Second BELISSIMA Workshop:

FIRST LIGHT OF THE MILANKOVIĆ TELESCOPE

6 - 7 June 2016
Vidojevica (Prokuplje), Serbia

PROGRAM & ABSTRACT BOOK

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Second BELISSIMA Workshop:

FIRST LIGHT OF THE MILANKOVIĆ TELESCOPE

6 - 7 June 2016, Vidojevica (Prokuplje), Serbia

PROGRAM

Sunday, 5th June 2016

dept. at 15:15	Organized transportation from Astronomical Observatory, Belgrade
dept. at 15:30	Organized transportation from Studentski Trg, Belgrade
dept. at 16:00	Organized transportation from parking lot near Buvljak, Belgrade
21:00 - 22:00	Welcome dinner at Beli Kamen, Vidojevica
22:00	Registration

Monday, 6th June 2016

08:00-09:00	Breakfast at Beli Kamen, Vidojevica	
09:30-10:40	Opening session	Željka Dukić, Senior Adviser, Representative of Ministry of Education, Science and Technological Development of the Republic of Serbia, followed by Zoran Knežević (AOB), Gojko Đurašević (AOB)
10:45-11:00	Srđan Samurović	**The BELISSIMA Project (July 2010 -- June 2016)**
11:00-11:30	Cofee Break	
11:30-11:55	Egon Döberl & Phillipp Keller	**BELISSIMA: ASA 1.4m telescope**
12:00-12:15	John Keith Davies	**The OPTICON Trans-National Access Programme**
12:20-12:35	Pavel Kroupa	**The distribution of matter in the Local Group, in the Local Volume and in the Local Universe is not compatible with the dark-matter-based standard model of cosmology (SmoC)**
12:40-12:55	Behnam Javanmardi	**Finding dwarf satellite galaxies outside the Local Group with small telescopes**

13:00-13:15	Michal Bilek	**The wonders of shell galaxies**
13:20-13:35	Viktor L. Afanasiev	**Perspectives of moderate resolution spectroscopy on 1-2 m size telescopes - tasks and instruments**
13:40-13:55	Imre Barna Bíró	**The elimination of stray light in the reflecting telescopes of Baja Astronomical Observatory**
14:30-16:00	Working lunch at Beli Kamen, Vidojevica	
16:30	Field trip to the Astronomical Station Vidojevica (~2.5km away)	
17:00	Visit to the telescopes	
20:00-21:00	Dinner at Beli Kamen, Vidojevica	
22:00	Remote observation session with the Milanković Telescope (if weather permits)	

Tuesday, 7th June 2016

9:00-10:00	Breakfast at Beli Kamen, Vidojevica	
10:00-10:15	Zach Ioannou	**A real-time data reduction pipeline for time-series photometry**
10:20-10:35	Tibor Hegedüs	**Some notes on strategies of observational project planning by small ground-based telescopes**
10:40-10:55	Christian Henkel	**Edge-on galaxies in the local Universe and what we can learn from them**
11:00-11:15	János Nuspl	**A Retrospective of Experiences with Small Telescopes**
11:20-11:40	Cofee Break	
11:40-11:55	Ingo Thies	**Simulating disk galaxies and interactions in Milgromian dynamics**
12:00-12:15	Gordana Apostolovska	**Astronomical research in the Republic of Macedonia**
12:20-12:35	Olga Atanacković	**Astronomy education and popularization in Serbia 2012-2016**
12:40-12:55	Nils Wittenburg	**Simulated galaxy formation in MOND with the Phantom of Ramses code**

13:00 – 14:00	Closing ceremony
14:00 - 15:00	Organized transportation from Beli Kamen, Vidojevica to Conference lunch
15:00 - 16:30	Closing lunch at restaurant "Savićevac", Prokuplje
16:30 - 20:00	Organized transportation to Belgrade

The BELISSIMA Project (July 2010 -- June 2016)

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The achievements of the BELISSIMA project, the most ambitious infrastructural project active at the Astronomical Observatory of Belgrade, from the beginning (July 2010) until the end (June 2016) are presented. The most important activities are described and the importance of the project for the future of astronomy in Serbia is outlined.

BELISSIMA: ASA 1.4m telescope

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ASA - Astrosysteme Austria has produced and installed the 1.4m telescope for the BELISSIMA project. The telescope tube and mount structure is entirely made from CNC machined parts and thus a very high accuracy could be achieved which allowed easy assembly and setup. The electronics and drive systems use state of the art direct drive technology and absolute encoders. The telescope was completely pre-installed and star tested at ASA in a special enclosure which is also unique for this telescope size. In the following paper we will describe some details of the telescope design, optics, electronics.

The OPTICON Trans-National Access Programme

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The FP7 OPTICON project is what is known as an Integrated Infrastructure Initiative, (I3). The activities being undertaken are wide ranging and grouped into the three themes which define an I3. These are Networks, Trans-National access and the technology oriented Joint Research Activities. OPTICON has more than 2 dozen contractors spread right across Europe. These contractors comprise national funding agencies, research groups and small commercial enterprises. This paper will describe the operation of the Trans-National Access Activity and present some conclusions after six years of operation.

The distribution of matter in the Local Group, in the Local Volume and in the Local Universe is not compatible with the dark-matter-based standard model of cosmology (SmoC)

Pavel Kroupa
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I will discuss the detailed structure of the satellite systems of the Milky Way and of Andromeda on scales of 500 kpc, the 3D structure of the Local Group of galaxies on a scale of 3Mpc, the distribution of galaxies in the Local Volume on a scale of 16Mpc and the distribution of matter in the Local Universe on a scale of 1+Gpc. The dark-matter-based SMoC is incompatible on all these scales with the data. The Milanković telescope of the BELISSIMA project may prove to be instrumental in surveys for performing further tests of structure formation in non-dark-matter frameworks.

Finding dwarf satellite galaxies outside the Local Group with small telescopes

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While giant telescopes and big surveys keep enhancing our understanding of the Universe, small telescopes have recently proved to be able to play a much more interesting role in performing cutting-edge research than expected. The newly launched Dwarf Galaxy Survey with Amateur Telescopes (DGSAT) which uses long exposure images obtained by 10-80 cm telescopes has, in its first application, already discovered 11 dwarf galaxy candidates around 6 nearby Milky-Way-type galaxies. I will give a summary of this project and will highlight its potential impact on the studies of the small scale problems of the cold dark matter galaxy formation scenario.

The wonders of shell galaxies

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Stellar shells in early-type galaxies are arc-like remnants of accreted satellites. Their observations with the Milanković Telescope could be very useful. I will explain the formation the shells, what they can tell us about the gravitational potential of their host galaxy, and how they can prove or disprove the existence of dark matter.

Perspectives of moderate resolution spectroscopy on 1-2 m size telescopes - tasks and instruments

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The elimination of stray light in the reflecting telescopes of Baja Astronomical Observatory

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A real-time data reduction pipeline for time-series photometry

Zach Ioannou[1] & Milan Bogosavljević[2,3]
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We have developed a real-time data reduction pipeline optimized for stellar time-series photometric observations. The photometry code is controlled through the widely used SAOImage DS9 package via the XPA messaging system. Incoming images from a telescope are processed and accurate photometric and astrometric solutions are available in real-time. Python and Fortran routines are used to determine shifts in pixel-space between successive images and each image is time stamped (if required) with Barcycentric Dynamical Julian Date. The photometry is carried out using both standard aperture as well as Optimal photometry algorithms for maximum S/N extraction. The software package is designed to be modular and requires minimum human supervision so that it can be easily implemented as a real-time robotic telescope photometry pipeline on any observatory.

Some notes on strategies of observational project planning by small ground-based telescopes

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On one side the astronomy of our era is dominated by armada of space telescopes and large aperture ground-based telescopes, of which huge amount of continuous data production gives plentiful research areas for many astronomers. However, no doubt, that these instrumentation needs high amount of permanent financing, enormous human resources just for basic maintenance, operation and preprocession of raw observational material. As the past history of space telescopes showed, their long-time services are limited not only by ever existing technological factors, but many other problems falling far beyond controllability by human knowledge. On the other side, there are several simultaneously existing surveys, and larger-scale continuous sky monitoring projects, carried by smaller instruments, which pour terabytes of data per instrument per night. The weak human resources are extracting some results related with just a very few concrete scientific questions, largest part of these amount is only stored for future use. By investing a moderate cost of 100 kEUR anyone can (and several groups really will) start newer monitoring projects (see FLY'S EYE and other initiatives) causing further unfailing sources of scientific data.
We try to consider, what kind of strategies can be counted in planning ground-based observing projects of a single-aperture, small-field <2 m class telescope can entice with acceptable rate of return of the invested amount of money. Some related astro-climate considerations are also noted.

Edge-on galaxies in the local Universe and what we can learn from them

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The talk will introduce a sample of galaxies with high inclination angle being sufficiently far away for wide field studies of their environment as well as near enough for detailed studies with high linear resolution.

A Retrospective of Experiences with Small Telescopes

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Beside recent and near future large scale ground-based surveys, the increasing amount of space-borne measurement data in certain wavelength regions not available for ground-based devices, makes the role of small telescopes questionable. Hence, installation of a new 1.4 m telescope in Europe might bring this question back for a discussion and make me share our experiences with brand-new and overhauled small telescopes, all equipped with new detectors, several hundred kilometers away. This short overview aims to focus on some of the troubles that cropped up in front of us pursuing leading edge scientific results - without being comprehensive.

Simulating disk galaxies and interactions in Milgromian dynamics

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Since its publication 1983, Milgromian modified Newtonian dynamics (MOND) has been very successful in modelling the gravitational potential of galaxies from baryonic matter alone. However, the dynamical modelling has long been an unsolved issue. In particular, the setup of a stable galaxy for Milgromian N-body calculations has been a major challenge. Here, I will show a way to set up disc galaxies in MOND for calculations in the PHANTOM OF RAMSES (POR) code by Lüghausen (2015) and Teyssier (2002). The method is done by solving the QUMOND Poisson equations based on a baryonic and a phantom dark matter term. The resulting galaxy models are stable after a brief settling period for a large mass and size range. I will show simulations of single galaxies as well as colliding galaxies.

Astronomical research in the Republic of Macedonia

Gordana Apostolovska & Olgica Kuzmanovska
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The short preview of the of history of astronomy, as well as the actual situation in astronomical education and research in the Republic of Macedonia are presented.
In our collaboration with the Solar System group from the Institute of Astronomy, BAS from the Republic of Bulgaria the main targets of astronomical observations performed at NAO Rozhen (071) are asteroids. The importance of actual asteroid research and the possibilities for astrometry, photometry and spectroscopy of asteroids with the new robotic telescope Milankovic are discussed.

Astronomy education and popularization in Serbia 2012-2016

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A review on astronomy education at all levels (elementary and secondary schools, universities) and popularization of astronomy in Serbia in the past four years is given. An emphasis is put on recent changes introduced in the accredited programs at all five state universities, students summer practices (since 2012) held at the Astronomical Station on the mountain Vidojevica, the role of the Petnica Science Center and its programs in astronomy education at secondary schools and on the participation of the Serbian team in the International Astronomy Olympiads. The importance of new 1,4m telescope "Milanković" in training of future researchers as well as in public outreach in Serbia is discussed. The numerous amateur astronomical societies in Serbia are presented and the growing activities in stimulating public understanding and appreciation of astronomy are summarized.

Simulated galaxy formation in MOND with the Phantom of Ramses code

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In 1983 M. Milgrom published the first formulation of modified Newtonian dynamics (MOND) and since then several relativistic and non-relativistic formulations of Mondian theories have been developed. Moreover the Mondian framework has been very successful in matching observations and measurement on galaxy scales. It correctly predicted the gravitational potential and rotation curve of galaxies from their baryons alone, also galaxy scaling relations e.g. the baryonic Tully-Fisher relation, and it lead to the discovery of new relations such as the mass discrepancy-acceleration relation.Despite having great success on these scales, there are only two hydrodynamical N-body simulation codes available to model galaxies, which were just recently developed. Both codes - RAYMOND and Phantom of Ramses (POR) - are based on the well known simulation code RAMSES (Teyssier 2002) and all simulations in this work are done with the publicly available POR code.The basic idea of this work is to evolve single gas spheres in a Mondian framework completely without dark matter and to see weather galaxies could have formed from them. First results will be shown, where two models (A and B) are examined. Both start with nearly the same initial conditions but sphere A is smaller and denser than sphere B. Surpisingly the outcome is very different as the dens model produces a single galaxy and the other a compact group of smaller galaxies, which is morphologically similar to the so called Hickson compact groups (HCG). This work is still ongoing and future effort will be put into the addition of more baryonic processes, variations of several initial parameters and the development of new output routines to calculate the rotation curves and star formation histories, especially for the compact group galaxies.

CCD observations of visual double stars at Vidojevica

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In this paper we present CCD observations of visual double stars by using CCD cameras SBIG ST-10ME and Apogee Alta U42 attached to the 60 cm telescope at Vidojevica in the period 2011 to 2016. The results of these measurements (position angles and angular separations) were used for establishing the nature of this system, i.e. to answer the question whether they are or not gravitationally bound and, after then, for calculation of the orbital or the linear elements.

The 60 cm ASV telescope in line with WEBT and Gaia-FUN-TO projects

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At the Astronomical Observatory (AOB, Belgrade, Serbia) we started the observations of blazars using the 60 cm telescope at Astronomical Station Vidojevica (ASV) at the beginning of 2013. At that time, we established a cooperation with the Astronomical Observatory of Torino as an international center for the Whole Earth Blazar Telescope – WEBT program. As result, about 20 objects were observed (in BVRI filters) until the end of 2015 (Carnerero et al. 2015, Raiteri et al. 2015, Furniss et al. 2015, Bhatta et al. 2015).
The satellite of Gaia mission was launched at the end of 2013. It is the cornerstone of the European Space Agency (ESA). The Gaia started the astronomical observations in August 2014, and the Gaia Photometric Science Alerts published alerts since October 2014. The main goal is to map the entire Galaxy, about one billion stars, and near 600 000 quasars (QSOs), but there are some subprojects as Gaia Follow Up Network for Transients Objects (Gaia-FUN-TO). Using the 60 cm telescope at ASV (of AOB, Serbia) we observed few objects of Gaia-FUN-TO for the test phase in 2013 and 2014, and about 20 objects were observed until the end of 2015 (near 600 CCD images in BVRI filters). Some objects are very rare ones as the eclipsing AM Cvn Gaia14aae one. We observed that object in October 2014. The paper about that was published (Campbell et al. 2015).

Bhatta, G., et al.: 2015, Astrophysical Journal Letters, 809, L27.
Campbell, H. C. et al.: 2015, MNRAS, 452, 1960.
Carnerero, M. I., et al.: 2015, MNRAS, 450, 2677.
Furniss, A., et al.: 2015, Astrophysical Journal, 812, 65.
Raiteri, C. M., et al.: 2015, MNRAS, 454, 353.

Inflation and Dark Matter in the RSII Model

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Classical and quantum dynamics of a wide class of models with the DBI-type Lagrangian with tachyon-like potentials are considered. This investigation is motivated by string theory and D-brane dynamics.
A simple tachyon model can be discussed in the framework of the second Randall-Sundrum (RSII) model. It was shown that one additional 3-brane moving in the AdS5 background of the RSII model behaves effectively as a tachyon field with the inverse quartic potential. The tachyon model of this kind falls into the class of the power-low tachyon potentials . In addition to tachyon field, the second scalar field (radion) is present in the RSII model. Radion is a massless scalar field that causes a distortion of the bulk geometry. A coupling of the tachyon with the radion and its effects on the tachyon inflation in the RSII model are discussed.
The bulk space-time metric of the extended RSII model which includes back-reaction of radion is given by the Fefferman-Graham coordinates. Hamilton's equations are derived in accordance with this metric and numerically solved. The slow-roll parameters of inflation, and observational parameters: scalar spectral index (n) and tensor-scalar ratio (r), are computed. Obtained results are compared with observational data from the Planck. The results partially fit to observational constrains and an influence of the radion field has a positive effect to the results obtained for the pure tachyon potential.
Besides, the phase of reheating after inflation and the problem of dark matter dominance are discussed.

Dynamical modelling of NGC 2841

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We study the dynamics of the massive spiral galaxy NGC 2841 using recent and detailed measurements of the rotation curve (RC) from HI observations, as well as contributions from the neutral gas and luminous matter. Navarro, Frenk & White (NFW) and isothermal halo models were used for dark matter, as well as several MOND models. Latest stellar population synthesis (SPS) models combining metallicity and age as indicators of the stellar mass-to-light ratio, were used for reducing the number of free parameters in the modeling. Best-fitting values of the stellar mass-to-light ratio agree with predictions from the SPS models based on the Kroupa initial mass function (IMF) in all tested models, with the exception of the MOND toy model. The fits of comparably good quality were obtained in the case of NFW and standard MOND models.

The activities of the project "Stellar physics"

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The project "Stellar physics" deals with a wide spectrum of topics in astrophysics. The main subject of investigation are interactive binary systems. Photometric and spectroscopic data are analyzed using a sophisticated mathematical model developed by G. Đurašević. Recent extensions made by A. Čeki and O. Latković make it possible to use the model to study non-radial stellar oscillations in eclipsing binary systems. O. Atanacković, I. Milić and I. Pirković specialize in theory of stellar atmospheres and its applications, such as modeling the polarization of light from stars and circumstellar disks. S. Jankov has been involved in the VLTI interferometric studies of Be-stars, while B. Arbutina collaborates with the group on finding a theoretical explanation for the phenomenon of double-periodic variables. M. Jurkovic focuses on the study of Type II Cepheids. All these diverse subjects of research within the project "Stellar physics" will benefit greatly from the observations done with the new 1.4 meter telescope.

A new density formula applicable to dark coronae

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A new density formula is proposed, applicable to dark coronae of galaxies. The density is assumed to be stationary and spherically symmetric; in the outer parts its approximate behavior is decreasing with the third power of the distance. Some well-known density laws, for instance that of Navarro, Frenk and White, appear as special cases of the new formula.

Near future speckle interferometer at Vidojevica

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For speckle interferometry it is necessary to evaluate short-exposure photographs, because only short-exposure images carry diffraction-limited information. The exposure time has to be about 0.01 sec or shorter in order to "freeze" the turbulent atmosphere. Right now we are expecting to get such a camera capable of recording very short exposure time. Actually, it is Andor iXon Ultra 897 camera with which we plan to begin speckle interferometry in the near future on the telescope Milanković at Vidojevica.

Full Stellar Kinematical Profiles of Central Parts of Nearby Galaxies

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In this contribution we present the details about the largest catalog of detailed stellar kinematics central parts of of nearby galaxies. The kinematics includes higher moments of the line-of-sight velocity distribution (LOSVD) function represented by the Gauss-Hermite series and is measured on a sample of galaxies selected from the Arecibo Legacy Fast ALFA (Alfalfa) survey using spectroscopy from the Sloan Digital Sky Survey (SDSS DR7). We study the consequences of the oversimplification of the LOSVD function with the Gaussian function on the velocity dispersion for two sets of stellar libraries, the empirical and the synthetic. For the empirical stellar library, this approximation leads to an increase of the virial mass of 13 % on average, while for the synthetic library the effect is weaker, with the increase of 9 %, on the average. We also show that the kurtotic parameter describing symmetrical departures from the Gaussian increases along the continuous morphological sequence from late- to early-type galaxies.

Examination of Galactocentric Orbits for SPOCS Catalogue

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Galactocentric orbits are calculated by using a gravitational potential of the Milky Way given analytically. Distribution of orbital eccentricities is also presented. A prominent peak is seen about eccentricity value 0.1.

NOTES

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Gojko Đurašević
Zorica Cvetković
Zoran Knežević
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Monika I. Jurkovic
Nemanja Martinović
Miodrag Sekulić
Milan Stojanović
Nataša Todorović

This workshop was made possible through support provided by the European Commission through project BELISSIMA (BELgrade Initiative for Space Science, Instrumentation and Modelling in Astrophysics, call FP7-REGPOT-2010-5, contract no. 256772).