large part on the detailed physics of diffusive shock acceleration. Much progress has been made in the past decade in confronting theory with observation and we now stand on the threshold of answering some of the most important questions.

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Invited Review

DARK ENERGY AND DARK MATTER AS CURVATURE EFFECTS

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Extended Gravity models have recently attracted a lot of interest as alternative candidates to explain the observed cosmic acceleration, the flatness of the rotation curves of spiral galaxies, the gravitational potential of galaxy clusters, and other relevant astrophysical phenomena. Very likely, what we call dark matter and dark energy are nothing else but signals of the breakdown of General Relativity at large scales and could be interpreted as a sort of curvature effect. Furthermore, PPN-parameters deduced from Solar System experiments and strong field astrophysical phenomena (compact objects, magnetars and neutron stars) do not exclude the possibility that such theories could give other observable effects. We review these results giving the basic ingredients of such an approach.

Invited Review

QUIET SUN MAGNETIC FIELDS

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The Sun is the first astrophysical object where magnetic fields have been detected and measured. As our closest star it offers to us the possibility of studying a case of stellar magnetism with great details. Its complex magnetic structuring has been explored with increasing spatial and temporal resolution, in particular recently from space born instruments such as SOT on the Hinode satellite, HMI on SDO or IMAX on SUNRISE, and from ground-based telescopes such as Themis. On the side of theory and modeling, more and more realistic 3D magneto-hydrodynamical models of the solar photosphere are now being developped. I will focus on the quiet Sun and show how these new data have led us to a significant change of paradigm about its magnetic structuring.

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Invited Review

GEOPHYSICAL FLUIDS, GEOMAGNETIC JERKS, AND THEIR IMPACT ON EARTH ORIENTATION

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Geophysical fluids (atmosphere, oceans, and to some extent also underground water) have significant impact on Earth orientation parameters. Dominant is the excitation of polar motion and speed of rotation, much smaller but now measurable influence can be found also in precession/nutation. Recently Zinovy Malkin (2013) found a correlation between the observed changes of Free Core Nutation parameters (phase, amplitude) and geomagnetic jerks (rapid changes of the secular variations of geomagnetic field). In our recent study (Vondrák and Ron 2014) we tested this hypothesis and found that if the numerical integration of Brzezinski broad-band Liouville equations (Brzezinski 1994) of atmospheric/oceanic excitations is re-initialized at the epochs close to geomagnetic jerks, the agreement between the integrated and observed celestial pole offsets is improved significantly. This approach tacitly assumes that the influence of geomagnetic jerks has a stepwise character, which is physically not acceptable. Therefore we introduce a simple continuous excitation function (having a double ramp shape), centered at the epochs of geomagnetic jerks, and estimate its amplitude to fit best the integrated pole positions to its observed positions. The combined results of numerical integration of atmospheric/oceanic excitations plus this newly introduced excitation are then compared with the observed celestial pole offsets. The comparison shows that this approach improves the agreement between the two time series significantly.

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Invited Lectures

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Invited Lecture

SHIFTS IN SCIENTIFIC PARADIGMAS, A KHUNIAN APPROACH, CASE STUDY: COPERNICUS VERSUS BRAHE

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When, in late 15th and 16th century the debate between different wievs on cosmogonia became open and apparent, the scientific arguments, despite nowadays belief, where in favour of Brahe school. Why and how?

Invited Lecture

CONDENSED MATTER PHYSICS AND IMPACT CRATER FORMATION

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Impact craters are a consequence of impacts of small bodies in the surfaces of the Earth, many satelllites and a number of asteroids. They are usually analyzed within a theory based on dimensional analysis [1]. The same problem can be addressed by using basic principles of condensed matter physics [2], [3], [4]. The aim of this lecture is to compare the two approaches and point out the possibilities for further work.

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Invited Lecture

SETI AND THE ARGUMENT FROM BIOLOGICAL CONTINGENCY

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The famous argument against likelihood of success of the Search for ExtraTerrestrial Intelligence (SETI) projects was given by George G. Simpson in 1961. Hereby, I revisit the argument and demonstrate how the advances made in both modern evolutionary biology and astrobiology tend to undermine its validity. While there are some ways to strengthen the argument as well, excessive scepticism vis-a-vis extraterrestrial intelligence based on our present biological knowledge is not warranted.

Invited Lecture

STARK BROADENING IN ASTROPHYSICS

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Significance for astrophysical plasma research and modelling of broadening of spectral lines by collisions with charged particles, or Stark broadening, is considered and analyzed here, as well as the corresponding applications of Stark broadening data. This line broadening mechanism is particularly of interest e.g. for the research of white dwarfs and hot stars of A and B type, and for the analysis and synthesis of their spectra. For example, a large number of data is needed for calculations of stellar opacities and modeling and investigation of stellar atmospheres. Data on Stark broadening of spectral lines are also important for diagnostics and research of laboratory, fusion, laser produced and technological plasmas.

Also, we will review and consider the results of Stark broadening research of astrophysical plasmas and spectra in Serbia, as well as investigations of interest for astrophysics and relevant to astrophysical problems. Additionally, organization of Stark broadening data in STARK-B database and FP-7 VAMDC (Virtual Atomic and Molecular Data Center) European project will be discussed.

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Invited Lecture

SUPERNOVA REMNANTS IN MAGELLANIC CLOUDS

M. Filipović

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This is an exciting time for the discovery of supernova remnants (SNRs) in galaxies other than our Milky Way. To date, some 85 SNRs in the MCs are well established with other 20 waiting for confirmation. I will review recent searches for SNRs in the Magellanic Clouds including our present state of knowledge of their comparative properties.

Invited Lecture

ASTRONOMY AND MYTHOLOGY

P. Grujić

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Astronomy has always been closely linked with mythology and religion. In this talk we shall present a number of examples, some of them being the results of the recent investigations. We shall especially consider Egyptian resources, like the connection between Pleiades and Bible.

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Invited Lecture

LOCALIZATION OF STABLE-UNSTABLE MANIFOLDS WITH FAST LYAPUNOV INDICATORS AND APPLICATIONS TO THE THREE BODY PROBLEM

M. Guzzo

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In the last decade the Fast Lyapunov Indicators have been used for the numerical localization of resonances in several problems of Solar System Dynamics. After a description of the method in its generality, I will present new developments and an application to several critical problems, including the detection of the so-called tube manifolds of the Lyapunov orbits of the Lagrangian equilibrium points L1, L2 in the planar circular restricted three-body problem.

Invited Lecture

EMISSION LINES AND INVESTIGATIONS OF THE CENTER OF ACTIVE GALACTIC NUCLEI

D. Ilić

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Active galactic nuclei (AGN) are hosting a super-massive black hole (SMBH) in their center, that is actively fueled by surrounding gas through an accretion disk that produces different physical processes. These give the powerful broad band continuum emission together with the prominent emission lines. Sometimes AGN contain emission lines that are very broad (line widths of several 10,000 km/s) and often show very complex and variable line profiles. Here we will summarize some tools and techniques for studying the properties of the SMBH and the geometry and physics of the surrounding gas using the broad emission lines properties and their variability.

Invited Lecture

LSST AND SERBIAN SCIENCE

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We will briefly review characteristics and current status of the Large Synoptic Survey Telescope. Its influence to astronomy, physics, informatics, dark mater and dark energy science will be discussed. A group of Serbian astronomers formally joined the LSST project in November 2013. Our contribution to the project is building a simulator of a stream of alerts AlertSim. It will be used in commissioning and early operation phase of the survey. We expect many exciting developments in the next twenty years, influencing not only astronomy but physics, informatics and Big Data science in general.

Invited Lecture

CENTRAL SUPERMASSIVE BLACK HOLE OF THE MILKY WAY

P. Jovanović

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An overview of some important aspects of the supermassive black hole at the Galactic Center, such as evidences for its existence, its main features, effects on stellar kinematics, gas dynamics and distributions of dark and visible matter in its neighborhood, is given here. The possibilities to use the observations of these phenomena as a tool for testing some of the predictions of General relativity and alternative theories of gravity in such extreme conditions is also considered, and some of our recently obtained results in this field are presented. Besides, the influence of the central supermassive black hole on the evolution of the Milky Way is discussed, as well as whether it could trigger the activity of our Galaxy in the future, by starting to accrete the surrounding matter with much higher rate. Taking into account that the Milky Way is on a collision course with M31 Andromeda galaxy, and that their central supermassive black holes will become gravitationally bound and form a binary system of these objects at some stage in the evolution of the resulting merger, some properties and possible consequences of this supermassive black hole binary are also considered here.

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Invited Lecture

IBSE – METHOD IN ASTRONOMY TEACHING

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The objective of the present talk concerns modern methods in astronomy teaching at the levels lower than university. The method known as IBSE (Inquiry-Based Science Education) is very modern and as such it deserves a copious presentation. It involves experiment, research, independent work, critical thinking, analysis of results and forming conclusions based on it, as well as a written report. Its application at the secondary-school level has been tested. The result of the test is that the IBSE method compared to the classical ones causes that both the quantity and retention of knowledge among pupils are higher.

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Invited Lecture

LITHIUM IN SMALL MAGELLANIC CLOUD: IMPLICATIONS FOR NEW PHYSICS?

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One of the main tests of the standard hot Big Bang model comes from predictions of abundances of primordial element, which have been synthesized during the epoch of the Big Bang nucleosynthesis. Though there is a general agreement, there is one more and more pressing disagreement that has not yet been resolved predicted primordial lithium abundance is about 4 times higher than what is observed in atmospheres of Milky Way halo stars at wide range of low metallicities. To test this issue lithium was observed in the interstellar medium in the Small Magellanic Cloud. The measured abundance was found to be barely consistent with the predicted primordial value, but only very little lithium was made in the cosmic-ray interactions. However, unlike the Milky Way, the Small Magellanic Cloud has suffered a significant tidal disruption due to close galactic fly-bys. We point out that in those cases, tidal shocks can give rise to a population of cosmic rays in addition to standard galactic cosmic rays accelerated in supernova shocks. We demonstrate that significant amount of lithium can be produced in such a scenario where a small galaxy is tidally disrupted in close galactic interactions. In the specific case of the Small Magellanic Cloud, this could potentially be sufficient to make its lithium abundance also inconsistent with the predicted primordial value, leaving the new physics as the only remaining solution to this discrepancy.

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Invited Lecture

THE BELISSIMA PROJECT

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We discuss the goals and achievements of BELISSIMA (BELgrade Initiative for Space Science, Instrumentation and Modelling in Astrophysics), the most ambitious infrastructural project currently active at the Astronomical Observatory of Belgrade (AOB). The FP7 REGPOT project BELISSIMA started in July 2010 and is extended to July 2015. The most important goals include the reinforcement of the AOB, purchase and installation of the 1.50-m class telescope, training of the AOB staff, public outreach, dissemination and promotional activities. The results of the local project ON 176021 (Visible and Invisible Matter in Nearby Galaxies: Theory and Observations) will also be discussed.

Invited Lecture

ACTIVITIES OF ASTRONOMICAL SOCIETY EUREKA IN PERIOD 2012–2014

Z. Tomić

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Astronomical Society Eureka in Kruševac is successfully promoting Astronomy since 2010. Since then it has organized and successfully implemented a number of activities in and around the city of Kruevac in order to animate young people to engage in science and enabling the wider population to be familiar with the night sky. It has successfully implemented a number of projects. This paper briefly describes the results in the field of promotion of astronomy that members of Eureka achieved within the specified period, where the emphasis will be placed on the description of the project "Sky for all", IASC 2013, International Observe the Moon Night, activities in the field of non-formal education and about project for construction of the city's astronomical observatory called "Sky is (not) the limit".

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Invited Lecture

ON THE DIFFERENT FORMS OF CONTINUUM RADIO SPECTRA OF SUPERNOVA REMNANTS: THEORETICAL FUNDAMENTALS

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In this lecture I briefly present the theoretical fundamentals of formation of the supernova remnant (SNR) continuum radio spectra. It represents necessary introduction for the main topic of the lecture: prediction of the different forms (linear or curved in log-log scale) of SNR radio spectra for both young and evolved SNRs. Also. all of these theoretically predicted forms of radio spectra are compared with real spectra obtained from observations. This analysis introduces some characteristic forms of the SNR radio spectra which can be used by radio observers to estimate age and evolutionary status of the new-detected Galactic and especially extragalactic SNRs.

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Contributed talks

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Contributed talk

ALERT SIMULATOR A SYSTEM FOR SIMULATING DETECTION OF TRANSIENT EVENTS ON LSST

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The Large Synoptic Survey Telescope will be a large ground-based optical telescope which will provide sky survey in unsurpassed details. One of the purposes will be time-domain astronomy and detection of transient events. In order to properly design the system, a simulation framework is required to optimize algorithms to large data volumes and frequent events. In this paper, Alert Simulator, the Serbian contribution to the project will be presented. Alert Simulator will be a software package that will simulate detection of transient events well in advance of first light. Its main goal will be to test the ability to detect and identify transients, test the performance as well as various failures or exceptional/extreme modes of operation, so appropriate design can be made.

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Contributed talk

ASTRONOMICAL SOCIETY "RUDJER BOŠKOVIĆ": 80 YEARS OF THE SOCIETY, 50 YEARS OF THE PUBLIC OBSERVATORY AND 45 YEARS OF THE PLANETARIUM

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Astronomical Society "Rudjer Bošković" is one of the oldest astronomical societies in Europe and the oldest one in the Balkans. It is founded in 1934, and the main goal is popularization of astronomy.

The Society is located in two buildings, Public Observatory and Planetarium. Both of them, as well as the society itself, celebrate jubilees in this year. The Society, 80 years, Public Observatory 50 years and Planetarium 45 years from founding.

In this paper, a brief history of the Society will be presented.

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Contributed talk

ADICT – ENGLISH-SERBIAN ASTRONOMICAL DICTIONARY

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ADICT is an interactive English-Serbian astronomical dictionary. The motivation for ADICT was a growing number of popular articles featuring mistranslated astronomical terms, as well as a lack of consensus on some terms among members of the academic community. ADICT has been developed following the principles of transparency, democracy and frequency of usage. While only professionals may contribute to its contents, ADICT is intended for professionals and non-professionals alike.

Contributed talk

ASTRONOMY EDUCATION IN SERBIA 2011-2014

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A triennial review is given on astronomy education in Serbia at all levels (primary and secondary schools, and all five state universities), on astronomy programmes of the Petnica Science Center, on the activities of amateur astronomical societies, and on the success of the Serbian team in the International Astronomy Olympiads.

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Contributed talk

TIME-SCALE AND ASTRONOMICAL FORCING OF SERBIAN LOESS-PALAEOSOL SEQUENCES

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The loess in Vojvodina region in Northern Serbia is regarded as one of the thickest and most complete palaeoclimate archives in Europe. Recent studies showed that loess in Vojvodina spans the last million years. Based on the interprofile correlation between two most important loess-palaeosol sequences Stari Slankamen and Titel Loess Plateau a synthetic profile was formed regarded as Stratotype Record of Serbian loess (SRSL). The synthetic profile has a total thickness of 62 m and is comprised of 10 loess layers intercalated with nine pedocomplexes. A new astronomically tuned age model is proposed based on correlating peak magnetic susceptibility (χ) responses with the timing of June perihelia. This target curve is derived from analysis of regional climate proxy responses during the last interglacial and independently dated last glacial-interglacial cycle of Serbian loess-palaeosol sequences. The use of a precession index target as the only tuning target presents the requirement of minimal tuning approach, which means that only the precession frequencies of the record will be manipulated.

Spectral and wavelet analysis of tuned magnetic susceptibility record reveal the presence of frequencies corresponding to 139 kyr, 94 kyr, 65 kyr and small amplitude cycles of 43 and 23 kyr in χ record. Spectral analysis of frequency dependent magnetic susceptibility (χfd) has spectral content concentrated around 100 kyr and 77 kyr, while higher frequency cycles are bellow significance level. There is a strong 245 kyr peak in spectral results of both χ and χfd record that needs additional attention.

Around 800 kyr in SRSLχ time scale and between 900 kyr and 600 kyr in SRSLχfd series the 100 kyr cycles become dominant, which could be identified as the period of

Mid Pleistocene Transition. This is the first record of this palaeoclimate transition in the Pannonian basin. The results presented in this study highlight the potential of Serbian loess-palaeosols sequences for investigation of detailed and long-term climate reconstruction over continental Eurasian extent.

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Contributed talk

CONSTRAINTS ON $f(R,\phi)$ (SANDERS-LIKE) GRAVITY POTENTIAL FROM ORBIT OF S2 STAR

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We investigate the possibility to explain theoretically the S2 star orbital precession around the massive object at the Galactic Centre using Extended Theories of Gravity [1], specifically $f(R,\phi)$ a Sanders-like [2] gravitational potential in total absence of dark matter. To this aim an analytic fourth-order theory of gravity, non-minimally coupled with a massive scalar field is considered. The interaction term is given by an analytic functions $f(R,\phi)$ where R is the Ricci scalar and ϕ is the scalar field. We simulated orbit of S2 star around the Galactic Centre in Sanders-like gravity potentials and compared it with NTT/VLT observations. We presented maps of reduced χ^2 over the $\{\alpha - m_\phi\}$ parameter space in the case of NTT/VLT observations. The approach we are proposing [3,4] seems reliable to constrain modified gravity models at astronomical level.

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Contributed talk

DISTRIBUTION OF RADIO SPECTRAL INDEX OVER THE LUPUS LOOP

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We use all-sky surveys at 408 and 1420 MHz with aim to investigate properties of the Galactic radio source Lupus Loop. We estimate the brightness temperature, surface brightness and radio spectral index of this supernova remnant using the method we have developed. The non-thermal nature of its radiation is confirmed, and also the distribution of spectral index over its area is given.

Contributed talk

ON MHD WAVE COUPLING BETWEEN TERRESTRIAL IONOSPHERE AND MAGNETOSPHERE

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We model the terrestrial ionosphere-magnetosphere system by a high plasma-β (low magnetic field) isothermal region separated by a horizontal boundary from a low plasma-β (strong magnetic field) domain above it. Perturbations induced by sudden impacts of the solar wind can generate MHD perturbations in the magnetosphere (the low plasma-β domain) that propagate downward and through the boundary into the ionosphere (the high plasma-β domain). Applying the VLF (very low frequency) technique, we are able to identify such hydrodynamic waves in the ionosphere by computation of characteristic oscillation spectra from amplitudes of reflected VLF radiowaves recorded in real time. As not all MHD waves can cross from the magnetosphere into the ionosphere, we present in this contribution the mathematical conditions required for MHD waves to enter the ionosphere and enable a magnetosphere-ionosphere coupling mechanism.

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Contributed talk

ASTROBIOLOGY AND RISK ANALYSIS: THE EXAMPLE OF SELF-SELECTION IN THE IMPACT CRATERING RECORD

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We consider a general issue of the relationship between contemporary astrobiology and risk analysis in cases of large risks to which planetary biospheres all over the Milky Way are susceptible. As a particular illustration of this, potentially quite fruitful, relationship we use the inference of impact risk from the cratering record and show that there are important selection effects acting to systematically bias our estimates. The effect of the "anthropic shadow" is discernible in the past record, leading to potentially harmful underestimate of the real risk.

Contributed talk

UTICAJ KORPUSKULARNOG ZRAČENJA SUNCA NA METEORSKI ROJ KVADRANTIDI U PERIODU 2005. - 2014.

Ž. Disterlo

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Analiziran je uticaj korpuskularnog zračenja Sunca na meteorski roj Kvadrantidi u periodu od 2005. do 2014. godine a na osnovu podataka dobijenih od telemetrijskog satelita SOHO (http://sohowww.nascom.nasa.gov) i (http://www.solen.info/solar). Radio-odjek meteora vršen je radio-teleskopom na frekvenciji 150MHz, a obrada signala računarskim softverom Radio-SkyPipe. Povećanje broja meteora u 2008. 2011. 2012. i 2013. je pod uticajem Sunčevih regiona-vulkana kada su oni bili u geoefektivnoj poziciji ka Zemlji zajedno sa uticajem koronarnih rupa koje su u geoefektivnoj poziciji ka Zemlji i jačini njihovih eksplozija. U dane maksimuma meteorskog roja pored povećanja broja meteora primećeno je i grupisanje meteora. Povećano grupisanje meteora ka maksimumu je brže, a sporije je opadanje broja meteora ka minimumu.

Contributed talk

THE LANGUAGE OF SKY

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The prehistoric man was much closer to the night sky than the modern people. We present a number of arhaeoastronomical sites from Europe, India and Australia. We discuss the recent observations concerning wall paintings In the Lascaux cave and their latest astronomical interpretations.

Contributed talk

CULTURES ACROSS THE UNIVERSE

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It is often proposed that people living in different cultural groups are brought up to perceive the world differently. The perception of celestial objects varies from culture to culture. Prehistoric cultures viewed the sky as the main leader of their life and they connected their fortune and daily life only with the universe. Until now this is preserved and reflected on the Oriental culture, especially on their breathing techniques, diet, self-training, cultivation, physical mobility, the ability to commune very subtly with nature. Consideration of the position of the earth in relation to the celestial bodies are often used in medicine, and until now it is used in the Indian culture, all this and much else has contributed to the great wisdom of the Eastern peoples, the wealth of their culture and man's place therein and in the Universe, their understanding of the mechanisms of regulation of his life activity and vital potentials are reflection of their culture. Here I prove that astronomy is the basis of cultures, and that national identities were shaped due to the nations special perception of celestial objects.

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Contributed talk

OBSERVATIONS OF EXTRASOLAR PLANETS FROM OBSERVATORY NIGHT HAWK IN BAČKA PALANKA

J. Grnja and J. Mravik

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In this paper we presented the results of photometric observations of extra solar planets from Observatory Night Hawk in Bačka Palanka, which were sent to ETD - Exoplanet Transit Database (Tresca database). In the period from 05. 03. 2012. to 08. 05. 2014. we sent a total of 102 observations of 48 transits.

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Contributed talk

COSMOLOGY OF NONLOCAL GRAVITY

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In this contribution we present a brief review of nonlocal gravity with its cosmological solutions. In particular, we pay special attention to two nonlocal models. We consider nonlocal gravity action without matter in the form

$$S = \int d^4x\sqrt{-g}\Big(\frac{R-2\Lambda}{16\pi G} + R^p\mathcal{F}(\Box)R\Big),$$

where $\mathcal{F}(\Box) = \sum_{n=0}^{\infty} f_n\Box^n$ is an analytic function of the d'Alembertian $\Box$ and $p = +1, -1$. We give some $a(t)$ nonsingular bounce cosmological solutions for the above two actions, see references (Biswas, Koivisto and Mazumdar 2010; Koshelev and Vernov 2012; Biswas, Mazumdar and Siegel 2006; Dimitrijević, *et al.* 2013a; Dimitrijević, *et al.* 2013b).

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Contributed talk

A STRUCTURAL RELATION BETWEEN PLANETARY DISTANCES AND ITS CONNECTION WITH PLANETARY DISTANCE LAWS

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First, the priority for a recently revived structural relation between planetary distances is established. The relation fits the observed distances reasonably well, although it is not sufficiently predictive.

However, the relation can be connected to the predictive planetary distance laws - both the well-known exponential law and some alternatives; relative merits of such 'laws' are briefly investigated. This connection is novel and is based on an interpretation of the structural relation as a partial difference equation. Generalisations and possible significance of the relation are discussed. The analysis is also applied to some extrasolar planetary systems.

Contributed talk

ON DECOUPLING CIVIL TIMEKEEPING FROM EARTH ROTATION

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During the recent 15 years intense efforts have been done in order to cease introducing leap second corrections in the UTC scale. Before, probably the final, decision at World Radiocommunication Conference in 2015, we discuss some aspects and consequences of such a UTC redefinition, to present our own viewpoint as well.

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Contributed talk

MASS ESTIMATION OF THE ELLIPTICAL GALAXY NGC 5846

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Determining the masses of early-type galaxies remains a challenging task, especially probing the masses of their outer halos. In this contribution we constrain the mass of the well-studied elliptical galaxy NGC 5846, the brightest galaxy in the group. The isolation of the NGC 5846 Group is what makes it favourable for using different "test-particles" as mass tracers. We use the "tracer mass estimator" (TME) method on several different families of tracers such as globular clusters (GCs), planetary nebulae (PNe) and dwarf galaxies, thus probing the total dynamical mass to much larger radii than by using stellar kinematics. The mass of NGC 5846 is also assessed from the X-ray observations of hot coronal gas and compared to the results obtained using the TME methodology.

Contributed talk

ASTEROID FAMILY CLASSIFICATION: PRESENT AND FUTURE

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Asteroid family classification has reached a certain maturity in terms of the methods and parameters used for the purpose, but it is still to a large extent subject to more or less arbitrary choices of criteria to identify families and their membership, and to assess the statistical significance of the results. Here, the present status is briefly reviewed and most important problems indicated. The future developments are discussed in terms of the recently proposed automated update of family classification aimed at achieving a stable classification which does not change for an extended period of time, but evolves in detail on a regular basis, that is with every increase of the catalog of asteroid proper elements.

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Contributed talk

CHALLENGES IN MASS-LOSS DETERMINATION FOR MASSIVE HOT STARS

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One of the most challenging problems in theory of winds of massive hot stars is the determination of reliable mass-loss rates. A major complication of mass-loss estimates comes from the fact that stellar winds are inhomogeneous and discordances between different mass-loss rate diagnostics were found. In this talk we will present our 3D Monte Carlo code which we developed in order to incorporate the 3D nature of the stellar wind clumping into radiative transfer calculations and investigate how different model parameters influence the resonance line formation. We will also show for several O-type supergiants how our detailed treatment of clumping, together with solar phosphorus abundance and moderate clumping factor, may resolve the discordance between the mass-loss rates derived from Hα and P V diagnostics, and establish some global properties of wind clumping.

Contributed talk

CONVERGENCE PROPERTIES OF THE FBILI METHOD FOR MULTI-LEVEL LINE TRANSFER

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We present the convergence properties of the iterative procedures that use the Forth-and-Back Implicit Lambda Iteration (FBILI) method and some of its variants when applied to the solution of multi-level non-LTE line formation problem.

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Contributed talk

COSMAS INDICOPLEUSTES AND HIS MODEL OF THE UNIVERSUM

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The Nestorian Christian monk Cosmas the Indicopleustes', wrote in the 6th centurynthe Christian Topography, a work through which he attempted to create a new system of geography and the representation of the World that would fit the information contained in the Holy Scripture. His work and life, and his model of the Universum, are considered here.

Contributed talk

ASTRONOMY FOR THE STUDENTS OF INFORMATICS

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We present a specific method for animating, motivating and teaching students of informatics on the classes of astronomy. This method includes the combination of theoretical basics of astronomy with already acquired knowledge of programming. Using the advantage that most of the students are interested in astronomical phenomena and informatics we have succeeded to direct them to combine these two disciplines to understand and visualize some of the most common astronomical problems and phenomena, e.g. coordinate transformations, time scales, parallax, eclipses, planetary systems, etc. We present several extraordinary students' works.

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Contributed talk

SUNČANI ČASOVNIK KAO MULTIDISCIPLINARNA NASTAVNA TEMA U PREDŠKOLSKOJ I ŠKOLSKOJ NASTAVI

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Sunčani časovnik je veoma korisna nastavna tema za podizanje učeničke motivacije, budjenje radoznalosti i promociju nauke. Njen poseban kvalitet u vaspitno-obrazovnom procesu je njena "očiglednost" i visok stepen korelacije sa raznovrsnim nastavnim sadržajima. U ovom radu predstavljamo teoriju i praksu za izradu tri tipa sunčanih časovnika: ekvatorijalnog, horizontalnog i analematskog. Izbor metoda i materijala za izradu može se prilagoditi nivou obrazovanja i uzrastu učenika. U tom cilju u radu izlažemo neophodne pojmove iz prirodnih nauka i matematike, na opisnom i definicionom nivou, a u skladu sa uzrastom učenika. Dajemo uputstva za nekoliko praktičnih i istraživačkih projekata, kako u klasičnom okruženju papir-kreda-tabla-naracija, tako i na terenu (školskom dvorištu), uz eventualnu upotrebu računarskih resursa. Na kraju, poseban akcenat dajemo slobodnoj interpretaciji vizuelnih i geometrijskih efekata i eventualnom umetničkom doživljaju teme i modela.

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Contributed talk

QUASI-THERMAL NOISE SPECTROSCOPY IN EARTH'S MAGNETOSHEATH: THEORY AND APPLICATION TO PLASMA DIAGNOSTIC ON WIND SPACECRAFT

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One of the most accurate techniques for in situ measuring the electron density and temperature in space plasmas is the quasi-thermal noise spectroscopy, which uses the voltage fluctuation spectrum on an electric antenna immersed into plasma. This method has been used since the last three decades in different space plasma environments, since it is immune to spacecraft limitations. The method is based on the analysis of the electrostatic field spectrum produced by the quasi-thermal fluctuations of the electrons, and Dopler-shifted thermal fluctuations of the ions. Here, the method has been adjusted for plasma in magnetosheeth of Earth, just behind the Earths bow-shock, where flat-top velocity distribution function of electrons has been measured. Theory has been applied to measurements performed by WIND satellite.

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Contributed talk

RECOMMENDATION FOR RUNNING PURE N-BODY SIMULATIONS ON COMPUTING FACILITIES IN SERBIA

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Pure (gravitational) N-body astrophysical simulations are an irreplaceable means of testing dynamics and evolution of astrophysical objects both on large scales (cosmological simulations) and on smaller scales (isolated galaxies, globular clusters, solar system dynamics, etc). One of the obvious major limitations is in computing facilities at disposal for running the simulations. In this talk we will present characteristics of computational facilities available in Serbia. We will discuss their advantages and disadvantages and we will try to give recommendation for optimum and maximum scope of both large scale simulations and small scale simulations which may be performed with those facilities. A quick overview of simulations completed so far will be given as well.

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Contributed talk

HALO MASS FUNCTION: FROM CALCULATIONS TO COSMOLOGICAL SIMULATION AND BACK

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One of the important ways in which we can study the general distribution of the dark matter halos in Universe is through halo mass function. In this talk we will explore and discuss a means of calculation of theoretical halo mass functions and we will derive and compare several important halo mass function fits. We will discuss connection that permeates cosmological simulations and theoretically calculated fits. Theoretical fits will ultimately be compared with halo mass function derived from our cosmological pure N-body simulation. We will acknowledge that agreement on smaller redshifts is good, but as will be seen, there is a discrepancy on higher redshifts, both between different theoretical halo mass functions and from halo mass function derived from the simulation.

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Contributed talk

REGIONAL ACTIVITIES RELATED TO IAU STRATEGIC PLAN AND INTEGRATION OF THE BYURAKAN ASTROPHYSICAL OBSERVATORY IN THE EUROPEAN ASTRONOMY

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The Byurakan Astrophysical Observatory (BAO) of Armenia is one of the candidates to host a Regional Office of Astronomy for Development (ROAD), the IAU Strategic Plan for 2014-2020 and further years. Armenian astronomers are rather integrated in the international and European astronomical communities, as well as BAO is one of the most important astronomical centres in the Middle East area. The Armenian Astronomical Society (ArAS) is one of the 25 EAS affiliated members and is rather active in organizing various events. The Armenian Virtual Observatory (ArVO) is a member of the International Virtual Observatory Alliance (IVOA). We have started a series of Byurakan International Summer Schools (BISS) for regional and European students with involvement of a number of European lecturers. Already 4 such events have been organized in 2006-2012. Viktor Ambartsumian International Prize is one of the important international astronomy awards. Armenian astronomy integrated into the European one may serve much more efficiently both for Armenia, Middle East region, as well as Europe, particularly establishing a link between Europe and EU East Partnership countries.

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Contributed talk

AGN PHASE: MATCHING NUMERICAL SIMULATIONS TO OBSERVATIONS

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We use high resolution cosmological numerical simulation to identify AGNs in field massive galaxies in redshift range z=[0.8, 2.5]. Assuming that their activity is merger driven and that the final product of their accretion is an M-sigma SMBH, we calculate expected AGN luminosity at the peak accretion activity. We compare these luminosities to those observed in AGNs of the COSMOS survey and find that most of the observed AGNs have passed their peak activity, accreting at lower Eddington ratios. This explains why a large number of AGNs is observed in "red sequence" galaxies.

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Contributed talk

ON A HIDDEN PARAMETER IN FRIEDMANN EQUATIONS

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In our paper (Mijajlović et al. 2012), we applied the theory of regularly varying functions in asymptotic analysis of cosmological parameters for the expanding universe. For this analysis we used differential equations, also known as Friedmann equations, which are derived from the Einstein field equations:

$$\begin{aligned} &\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G}{3}\rho - \frac{kc^2}{a^2}, && \text{Friedmann equation,} \\ &\frac{\ddot{a}}{a} = -\frac{4\pi G}{3}\left(\rho + \frac{3p}{c^2}\right), && \text{Acceleration equation,} \\ &\dot{\rho} + 3\frac{\dot{a}}{a}\left(\rho + \frac{p}{c^2}\right) = 0, && \text{Fluid equation.} \end{aligned} \tag{1}$$

Cosmological parameters appearing in these equations are the scale factor $a = a(t)$, the energy density $\rho = \rho(t)$ and $p = p(t)$, the pressure of the material in the universe. It appears that these parameters, including Hubble parameter $H(t)$ and deceleration parameter $q(t)$, are regularly varying functions. According to the representation theory for regularly varying functions, all these parameters depend on a 0-function $\varepsilon(t)$ which is "hidden" in the integral representation of regularly varying functions. While $a(t)$, $\rho(t)$ and $H(t)$ uniformly depend only on $\varepsilon(t)$, the parameters $p(t)$ and $q(t)$ depend also on $\dot{\varepsilon}$, what may lead to various evolutions of these parameters. We derived a differential equation for $\varepsilon(t)$ and discussed possible solutions.

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Contributed talk

SWEEP-BY-SWEEP IMPLICIT LAMBDA ITERATION FOR NON-LTE RADIATIVE TRANSFER IN 2D CARTESIAN COORDINATES

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Here we present a novel method for solving non-LTE radiative transfer problem in multidimensional media. The method can be considered as a generalization of "Forth-and-back" implicit lambda iteration originally developed for 1D atmospheric models. Sweep-by-sweep implicit lambda iteration is based on short characteristics approach for the formal solution of the radiative transfer equation and achieves significant acceleration of convergence by using multiple source function updates in one iteration and additional acceleration by use of iteration factors.

We present its implementation in the case of 2D Cartesian grids and compare it with similar iterative methods (Jacobi and Gauss-Seidel iteration) in the case of two-level atom line transfer and coherent scattering. We show that Sweep-by-sweep ILI converges 6-7 times faster than the Jacobi iteration and also scales better with grid resolution. We also comment on future tests and further generalizations.

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Contributed talk

ON THE INNER BORDER OF PHOCAEA GROUP OF ASTEROIDS

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The Phocaea group is located in the inner asteroid belt, and consists of asteroids having orbital inclination higher than about 20 degrees, and eccentricity ranging between 0.15 and 0.3. This region is known to have dynamical boundaries which completely surround it. An inner boundary in semi-major axis, often related to the 7/2 mean motion resonance (MMR) with Jupiter, is located at about 2.25 AU. The outer boundary, at around 2.5 AU, is set by the powerful 3/1 MMR with Jupiter. Moreover, the region is delimited by important secular resonances (SRs): the $\nu_6 = g - g_6$ at low inclination, and the $\nu_5 = g - g_5$ and $\nu_{16} = s - s_6$ at high inclination.

The aim of this work is to check whether or not the inner boundary of the region in terms of semi-major axis, namely the 7/2 resonance with Jupiter, could be crossed under the influence of gravitational and non-gravitational forces. The obtained results show that a significant fraction of our test particles successfully transit across the resonance, without being removed from the region. This means that, despite being relatively effective in pumping up asteroid eccentricities in this region, the 7/2 resonance is not an absolute dynamical boundary.

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Contributed talk

SURFOVANJE SVEMIROM

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Tokom prethodne decenije internet je postao nezamenljiv izvor informacija i znanja. Potreba za znanjem iz oblasti astronomije je velika, što pokazuje analiza poseta tematskih sajtova, ali primetan je nedostatak savremenih internet servisa i multimedijanih tehnologija u oblasti astronomije [1].

U ovom radu biće predstavljeni rezultati prethodnog rada i iskustva autora i Astronomskog društva "Alfa" u oblasti popularne astronomije. Kroz primer realizacije studentskog projekta "Astronomija iz fotelje" [2] predstavićemo naša iskustva tokom opremanja amaterske opservatorije i rada na popularizaciji astronomije u Nišu. U radu će, osim standardnih metoda promocije astronomije kroz javna naučno-popularna predavanja i posmatranja, biti predstavljene i "onlajn" metode koje su zasnovane na interaktivnom internet prenosu predavanja i astronomskih posmatranja.

Pokazaćemo kako je moguće realizovati ovakvu vrstu prenosa primenom gotovih i besplatnih softverskih rešenja, kao i mogućnosti za razvoj novog i potpuno nezavisnog sistema za realizaciju prenosa i snimanje predavanja.

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Contributed talk

OPERATION AND SUCCESS OF ROBOTIC OBSERVATORY "NIGHT HAWK"

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The topic is how the observatory was built and equipped, what has been recorded and how the success since its foundation has been achieved.

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Contributed talk

FIRST RESULTS OF BOSNIA-HERZEGOVINA METEOR NETWORK (BHMN)

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Meteor astronomy in the modern era is one of the areas that allow successful co-operation between professional and amateur astronomers. This is due to the relatively low cost of equipment that allows the establishment of video meteor network and continuous recording of meteors over one area. Practical work within the meteor network consists of making video recordings of meteors, simultaneously with at least two distant cameras. On this basis it is possible to determine atmospheric trajectory of meteor particle and its velocity in each video frame. Knowing this velocity it is possible to determine its heliocentric velocity and its orbit before collision with Earth atmosphere which in some cases gives us its origin.

In the case of meteorite fall (if a meteor does not burn completely in the atmosphere) such recordings enable us to estimate the location of its fall. Finding a meteor which was recorded during its flight through the atmosphere, from which its orbit is calculated, researchers of the Solar System use a space mission with sample return from a parent comet or asteroid for comparison.

Modeled on similar networks in the region, since the spring of 2013th, in Bosnia and Herzegovina an operation of video meteor network began which currently includes five stations. In preparation is expansion of the network by setting up another 5 stations. The Network is jointly managed by Astronomical Society Orion Sarajevo and Federal Hydrometeorological Institute in Sarajevo whose meteorological stations were used for installation of cameras. By mid-June 2014, cameras of BH meteor network recorded over the 9614 meteors and we calculated 1306 orbits. In this paper we present the results of the first year of operation of our meteor network and the analysis of Geminids recorded during the peak of this meteor shower that occurred on 13/14th December 2013th, which confirms the high quality of the data obtained. The orbits obtained with the help of stations of our Network were compared to the orbits of the Geminid meteors obtained by Japanese video meteor network (SonotaCo) and the orbit of the presumed parent body of the shower - asteroid 3200 Phaethon, using Southworth-Hawkings D-criteria.

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Faculty of Mathematics and Astronomical Observatory, Belgrade, 2014

Contributed talk

FORMATION OF ULTRA-COMPACT DWARF GALAXIES

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Ultra-compact dwarf (UCD) galaxies have characteristics similar to massive globular clusters and compact remnants of dwarf galaxies. Their origin is still not fully understood. We investigate the case in which these objects are formed as a result of the influence of strong tidal field on dwarf galaxies inside Fornax galaxy cluster. We use N-body simulations of stable high-resolution models of late-type dwarf galaxies through the numerical potential of the Fornax cluster. Motivated by previous works, we examine remnants of galaxies with different density profiles of dark matter halos of dwarf galaxies and different orbits within the Fornax cluster. We analyse dynamical and morphological evolution of dwarf galaxies. We find that the choice of density profile, as well as the orbits, significantly affects the final remnants of galaxies. In some cases, galaxies are completely torn apart after few orbits. The results deviate from the observed characteristics of UCD galaxies. We find that the final remnants of dwarf galaxies are more similar to the observed spheroidal dwarf galaxies.

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Contributed talk

UPDATED RADIO SURFACE-BRIGHTNESS-TO-DIAMETER RELATION FOR GALACTIC SUPERNOVA REMNANTS

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We present updated empirical radio surface-brightness-to-diameter ($\Sigma - D$) relations for supernova remnants (SNRs) in our Galaxy. Our original calibration sample of Galactic SNRs with independently determined distances was reconsidered and filled with data which became available in the past two years. Different fitting procedures are applied to the calibration sample in the $\log \Sigma - \log D$ plane. Non-standard regressions keep $\Sigma - D$ and $D - \Sigma$ relations invariant within estimated uncertainties which is essential due to existence of large scatter in both D and Σ. Four non-standard fitting methods, which treat Σ and D symmetrically, give different $\Sigma - D$ slopes β for the calibration sample. Our previous Monte Carlo simulations verified that the slopes of the empirical $\Sigma - D$ relation should be determined by using orthogonal regression, because of its good performance for data sets with severe scatter. The new empirical relation is applied to estimate distances of Galactic SNRs, and this result can severely affect the distance scale for them.

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Contributed talk

MEASUREMENTS OF VISUAL DOUBLE STARS BETWEEN 2011-2014

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In the period from 2011 to 2014 we observed visual double and multiple stars at AS Vidojevica (ASV) and NAO Rozhen (NAOR) and measured the relative coordinates. Frames were taken by using three CCD cameras: SBIG ST-10ME and Apogee Alta U42 attached on the 60 cm telescope at ASV and VersArray 1300B attached on the 2 m telescope at NAOR. Analysing the separations of the same pairs obtained by using these two telescopes we detected a systematic difference in the separations. The reason of this is disagreement between the telescope focal length and that declared by the producer. We present more correct focal lengths for both telescopes based on our measurements. Also, we give orbits, linear solutions and other parameters obtained in this period.

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Contributed talk

GALACTIC CENTER GAMMA-RAY "EXCESS" FROM AN ACTIVE PAST OF GALACTIC CENTER?

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Several groups have recently claimed evidence for unaccounted gamma-ray excesses over diffuse backgrounds at few GeV in Fermi-LAT data in a region around the Galactic Center, consistent with a dark matter annihilation origin. We demonstrate that the main spectral and angular features of this "excess" can be reproduced if they are mostly due to inverse Compton emission from high-energy electrons injected in a burst event of $\sim 10^{52} - 10^{53}$ erg roughly $O(10^6)$ years ago. We consider this example as a proof of principle that time-dependent phenomena need to be understood and accounted for—together with detailed diffuse foregrounds and unaccounted "steady state" astrophysical sources—before any robust inference can be made about dark matter signals at the Galactic Center. In addition, we point out that the timescale suggested by our study, which controls both the energy cutoff and the angular extension of the signal, intriguingly matches what is inferred by other forensic evidences suggesting a very active Galactic Center (e.g. due to intense star formation and accretion phenomena) over similar timescales.

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Contributed talk

MORPHOLOGICAL CLASSIFICATION OF GALAXIES (IN GENERAL), AND CLASSIFICATION IN THE ALHAMBRA SURVEY (IN PARTICULAR)

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In this talk I will emphasize how much the morphological classification of galaxies is important for any study of galaxy formation and evolution. I will go through different methods of morphological classification, explaining the advantages and disadvantages of each. Finally, I will present the ALHAMBRA survey and publicly available data, including the morphological catalogue of galaxies.

Contributed talk

STAR FORMATION IN THE MOST LUMINOUS LOCAL LINERs

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Estimates of the star formation rates (SFRs) in local LINERs, based on different methods, can differ by large factors. This may be attributed to the confusion between AGN and SF contributions in various parts of the host galaxy. We obtained long slit spectra for a sample of local type-1 and type-2 LINERs at $0.04 < z < 0.11$ to distinguish between the AGN and starburst emission and to estimate the specific SFR (sSFR) by using the Dn4000 method. We studied the location of luminous local LINERs in the SFR vs stellar mass diagram, compared them with the local high ionisation AGN, and estimated the reliability of sSFR estimators based on UV, optical, and IR.

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Contributed talk

ASTRONOMY FOR DEVELOPMENT PROGRAMME (OVERVIEW)

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In this talk I will present the IAU Office of Astronomy for Development (OAD), by focusing on its mayor objectives and possibilities to participate. After that, I will describe briefly the Network for Astronomy School Education (NASE) project and the status of astronomy in east African countries, where both programs were supported by the OAD.

Contributed talk

AD "ANTARES", SOKOBANJA

D. Radovanović

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U ovom radu biće predstavljeno astronomsko društvo "Antares" iz Sokobanje.

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Contributed talk

SPECTRAL LINES OF Zr IV IN THE ATMOSPHERE OF CHEMICALLY PECULIAR STARS

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The electron-impact widths for several Zr IV spectral lines have been calculated by using the modified semiempirical method. We analyzed the importance of Stark broadening fot the obtained results in the spectra of the atmosphere of chemically peculiar stars.

Contributed talk

AN ATTEMPT TO EXPLAIN THE EVOLUTION OF LYMAN-ALPHA BLOBS NUMBER DENSITY AT Z 1-6

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Lyman-alpha blobs (LABs), very luminous ($\sim 10^{43} - 10^{44}$ erg/s) and very extended ($\sim 50 - 150$ kpc) radio quiet sources, are discovered 10-15 years ago, and observed in redshift range from 1 to 6.6. The source of their energy is still not clear. In this work we model the evolution in comoving number density of LABs as a function of redshift. Our model is based on empirical recipes for the cold mode accretion derived from cosmological hydrodynamical simulations. We assume that the cooling radiation (CR) from the cold mode accretion in intergalactic gas is the main source of LAB emission and we "paint on" empirical recipes on the numerical merger tree for dark matter halos in the post-analysis of high-res cosmological dark matter only simulation. In this way, we can calculate the Lyman-alpha luminosity expected in every dark matter halo at every redshift, and predict the theoretical luminosity and area functions of LABs at various redshifts. In this work we compared predicted luminosity functions and number densities to the observed ones for some parameters and at various redshifts, and we concluded.

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Contributed talk

MODELING OF SUPERMASSIVE BLACK HOLE GROWTH AT REDSHIFT $Z = 7$

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It is widely accepted that SMBHs reside in centers of massive galaxies and quasars. SMBHs are formed by a combination of gas accretion and merges with other massive BHs. Some SMBHs are detected in very early Universe ($\sim$ 800 Myr). We use Millennium II simulation in order to find out if SMBH can be formed that early with known growth mechanisms. We find that BH seeds with masses $100M_{\odot}$ that accrete at the Eddington ratio 2.9 can form SMBH with mass $10^9M_{\odot}$ at $z = 6.2$ or at $z = 7.3$ for accretion at the Eddington ratio 3.2. Our results are consistent with previous works which have shown that the most realistic scenario for SMBH formation are BH seeds with masses $10^5 - 10^6M_{\odot}$ because in that case there is no need for super-Eddington accretion. We show that even BH seeds with masses $100M_{\odot}$ can form the same SMBH if they accrete at the Eddington ratio $\sim$ 3, which is still difficult to explain, but it might be possible especially after new observational evidence of quasars that accrete at super-Eddington ratio of the similar values.

Contributed talk

THE DUSTY TORUS OF ACTIVE GALACTIC NUCLEI

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The unification model of active galactic nuclei (AGN) postulates a supermassive black hole accreting matter as the central engine which produces a very strong continuum. To explain the variety of AGNs, and at the same time to account for the observed infrared bump, a roughly toroidal structure of dust, dubbed 'the dusty torus', is assumed to be found in the equatorial region. This dust absorbs the incoming radiation, re-emits it in the infrared and obscures our view of the central region at certain inclinations, making an AGN appear different depending on our line of sight to it. However, while this dusty torus is a crucial part of AGN, it is still surprisingly poorly understood. In this contribution I will present our latest efforts to gain insights in structure and physical conditions of the dusty torus by means of state-of-the-art 3D radiative transfer simulations based on Monte Carlo technique.

Contributed talk

MOBILE PLANETARIUM AS TEACHING AND COMMUNICATION TOOL

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In the past five years Astronomical Society "Rudjer Boskovic" and Society of Astronomers of Serbia use mobile planetarium as a tool of astronomy communication. During the 2013/2014 school year this modern technical equipment has been used in schools as an educational tool in the term of correlation with teaching subjects and lessons (Geography, Physics, Mathematics, Chemistry, History, Biology, World Around Us, Knowing the Nature). As we reached 15000 schoolchildren and 500 teachers detailed analysis of these activities will be presented and discussed.

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Contributed talk

SUNDIALS AS A COMMUNICATION TOOL

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"It is undoubtedly true that teaching with sundials would be easier and more effective than with books and other tools" said professor V. V. Mišković long time ago (1931) when he commented letters from teachers who asked him for advice in sundial construction for schools. Inspired by this comment and starting with the motto "Umbra docet" (written on many sundials) we discuss a sundial as a multifaceted means of science communication.

Nowadays the word "communication" is often widely used in various fields of human activity in the different meanings as a connection of one object (or subject) with another (in social meaning), or as a process. Information exchange (communication as a process) can take place immediately, with the help of language, or indirectly - by means of certain technical equipment and supplies.

In this paper we deal with technically mediated communication, in which the mediator (tool), is sundial. We look at a sundial in two perspectives: 1) as an aid in teaching and popularizing astronomy in the classroom, astronomy courses, planetarium lectures etc) and 2) as an instrument which communicates with the user/viewer by all its elements - written message, artistic impression, technical solutions, settings (area, place, institution, constructor and particular historical moment) in several levels educational, artistic, scientific, phylosophical and spiritual. Unlike direct communication, where communicator (teacher) have to be physically present in the process of communication, sundial offers indirect communication with the general public for many years and even further than one epoch of time. This work includes an overview of all cuntructed sundials on theritory of Republic of Serbia (detailed map will be given and presented), especially in schoolyards and other cultural institutions.

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Contributed talk

CALCULATION OF MEAN DENSITY OF SOLAR PLANETS BY MODIFIED SAVICH-KASHANIN METHOD

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In order to calculate the mean density of solar planets Savich and Kashanin in 1960-ties developed a mathematical model based on van der Waals (vdW) equation of state. However, there are the great relative errors of calculated values of planet's mean densities since vdW equation is not in agreement with empirical data published more recently. Using this empirical data, we modified mathematical model of Savich and Kahanin which enabled the more exact calculation of planet's densities. Furthermore, modified model enables calculation of densities of matter in its characteristics states (i.e. critical point, triple point, absolute zero temperature...) as well as to predict the structure of fluids (real gases and liquids), which has a great importance in physics and chemistry, too.

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Contributed talk

MATEMATIČKE OSNOVE SUNČANIH ČASOVNIKA I PRINCIPI MODELOVANJA

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U ovom radu su izložene opšte matematičke osnove izrade sunčanih časovnika za posmatrača na Zemlji. Isti principi su ekstrapolovani na proizvoljnu planetu Sunčevog sistema i izvršena je odgovarajuća geometrijska interpretacija i dati su osnovni obrasci na osnovi sferne trigonometrije. Na osnovi dobijenih obrazaca izvršena je analiza mogućnosti izrade različitih vrsta sunčanih časovnika i njihove materijalizacije. Time su u osnovi dobijeni potrebni elementi i principi za klasifikaciju sunčanih časovnika. U cilju približavanja osnovnih pojmova sferne trigonometrije slušaocima koji znaju osnove ravne trigonometrije, dato je poglavlje o izvodjenju sfernih obrazaca iz ravnih trouglova.

Contributed talk

AD "PLEJADE", TUZLA

E. Tanović

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U ovom radu biće predstavljeno astronomsko društvo "Plejade" iz Tuzle, njegove dosadašnje aktivnosti kao i budući ciljevi.

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Contributed talk

ASTEROID BELT AND THE FAST LYAPUNOV INDICATOR

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Computing the Fast Lyapunov Indicator (FLI) is one of the fastest numerical ways to detect the stability properties of a given orbit. FLI quickly discriminates not only between stable and chaotic motion, but also between weak and strong chaos, as well as between regular motions inside and outside of a resonance. With such sensitivity, FLI is very convenient for the evaluation of dynamical maps, providing structural information of a given system, and a good starting point in further investigations of its dynamics. However, despite its efficiency, FLI was mostly used to detect structures in simplified and idealized systems, but rarely to study dynamics of the 'real world'. Therefore, we are interested to evaluate FLI maps able to show dynamical structures in our Solar System. The FLIs are determined from numerical integrations by using a model that includes seven planets (from Venus to Neptune). According to our results, we can say that once again FLI has shown its efficiency to detect structures in the Main Belt, with a surprisingly high clarity.

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Contributed talk

NEGATIVNA DUŽINA I MASA U GRAVITACIONOM SISTEMU - KOSINUSNA PITAGORINA TEOREMA

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Rešavan je zadatak Kopernikovog određivanja perioda revolucije planeta oko Sunca, daljina od Sunca i od Zemlje, polazeći od njime utvrđenog stanja o Suncu kao centralnom telu i kružnim putanjama planeta. Pokazano je da kosinusna teorema, osim formule koja je opšte poznata, može da se prikaže i kao Pitagorina teorema, takođe i kao usklađivanje odnosa rastojanja geometrijskom sredinom. Tako se planetna kretanja pojavljuju i kao manifestacija fraktalne prirode, koja je neodvojiva od istovremeno kontinualne prirode odnosa kinematičkih parametara planeta.

Kako se u novim formulama pojavljuje efektivna negativna dužina, kao mera rastojanja tačkastog tela sa masom, razmatrana je održivost negativne mase uvedene u Nilsenovoj kosmološkoj teoriji. Pokazalo se da je to veoma značajno za konceptualno usaglašavanje modela elektro-magnetne i gravito-dinamičke sile.

Contributed talk

ONE LETTER CONCERNING CALENDAR REFORM

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In this work the authors present a letter from 1923, which sent the director of National Observatory of Athens Dimitrios Aiginitis (1862-1934) as a response to the professor of Belgrade University Milutin Milanković (1879-1958). The letter was written in French and it explains why the resulting differences were existing in calculation of the date of Easter, on which both of them worked separately, and that was the main object of interest in a letter previously sent by Milanković.

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Faculty of Mathematics and Astronomical Observatory, Belgrade, 2014

Cantributed talk

SUMMARY OF THE IX BULGARIAN-SERBIAN ASTRONOMICAL CONFERENCE: ASTROINFORMATICS

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We present a summary of the IX Bulgarian-Serbian Astronomical Conference: Astroinforma.ics (http://www.wfpdb.org/ftp/9_BSACA/), held in Sofia in July 2014, as well as our view on achieving the goal of these regular conferences started in 1998. We discuss the basic scientific directions and prospects of the Bulgarian-Serbian collaboration in Astronomy and Astroinformatics.

Contributed talk

AN ANALYSIS OF UU CAS RADIAL VELOCITY CURVES

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We present the results of radial velocity measurements of UU Cas close binary star obtained from three sets of spectra observed at different observatories with different spectral resolution. Amplitudes of radial velocity curves acquired from these three observed sets differ significantly. Moreover, velocity curve amplitudes obtained from spectral lines of helium and metals are also significantly different even in frame of the same set. These differences in velocity curve amplitude are explained by systematic errors introduced by difference between photometric centers and center of masses of the binary components.

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Contributed talk

IMPLICATIONS OF THE KINEMATICS ON THE CHEMICAL AND DYNAMICAL PROPERTIES OF NEARBY ELLIPTICAL GALAXIES

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We have selected 1450 elliptical galaxies from approximately 7000 galaxies presented in the Nearby Optical Galaxy sample, which is a complete, distance-limited (cz $\leq$ 6000 km/s) and magnitude-limited (B $\leq$ 14) catalog of nearby galaxies. By cross-matching this sample with SDSS database (DR10), we have found spectroscopical confirmation of 179 ellipticals with signal-to-noise ratio between 10 and 80, sufficient for calculation of full kinematical profiles of these galaxies. Also, we have calculated Lick indices, including corrections due to the kinematics. Finally, we discuss the influence of the full line-of-sight velocity distribution on the mass estimates.

Contributed talk

ZAJEDNIČKE AKTIVNOSTI

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Svako astronomsko društvo sprovodi, po svom planu, svoje programe. Medjutim, postoje i neke aktivnosti koje su rezultat saradnje dva ili više astronomskih društava ili pak nisu vezane ni za jedno astronomsko društvo. O tim aktivnostima govori se u ovom radu.

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Posters

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XVII NATIONAL CONFERENCE OF ASTRONOMERS OF SERBIA
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Book of abstracts, eds. S. Šegan, S. Ninković, A. Kovačević and B. Novaković
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Poster

SEARCHING FOR CHAOS IN THE X-RAY LIGHT CURVES OF AGN

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We explored short-term X-ray light curves of several Type I active galaxies from XMM - *Newton* in order to search for signatures of low-dimensional chaotic behavior. For our analysis we used 8 light curves of 4 AGN, each consisting of a total of $\sim$ 2000 to $\sim$ 5000 equidistantly located points. The correlation integral method was applied to search for chaos. The preliminary results show possible indications for the presence of a low-dimensional attractor (D<5) in some of the light curves, however the results are not entirely conclusive.

Poster

OPPORTUNITIES AND DIFFERENT APPROACHES TO FUNDING OF ASTRONOMICAL RESEARCH AND OUTREACH ACTIVITIES

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This paper presents an overview of the funding of scientific research activities and popularization of astronomy in the region. The aim of this paper is to draw attention to the current situation, obstacles and opportunities for providing additional financial resources for scientific research institutions and amateur associations.

This survey is based on reports of professional research institutions, amateur organizations and potential sponsors of research and outreach activities.

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THE LINK BETWEEN FUTURE GAIA CRF AND ICRF AND THE OBSERVING FACILITIES OF THE 60 cm ASV TELESCOPE

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The cornerstone mission Gaia of the European Space Agency (ESA) was successfully launched at the end of 2013. The main goal of Gaia is to map the entire Galaxy, over one billion stars, and about 500 000 quasars (QSOs) during its 5-year lifetime. It means, all objects with apparent V magnitudes between 5.6 and 20; the result will be a unique time-domain space survey. The main goal is to make a dense optical QSO-based Gaia Celestial Reference Frame (Gaia CRF). We need the link future Gaia CRF - International CRF (ICRF) with high accuracy, and it is an important task because for now near 90suitable for mentioned link. The objects are not bright enough in optical domain, they have significant extended radio emission, etc. It is necessary to check other sources. They are weak extragalactic radio sources - ERS with bright optical counterparts, but we need to investigate these objects. The displacements of the optical photocenter (of mentioned objects) could be the result of its astrophysical processes. So, the variations of light curves of objects are important for good link. The part of that investigation is the observation of 47 objects (mostly QSOs) made in the B, V and R bands using new telescope at the Astronomical Station Vidojevica - ASV (of Astronomical Observatory in Belgrade, D/F=60cm/600cm). Some preliminary photometric results of QSOs in frame of that investigation are presented.

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ACTIVITIES OF THE GROUP FOR ASTROPHYSICAL SPECTROSCOPY 2011-2014

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Results of avtivities of the fellows of the Group for Astrophysical Spectroscopy within the period 2011-2014 (between two conferences of Serbian astronomers) are reported.

Poster

A.A.D. "TYCHO BRAHE" BEOGRAD

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Amatersko astronomsko društvo "Tycho Brahe" osnovano je 7. juna 2010. godine u Beogradu od strane četvorice bliskih prijatelja pasioniranih astronomijom i astrofotografijom i za sada još uvek nije zvanično registrovano. Kako se profesionalno bavimo različitim poslovima koji nisu direktno vezani za astronomiju, kada god smo u mogućnosti trudimo se da naše slobodno vreme provodimo na terenu pod otvorenim nebom i pri tome da svoju ljubav prema vasioni i njene ne tako pristupačne lepote takodje uživo prenesemo što je moguće većem broju naših prijatelja, njihovim poznanicima i drugima. U tom smislu u januaru 2011. pokrenuli smo i blog na Internetu "Urbani astronomski dnevnik" (http://aadtychobrahe.blogspot.com) putem koga redovno i detaljno izveštavamo o svim našim aktivnostima. Pored osmatračke astronomije, veoma smo angažovani i po pitanju astrofotografije i za sobom već imamo znatan broj radova koji uključuju Mesec, Sunce, planete Sunčevog sistema, magline, zvezdana jata, galaksije i sve drugo što verujemo da je vredno i bitno ovekovečiti.

Poster

ASTRONOMY AND MEASUREMENT

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Poster is visualization of a forgotten analog computer as a measuring instrument. Further progress in astronomy reflected through a brief historical development of measurement instruments that are necessary for many studies, approaching us distant phenomena and events.

Poster

ASTRONOMSKO UDRUŽENJE ANDROMEDA

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Astronomsko udruženje Andromeda postoji više od 10 godina i bavi se popularizacijom astronomije i primenom informacionih tehnologija u astronomiji. Za više od 10 godina postojanja održali smo svake godine po dve škole astronomije, jesenju i prolećnu i ugostili više profesora van Knjaževca, a neki su bili i iz inostranstva. Društvo danas broji preko 350 članova medju kojima ima i doktora nauka koji se bave ovom problematikom.

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Poster

THE EFFECT OF DECREASE OF THE COSMIC RAYS INTENSITY INFLUENCED BY QUASI-STATIONARY AND SPORADIC HIGH-SPEED STREAMS OF SOLAR WIND

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Based on statistical analysis from 1995 to 2013 years, it was shown that recurrent high-speed streams of the solar wind, generated by coronal holes, modulate of the galactic cosmic rays flux near the Earth. A comparative analysis has been done for two types of decreases galactic cosmic rays intensity from coronal holes and solar flares (or CME) by the main parameters such as the typical shape, magnitude, duration of decrease, delay, and size of galactic cosmic rays modulation area. We found that the radius of the modulation area is different for the two types of decreases by absolute magnitude and changes with duration of the cycle of solar activity. It was shown that radius of effective modulation zone of the cosmic rays increases from minimum to maximum of solar activity for the Forbush effects associated with flares (or CMEs) and behaves conversely for decreases caused by high-speed flows from coronal holes (anticorrelation with Wolf numbers). Correlations with various indices of solar and geomagnetic activity were investigated for decreases of both types.

Poster

SERBIAN ASTRONOMICAL JOURNAL IN SCIENCE CITATION INDEX AND JOURNAL CITATION REPORT

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We disscuss the first year Serbian Astronomical Journal bibliographic and citation data in the Thomson Reuters' Science Citation Index and Journal Citation Report.

Poster

ASTRONOMY CLUB IN PRIMARY SCHOOL

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Astronomy club in primary school "Vasa Živković" in Pančevo started in 2006, inspired with cooperation with Astronomical Society "Rudjer Bošković". Schoolchildren visited planetarium in Belgrade and they wanted to continue research in astronomy in school. Once a week, kids prepare books, websites and ideas to work on in the club, correlating geography and astronomy knowledge. After eight years of activity, this poster will present recent results and achievements.

Poster

POSSIBLE EXOMOONS AS TARGETS FOR SETI

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Idea for search for intelligent life on possible exomoons will be presented in this paper.

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Poster

NEKOLIKO PRINCIPA KLASIFIKACIJE I KLASIFIKACIJA SUNČANIH ČASOVNIKA SA PREGLEDOM NAJPOZNATIJIH IZVEDBI

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U ovom radu je definisano nekoliko principa klasifikacije sunčanih časovnika, kako sa istorijskog, hronološkog stanovišta, tako i sa stanovišta umetničkog i zanatskog. Prepoznati su i moderni zahtevi prema fenomenu sunčanog časovnika i klasifikovane su dobijene realizacije, u glavnom, u svetskim razmerama. Prateći deo je dat kao foto-katalog najpoznatijih svetskih realizacija sa opisom.

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MODELI SUNČANIH ČASOVNIKA - UČENIČKA PRAKSA

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U ovom radu učenici će prikazati na koje se sve načine vrši promocija nauke i povećava učenička motivacija kroz umetničke i praktične radove čija je tema nekom niti povezana sa astronomijom. Učenici će dramatizovati odlomak knjige "Autobiografija" Branislava Nušića, predstaviti nekoliko literarnih i likovnih učeničkih radova, a glavni deo rada je izložba modela različitih vrsta sunčanih časovnika o kojima će izlaganja činiti njihovi autori - učenici.

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Poster

SUNSPOTS OPACITY: THE ION-ATOM ABSORPTION PROCESSES

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As a continuation of the previous investigations of the symmetric and strongly non-symmetric ion-atom absorption processes within the models of the quiet Sun photosphere, we studied these processes within a model of the sunspots in the far-UV region. We considered the processes of the photodissociation of the H_2^+ and HM^+ molecular ions and absorption processes in the H(1s)+H^+ and H(1s) + M^+ collisions, where M is one of the metal atoms: M = Na, Ca, Mg, Si and Al. It was analyzed the significance of these processes in far UV and EUV regions in comparison with the concurrent absorption processes, especially with the processes of the photo-ionization of the metal atoms (Na, Mg, Ca, Al, Fe, etc.). Calculated results show that the influence of the analyzed ion-atom absorption processes on the opacity of sunspots in the considered spectral region, 100 nm $\leq \lambda \leq$ 250 nm, is not less and in some parts even larger than the influence of the referent electron-atom processes. It is shown that the considered ion-atom absorption processes should be included ab initio in the corresponding models of sunspots of solar-type and near-solar-type stars.

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AKTIVNOSTI ASTRONOMSKE GRUPE DRUŠTVA ISTRAŽIVAČA "VLADIMIR MANDIĆ MANDA" U PERIODU OD 2012. DO 2014. GODINE

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Društvo istraživača "Vladimir Mandić Manda" osnovano je 1969. godine u Valjevu. Danas Društvo broji šest aktivnih grupa medju kojima je i astronomska, koja funkcioniše još od 1973. godine. Članovi ove grupe su većinom srednjoškolci amateri koji se astronomijom bave iz ljubavi kroz niz praktičnih vežbi i predavanja. Grupa se bavi posmatranjima i praćenjem meteorskih rojeva, Sunca i drugih nebeskih tela i dogadjaja. Takodje, jedan od važnijih ciljeva grupe je promocija astronomije medju mladima grada Valjeva kroz organizovanje javnih posmatranja i škola astronomije. U ovom radu su predstavljene najuspešnije aktivnosti grupe realizovane u periodu od 2012. do 2014. godine podeljene u tri najbitnije celine: promocija nauke, istraživačka delatnost i naučno obrazovanje.

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Poster

DESIGN OF SAFE AND COMFORTABLE UNDERGROUND LUNAR HABITAT

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For humans to live on the Moon in safety and reasonable comfort, first our self-repairing remote-controlled robotic heavy machinery must build (however long it may take) an appropriate habitat, in a system of tunnels, with the main gate at the ground level and the entry tunnel horizontal but drilled in a massive rock formation, in a lunar hill, geologically reliable. Inside, there will be a number of tunnels, storage spaces, apartments, garages, reservoirs of oxygen and water, centrifugal devices for the human residents to compensate for weak lunar gravity, rescue exits, a medical facility, and other necessities, protected by at least 200 meters of solid rock from any meteorite impacts, radiation, temperature variations etc. Outside, there must be a road to the nearby landing field, which must be completely flat, cleared from any rocks and dust, and marked by proper beacons. The craft for a return to Earth must be provided with at least triple redundancy (at least 3 independent take-off craft, secured in permanent storage). Permanent audio/video communications must be installed in the surrounding areas. Only then will it be humane to send humans to live and work on the Moon; the same for Mars. It would be irresponsible and inhuman to send them to live in a flimsy, small module, a tin-can standing on four legs, exposed on the surface. Even if the construction of this habitat should take many years, it would be a justified and reasonable plan for making a small, sustainable lunar (or Martian) settlement.

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Poster

PARTICIPATION OF SERBIA AT THE INTERNATIONAL OLYMPIAD IN ASTRONOMY AND ASTROPHYSICS IN 2012 AND 2013

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The participation of contestants from Serbia at the VI International Olympiad in Astronomy and Astrophysics (IOAA) that took place in Brazil 2012, the VII IOAA that took place in Greece 2013 and the Saint Petersburg Olympiad 2013 and 2014 will be one of the points examined in this poster. The poster will also discuss the organisation and preparation of contestants, volunteering done by the instructors, funding problems encountered and the contribution of the Mathematical High School in Belgrade. The poster will feature an in-depth review of the domestic competitions where the teams for the international competitions were chosen, as well as a discussion of the problems competitors were asked to solve. The international competitions, their organisation and the success of Serbian competitors will be analysed as well.

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HF CHARACTERISTICS OF THE ASTROPHYSICAL PLASMAS

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The values of electrical conductivity of plasma of stars with a magnetic field or moving in the magnetic field of the other component in a binary system could be of significant interest, since they are useful for the study of thermal evolution of such objects, cooling, nuclear burning of accreted matter, and the investigation of their magnetic fields. So, on the basis of numerically calculated values for the dense plasma conductivity in an external HF electric field, we determine the HF characteristics of astrophysical plasmas under extreme conditions. The examined range of frequencies covers the IR, visible and near UV regions and consider electronic number density and temperature are in the ranges of $10^{21} \leq Ne$ and $20\ 000 \leq T$, respectively. The method developed here represents a powerful tool for research into white dwarfs with different atmospheric compositions (DA, DC etc.), and for investigation of some other stars (M-type red dwarfs, Sun etc.).

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Poster

THE IMPORTANCE OF DARK MATTER IN NEARBY MASSIVE EARLY-TYPE GALAXIES

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In this contribution we present the study of the dynamics of the sample of ten early-type galaxies in both Newtonian and MOND approaches. We use the measurements of the radial velocities of globular clusters detected in the galaxies in the sample to test the predictions of dynamical models with and without dark matter out to several effective radii. We solve the Jeans equations for both the Newtonian (mass-follows-light and dark matter models) and MOND approaches (three different MOND models) assuming spherical symmetry; for both approaches we assume various values of velocity anisotropy. We compare thus obtained estimates of the mass-to-light ratios with results obtained using stellar population synthesis models. We find that the Newtonian mass-follows-light models without significant amount of dark matter can provide successful fits for only one galaxy (NGC 2768) and for the remaining nine early-type galaxies various amounts of dark matter are required in the outer parts. With MOND models, we find that four early-type galaxies can be fitted without dark matter and that the remaining six galaxies require an additional dark matter component to successfully fit the observed velocity dispersions.

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Poster

SED OF BINARY BLACK HOLES

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We investigate observed continuum radiation in galaxies with active nuclei. It is well established that galaxies with huge energy output 10^44ergs/s can produce radiation with various wavelengths. In case of Active Galactic Nuclei it is proposed that main source of continuum radiation is produced by accretion disk. We develop a simple model for computing energy distribution of accretion disk in thin disk approximation. The results are given for particular case when galaxy contains a super massive binary black hole system with usual mass of components around $10^8 M_{sun}$. Additionally, we present discrete emission in particular case when spectral line doublet can be observed and discuss range of values of used parameters

Poster

UNTYPICAL PERTURBATIONS ON VLF RADIO SIGNALS DURING SOLAR FLARES

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The perturbations in the D-region induced by solar flares were studied using monitored amplitude and phase data from European very low frequency (VLF, 3 - 30 kHz) transmitters, in period 2008 - 2014. All data were recorded by AWESOME system at Belgrade station (44.85^0 N, 20.38^0 E). Statistical results show that the magnitude of the VLF perturbations is in correlation with intensity of X-ray and solar zenith angle. The focus of this work is on the study of untypical perturbations of VLF radio signals and to define their cause.

Poster

DIGITAL ALMANAC - ELEMENTS AND TABLES OF THE PHYSICAL AND MATHEMATICAL EPHEMERIS OF THE SOLAR SYSTEM BODIES

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We present the program to calculate and generate arbitrary tables of the physical and mathematical ephemeris of the Solar system bodies according to the Jet Propulsion Laboratory Development Ephemeris (JPL DE). This program has also been used as a basis and guide for the student on the classes of Ephemeris astronomy in which they are required to upgrade the program by introducing some additional possibilities, e.g. plotting of arbitrary data such as positions, magnitudes, observational parameters etc. or by adding more bodies to the basis, primarily asteroids and natural satellites.

Poster

SUPERNOVA REMNANTS AND THEIR INFLUENCE ON Hα DERIVED STAR FORMATION RATES

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In this paper we present the available sample of detected supernova remnants (SNRs) in optical range in 25 nearby galaxies. We also discuss the contribution of the Hα flux from the SNRs to the total Hα flux and its influence to the derived star formation rate (SFR) for each galaxy. We obtain for the contribution of SNRs' flux to the total Hα flux up to 15% for analyzed galaxies. Due to the observational selection effects, the contamination of derived SFRs by SNRs obtained in this paper represents only a lower limit.

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Poster

USE OF COMPLEX EVENT PROCESSING ENGINES IN TIME-DOMAIN ASTRONOMY

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The volume and complexity of events that need to be processed in high-growth industries (such as finance, telecommunications, banking, medicine etc.) rapidly expands. New paradigms and tools have emerged for handling such events. Complex event processing (CEP) engines offer a) scalability which cannot be easily achieved through previous standard practices b) loose coupling between processing logic and mainstream application code and c) decoupling between event producers and consumers.

Upcoming large synoptic surveys, such as LSST, will produce stream of real-time transient alerts. These alerts will need to be ingested, filtered and processed in timely fashion with temporal inference mechanism being applied. We investigate a possible application of the CEP engines on a stream of astronomical transient alerts.

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PhD and Master Theses

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XVII NATIONAL CONFERENCE OF ASTRONOMERS OF SERBIA
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PhD Thesis

DETERMINATION OF THE DIFFERENCE BETWEEN DYNAMICAL TIME AND UNIVERSAL TIME AND PREDICTIONS OF VARIATIONS IN THE EARTH'S ROTATION

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The problem of precise prediction of the Earth's spatial orientation is directly related to the knowledge of the forthcoming values of the Earth's rotation parameters, by the use of which the transformations between celestial and terrestrial reference systems are carried out. These parameters depend upon a multitude of astronomical and geophysical causes; however, for their combined (simultaneous) effects no adequate theoretical models are available to describe precisely enough the changes in the Earth's orientation. Therefore, the predictions of the Earth's rotation parameters to a lower extent rely on geophysical theories, and more on mathematical modeling based on various numerical methods.

The objective of the thesis was to demonstrate that it is possible, applying mathematical approach exclusively (without using geophysical models and corrections) to achieve improvements in predicting the non-uniformities of UT1 universal time scale. It is a common knowledge that this parameter features the fastest and highest change, since it completely reflects the Earth's rotation with all its non-uniformities, and consequently its predictions feature the lowest accuracy.

The original numerical method for deriving approximate functions having the form of the sum of harmonics and exponentials (HE) is applied in the thesis. Based on actual data, 10-day, 30-day and 500-day predictions were done in the continual one and a half year period. In addition, presented were the actual achievements of a long-term prediction that, applying the same method, had been accomplished before.

The obtained results were compared to the respective results of other authors, who applied different prediction methods in the course of the international project "Earth Orientation Parameters Prediction Comparison Campaign" (EOPPCC). The HE method proved to release similar results as other methods of 10-day and 30-day predictions; however, in case of 500-day predictions it produced convincingly superior results. This method is actually suitable for longer interval predictions; this fact is confirmed by so far (after eight years) achieved results of a ten-year prediction.

The implied conclusion is that the prediction of the value ΔT, which is released in astronomical almanacs, could be considerably upgraded by using the HE method.

PhD Thesis

DETECTION OF TERRESTRIAL IONOSPHERIC PERTURBATIONS CAUSED BY DIFFERENT ASTROPHYSICAL PHENOMENA

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In this paper, we present our results of investigation of perturbations in the ionospheric D-region caused by different astrophysical phenomena. We considered induced time variations of electron density during solar X-flares, generation of gravity and acoustic waves by solar terminator, and possibility of gamma ray burst detection by very low frequency radio signals. The studies are performed through analyses of data bases related to radio signals emitted by worldwide distributed transmitters and recorded by the receiver located in Belgrade in real time.

Master Thesis

THE APPLICATION OF THE FBILI METHOD TO THE SOLUTION OF RADIATIVE TRANSFER PROBLEMS IN MOVING MEDIA

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The application of the fast convergent Forth-and-Back Implicit Lambda Iteration (FBILI) method to the solution of the two-level atom line transfer problems in moving media with low velocity fields is presented. Two astrophysically important problems are solved and discussed: (a) line formation in a plan-parallel moving slab of finite thickness, and (b) line formation in a spherically symmetric expanding stellar atmosphere.

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Master Thesis

RELATIVE-COORDINATE DETERMINATION FOR VISUAL DOUBLE STARS BY APPLYING FOURIER TRANSFORMS

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Here we discuss a software developed for the purpose of determining the relative coordinates (position angle θ and separation ρ) for visual double or multiple stars. It is based on application of the Fourier transforms in treating CCD frames of these systems. The objective was to determine the relative coordinates automatically to an extent as large as possible. In this way the time needed for the treatment of many CCD frames becomes shorter. The abilities and limitations of the software are also examined. Besides, the possibility of improving it is also considered. The software has been tested and checked on a sample containing CCD frames of 165 double or multiple stars, obtained with the 2m telescope at NAO Rozhen in Bulgaria in October 2011. The results have been compared to the corresponding results obtained by applying different softwares and the agreement is very good.

Master Thesis

APPLICATION OF FRIEDMANN EQUATIONS IN ANALYSIS OF COSMOLOGICAL CONSTANTS

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Hereby we discuss cosmological constants and their evolution through epochs. This is based on solutions of Friedmann equations.

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Master Thesis

LINE PROFILE VARIABILITY IN GALACTIC B SUPERGIANTS

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Many B-type supergiants are reported to show both spectroscopic and photometric variability. In addition, their line profiles show an excess broadening, typically referred to as macroturbulence. While the cause for these variabilities and the macroturbulence are not clear yet, pulsations seem to play an important role: They influence the radial velocity, width and shape of photospheric lines. To investigate these phenomena, we employ the moment method and the fast Fourier transform method. We apply these methods to selected atmospheric lines of a sample of B-type supergiants to search for pulsational indications.

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PhD Thesis

STATISTICS OF LANGMUIR WAVES ASSOCIATED WITH TYPE III SOLAR RADIO BURSTS

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Sixteen years of radio, waves and particles data recorded by the Wind spacecraft are examined searching for type III solar radio bursts observed *in situ*. Applying rigorous criteria, a data set of 36 high-quality events is selected. With such a numerous data set, which is statistically representative of the studied phenomenon, it is now possible to constrain observationally and with a better confidence the type III generation models. For each of the events, the precise shape of the Langmuir wave power distribution observed in the spectral domain is determined. These observed distributions are modeled by a Pearson system of probability distributions. It is shown that the probability distributions of the logarithm of the Langmuir waves power spectral density belong to three "main" types of Pearson's probability distributions: type I, IV and VI. In addition, the effects of the instrumental integration time of the Wind radio receivers on the observed Langmuir wave power distributions is modelled. The results imply that it is not possible to conclude definitively, that the distribution of the Langmuir waves energy in the real temporal domain is lognormal, as it is predicted in some theories as the Stochastic Growth Theory by Robinson, 1992.

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