IBWS 2015
BOOK OF ABSTRACTS

12th INTEGRAL/BART Workshop

`http://www.ibws.cz`

April 20-24, 2015
Karlovy Vary (Carlsbad), Czech Republic
`(GPS: 50° 13’ 4.3896’’ N, 14° 12’ 49.62438’’ E)`

IBWS 2015 is 12th in the series of successful workshops dedicated to high energy astrophysics and supporting ground-based experiments (e.g. robotic telescopes). The workshop will include Small satellite day with the objective to bring together scientific experimenters and payload providers with the small satellite designers and realizers.

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Astronomical Institute of the Academy of Sciences
Czech Technical University in Prague
Karlovy Vary observatory
Dr. Remeis observatory Bamberg
University Wuerzburg

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IBWS Workshops Introduction and Historical Background

Rene Hudec

A short introduction to IBWS Workshops and Historical Background will be given

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Milan Kadera

Space Activities in the Czech Republic

Giovannelli Franco

Frontier Research in Astrophysics: A Short Cruise

In this short cruise I will discuss the most important old and new results obtained in astrophysics by means of space- and ground-based experiments that provided a strong acceleration on the knowledge of the physics of our Universe within the framework of current theoretical knowledge and its possible advancing. Because of the obvious limits of my knowledge, and of the length of this paper, I will present a selection of results without any pretension of completeness.

Giovannelli Franco

Low energy indicators of high energy processes in X-ray pulsars: A possible general model

Franco Giovannelli (1), Corinne Rossi (2), Gennady Bisnovatyi-Kogan (3, 4), Ivan Bruni (5), Fabio Martinelli (6), Javier Salas-Procas (7) (1) INAF - Istituto di Astrofisica e Planetologia Spaziali, Roma (2) Dpt of Physics University of Roma "La Sapienza" (3) Space Research Institute, Moscow (4) National Research Nuclear University MEPhI, Moscow (5) INAF - Osservatorio Astronomico di Bologna, Stazione Astronomica di Loiano (6) Montecatini Val di Cecina Astronomical Centre (7) Agrupación Astronómica de Huesca Abstract ======= In this paper we will discuss a long series of data obtained with observations of the X-ray pulsar A0535+26 and its optical Be-companion HDE 245770. The results demonstrate that optical luminosity brightening of HDE 245770, occurring around the periastron passage, precedes the subsequent X-ray outburst of A0535+26 of about 8 days. Such a delay is the time necessary to the matter coming from the Be star for crossing the temporary viscous accretion disk formed around the neutron star, until reaching its polar caps. The model developed for explaining such a delay seems to be general for the class of X-ray pulsars and more, like CVs, and AGNs.

Vojtech Simon

Monitoring the soft X-ray transient Aql X-1

We will show the long-term activity of the soft X-ray transient Aql X-1. This system which contains a mass-accreting neutron star displays outbursts with the recurrence time of about 200 - 300 days. The profile of the outburst largely differs for various energy bands not only as regards their profiles, but also as regards the duration of the event and the time of the peak intensity.

Marcus Langejahn

Hard X-ray Emission of Blazars and Other AGN with Swift/BAT

The AGN subclass of blazars is notoriously hard to detect at hard X-rays due to their low emission in this energy range. Using the Swift/BAT all sky survey at 14-200 keV, and covering 104 months of integrated emission, we evaluate the signal-to-noise distributions compared to the background noise distribution for statistical samples of faint sources. This approach reveals a large number of hundreds of blazars in a frequency band with only a few associated sources currently known. Detection statistics differ substantially between different sources samples, allowing us to constrain the broadband spectral energy distributions and address the question of the nature of unassociated Fermi gamma-ray sources.

Matthias Kuehnel

The Fit Statistics of Simultaneous Fits in ISIS

In a previous work we have introduced a new tool for analyzing multiple datasets and datatypes at the same time, which has been implemented into the Interactive Spectral Interpretation System (ISIS). However, the large number of degrees of freedom as well as many individual datasets lead to the question whether the traditional fit-statistics are still a good measure for the quality of a fit. We will present ongoing work and ideas for new fit statistics, which take, e.g., the physical context of the datasets into account. Furthermore, we show that by combining the residuals of all datasets weak features can be detected, which are not visible in an indivudal dataset.

Ralf Ballhausen

The 2013 outburst of KS 1947+300 as seen by Suzaku

KS 1947+300 is a transient X-ray binary consisting of a neutron star and a Be companion. The system underwent an outburst in 2013 after more than 10 years of quiescence, reaching a peak luminosity of ∼300 mCrab in the Swift/BAT band. We present a detailed study of two Suzaku observations of this outburst. The pulse profiles are found to be highly energy-dependent showing an unusual evolution from one broad peak to two peaks towards higher energies. The continuum is modeled with an absorbed powerlaw with a high-energy cut-off and an additional blackbody component. We find indications for the presence of fluorescent emission from both neutral and He-like iron, which is the first time multiple ionization states of iron are detected in this source. The pulse phase-resolved spectral analysis shows moderate spectral variation over pulse phase, involving both continuum components as well as the strength of the absorption. Determining the source-intrinsic variability is complicated by artificial parameter correlations of the empirical continuum model. Taking these effects into account, we discuss spectral differences for different viewing angles as well as possible intrinsic parameter correlations.

Falkner Sebastian

Self-consistent simulations of the observable flux of accreting neutron stars

We present our ongoing work on self-consistent simulations of the observable flux of accretion powered, magnetized X-ray pulsars. Applying a new Monte Carlo code simulating cyclotron resonant scattering features by propagating photons in flexibly configurable geometries, we produce intrinsic emission profiles of an accretion column. Based on these emission profiles we calculate the observed phase and energy dependent flux using a general relativistic light bending code. We developed this code to simulate pulse profiles of pulsars. It allows for arbitrary geometries and emission profiles of the emission region (e.g., accretion column), while keeping the computational time low.

Rene Hudec

Recent Results in Photographic Archives Digitization

Recent Results in astronomical Photographic Archives Digitization will be given and and possible applications in high energy astrophysics will be discussed

Vojtech Simon

The optical long-term activity of the high-energy sources: Perspectives for GAIA

We will discuss the possibilities of observing the optical counterparts of high-energy cosmic sources of various types in the data from the Gaia satellite. We will show that identification of optical afterglows of gamma-ray bursts can be made using their very specific color indices. We will also show how the active optical counterparts of binary high-energy sources can be classified and studied by the statistical methods even in the sampled data which will be provided by the Gaia satellite.

Petr Skala

Measurement of properties of wide field lenses

How to measure MTF and other important properties of wide field lenses if they are not spatially invariant?

Gennady Bisnovatyi-Kogan

SGR and AXP - are they magnetars?

Some data are presented about observations of Soft Gamma-ray Repeaters (SGR) and Anomalous X-ray Pulsars (AXP) in different spectral regions. It is noted that there are ordinary radiopulsars with very strong magnetic fields, up to 10^{14} Gs, and slow rotation, with periods 8 seconds, which don't show any pecularity, or differences from a stardard radiopuslar behaviour. From the other side there are SGR with normal pulsar field , 10^{12} Gs. The conclusion is made that there is an additional parameter which determines an unusual behaviour of some neutron stars, and anomalously small NS mass is suggested as such parameter. The pulsars activity in the gamma-rays is connected with their relative youth and is provided by the energy stored in the non-equilibrium layer located in the crust of low-mass neutron stars. It is shown that the mass and the thickness of the non-equilibrium layer increase nonlinearly with decreasing of the NS mass. The energy release happens due to mixing of the accreted matter with the matter of the neutron star crust with super heavy nuclei, which approache the NS surface and become unstable. The nuclear fission in the low-density region initiates chain reactions leading to the nuclear explosion. The outbursts are likely to be triggered by an instability developing in the region where the matter accreted by the neutron star is accumulated at the magnetic pole regions. A possibility is analysed for an explanation of the phenomenon of the AXP and SGR within a scenario of fall-back magnetic accretion onto a young isolated neutron star. The X-ray emission of the pulsar in this case is originated due to accretion of matter onto the surface of the neutron star from the highly magnetized accretion disk, surrounding its magnetosphere.

József Kóbori

Orphan afterglow rate with future sky survey programs

Gamma-ray bursts are high-energy astrophysical phenomena. After the prompt gamma-emission a multiwavelength afterglow can be observed produced when a highly relativistic outflow encounters the progenitorś circumburst medium. If the outflow is beamed into a narrow jet the shape of the detected lightcurve strongly depends on the angle enlcosed by the observerś line of sight and the jetś symmetry axis. If this angle is larger than the jet original half opening angle the prompt emission might be missed and an orphan afterglow is detected. Using theoretical considerations we determine the expected rate of orphan afterglows to be detected by various future sky survey programs. Our results show significantly lower rates compared to previous works.

Schmidl Sebastian

Two recent GRB supernovae observed with GROND and VLT

Long GRBs at low redshift (z $<$ 1) can be accompanied by an observable type Ic Supernova. In the Swift era (2005+) typically 1-2 GRB-SNe are spectroscopically confirmed per year, resulting in a total sample size of only about 15 events so far. Here I report about 2 recent GRB Supernovae (GRB 120714B at z= 0.40, GRB 130831A at z = 0.48), which were followed-up by GROND at the 2.2m telescope on La Silla and were pectroscopically confirmed with the VLT by our team. I discuss the light curves from the first hours up to several months after the burst in all 7 GROND bands (gŕíźJHK). In addition, I present the results obtained from our VLT spectra around the time of the corresponding SN peak.

Maria D. Caballero-Garcia

Initial follow-up of optical transients using BOOTES (part II)

Important advances in the astrophysical research community during the recent years have been done thanks to the advent of robotic telescopes. They have been designed to perform continuous observing campaigns of the sky, inverting most of their time in the discovery and classification of new (sometimes unexpected) sources. BOOTES is a world-wide web of (50-60 cm) robotic telescopes that has been developed during the last years. Besides the follow-up of the Gamma-ray Bursts, the main goal is the follow-up of optical transients in the sky (either of known/unknown nature). We will show some of the results obtained from our own observing campaigns.

Martin Topinka

Machine learning classification of short transient γ-ray events

+/- what the title says, trained on the INTEGRAL IBIS/ISGRI data.

Robert Filgas

PICO - Search for Dark Matter with Bubble Chambers

The PICASSO and COUPP collaborations use superheated liquid detectors to search for cold dark matter through the direct detection of weakly interacting massive particles (WIMPs). These experiments, located in the underground laboratory of SNOLAB, Canada, detect phase transitions triggered by nuclear recoils in the keV range induced by interactions with WIMPs. We present details of the construction and operation of these detectors as well as the results, obtained by several years of observations. We also introduce PICO, a joint effort of the two collaborations to build a second generation ton-scale bubble chamber with 250 liters of active liquid.

Martin Blazek

Simulator of stellar crowded fields

Due to the existence of noise in astronomical data no certainty is given for the existence of mathematically exact result of stellar deconvolution and iterative or other methods such as aperture or profile photometry are commonly used. Iterative methods are important namely in the case of crowded fields (eg. globular clusters). For the tests of efficiency of those iterative methods on various stellar fields information about real fluxes of sources is essential. For that purpose simulator of artificial images with crowded stellar fields brings this initial information of source fluxes for robust statistical comparison of various deconvolution methods. Simulator GlencoeSim consider various settings of Point-Spread Functions, noise types and spatial distributions with the aim to produce as realistic astronomical optical stellar image as possible.

Gabriel Szász

Dawn of the Scientific Cloud Computing

Cloud computing is undoubtedly changing whole paradigm of the IT as we knew it. By standing on the edge of a revolution, we are finally getting closer to the solution of the data avalanche - one of the most prominent problems of the modern science. We will discuss advantages of using cloud computing in contemporary astrophysics. In a short demo, we will also introduce OpenStack as an example of the open source cloud platform.

Vladimír Tichý

Mathematical descriptions of multi-foil optics

The contribution is aimed to methods First, numerical method based on simplifying common ray-tracing procedure is presented. Some optics, like Schmidt lobster eye does not require to calculate traces of all rays are necessary to simulate but only of few ones. Therefore, the presented method is extremely effective. Moreover, to simplify the equations, the specific mathematical formalism is used. Because only few simple equations are used only, the program code can be simple as well.

Joern Wilms

The ATHENA end to end simulations

ATHENA, to be launched in 2028, is the next large X-ray observatory. The mission is currently in its definition phase. As part of the definition, a large number of science simulations are to be performed to understand the scientific performance of the mission. In this talk I will present an overview of the end-to-end simulation framework for the ATHENA mission.

Carlos Granja

Quantum Imaging Detection and Directional Visualization of Space Radiation with SATRAM/Timepix Spacecraft Payload in LEO Orbit

The compact light weight SATRAM payload is operating in on-board ESA's Proba-V satellite in low Earth orbit since May 2013. Equipped with the Timepix detector the device can determine the composition and spectral characteristics of ionizing radiation (X-ray, light and heavy charged particles) in the satellite environment. Single quantum counting capability and per-pixel energy sensitivity enable quantum-level detection, high resolution tracking, LET sensitivity and directional visualization of energetic charged particles over a wide dynamic range of particle fluxes, energies and wide field of view. A description of the payload is presented together with preliminary data results such as spatial and time correlated maps of particle flux along the satellite orbit.

Rene Hudec

ESA M4 Candidate Missions with Czech Participation

ESA M4 Candidate Missions LOFT and THESEUS with Czech Participation will be presented and discussed

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Martin Jelinek

Observing GRBs with Robotic Telescopes

I will re-perform my PhD defense talk from last November. GRBs, Telescopes BOOTES, Spectrograph COLORES.

Jan Strobl

Autonomous robotic telescopes in Ondrejov: D50 & BART

We would like to present the actual state, recent advances and results of our autonomous robotic telescopes BART & D50, both located in historical part of observatory in Ondrejov, Czech Republic.

Martin Topinka

Personal Space

Igniting interest in astronomy by showing deep sky objects in the patch of the sky above your head. It's not a real talk, I am advertising that Personal Space is looking for a coder.

Klauss Schilling

Picosatellites

Vladimír Dániel

VZLUSAT-1 EQM and PFM testing campaign

The testing campaign of EQM and PFM model of 2U CubeSat VZLUSAT-1 is presented. The EQM testing campaign take part in the Q4 of 2014, the PFM campaign is planned to Q1 and Q2 of 2015. The testing campaign includes assembly of the nanosatellite in the cleanroom, functional testing of platform and payloads, vibration and shock tests and thermal vacuum testing. For the PFM the testing campaign includes also the end to end test of radio communication with ground segment.

Vladimír Tichý

Optical study of nano-satellite x-ray monitor

The Schmidt lobster eye design for a grazing incidence X-ray optics provides wide field of view of the order of many degrees, for this reason it can be a convenient approach for the construction of space X-ray monitors. Schmidt lobster eye is possible to assemble in various scales of dimensions and also dimensions and focal lengths acceptable for nano-class satellites are possible. In this paper, draft of nano-class space mission providing monitoring of specific sky area is presented. Preliminary optical design study for such mission is performed. Two of possible opticle designs are presented. For those designs, field of view, effective input area and other basic optical parameters are calculated.

Ladislav Pina

X-ray monitoring for astrophysical applications on Cubesat

The primary objective of the project VZLUSAT-1 is the development, manufacturing, qualification and experimental verification of products and technologies in Earth orbit (IOD – In-Orbit Demonstration). This work addresses the issue of X-ray monitoring for astrophysical applications. The proposed wide-field optical system has not been used in space yet. The proposed novel approach is based on the use of 1D "Lobster eye" optics in combination with Timepix X-ray detector in the energy range 3 - 40 keV. The proposed project includes theoretical study and a functional sample of the Timepix X-ray detector with multifoil wide-field X-ray "Lobster eye" optics. Using optics to focus X-rays on a detector is the only solution in cases the intensity of impinging X-ray radiation is below the sensitivity of the detector, e.g. while monitoring astrophysical objects in space, or phenomena in the Earth's atmosphere. On board the functions and features of Radiation Hardened Composite Housing (RHCH), Solar panels based on composite substrate and Hollow Retro Reflector Array based on composite (HRRA) will be verified. To verify the properties of the developed products the satellite is equipped by Health Monitoring system (HM). HM system includes temperature, volatiles, radiation and mechanical properties sensors. The custom ADCS algorithms are being developed within the project. Given the number of IOD experiments and the necessary power the 1U CubeSat is equipped with Composite Deployable Panels (CDP) where HM panels and additional Solar panels are located. Satellite platform is assembled from commercial parts. Mission VZLUSAT-1 is planned for 6 months with launch in 2016.

Martin Urban

Measurement of evaporation and evaluation of changes of the mechanical properties on nanosatellite

The goal of the measurement of gas in space is detection of vaporization of some residual water or other substances from material. To check this there will be placed several different types of sensors in the probe. These sensors were assembled to the PCB Measurement board. Four of them are digital sensors with integrated thermometer. Last three sensors are HAL2 type measured by PicoCap2. These sensors are analogue and return value is ratio of capacity compared to nominal capacity. From these values are calculated humidity. Mechanical changes are evaluated by using Fast Fourier Transform. With FFT are analysed changes in resonance frequency by the time.

Ondrej Nentvich

Measurement of mechanical properties of carbon-fibre composite on nanosatellite

The goal of the measurement is to determine mechanical properties like resonant frequency and attenuation coefficient. Measurement on the nanosatellite is different compared to the spaceships or to the Earth. It is limited by space in the probe, weight of equipment and amount of data which is possible to transfer. Idea of the experiment is that coil excites beam, made from carbon-fibre composite. It produces oscillations which are recorded by microcontroller. Signal is evaluated by Fast Fourier Transform (FFT) and gives some peaks according to the resonant frequencies. Very precise frequencies are required so FFT has many points of transformation. Attenuation coefficient is gained from averaged signal and computed by method of logarithmic decrement of attenuation. All calculations are made on the orbit. Final data like resonant frequencies, attenuation coefficient, temperatures and position of the probe will be sent the earth but not sampled signal, because of amount of data.

Veronika Stehlikova

Study of radiation impact on orbit

The new carbon fiber material will be tested as shielding material for future usage on large satellites. The Cube carries three PIN diodes and one TeCd detector. PIN diodes are shielded with wolfram from behind to eliminate secondary radiation generated inside the probe. Active layers are orientated to the free space and each one of them has different shielding. One is protected by wolfram plate, the second by the tested carbon fiber and the last does not have any covering. Signal from diodes is amplified, led to another board and digitalized. Signals energy is awaited to begin about 10 keV. Data from new material measuring will be compared to reference diodes and final results will be processed on the Earth.

Philip Bangert

Recent Advances in the UWE satellite series

Recent advances in the University Würzburg Experimental satellite programm are the focus of this presentation. The UWE-3 satellite was launched in November 2013 and a short overview over the operational aspects since then will be given. An extensive software update on all satellite subsystems in February 2015 opened up new features and operational capabilities, mostly related to attitude control, of which in-orbit results will be presented. Besides the operation of UWE-3, the successor satellite UWE-4 and plans for future developments will be introduced.

Alexander Kramer

Suitable propulsion systems for a 1U CubeSat

In the scope of the N̈etworked Pico-Satellite Distributed System Controlp̈roject at the Zentrum für Telematik in Gerbrunn, Germany promising propulsion systems suitable for 1U CubeSat missions are examined. The CubeSat standard puts several restrictions on the design possibilities of miniaturized propulsion systems. For this reason only a limited number of already existing propulsive technologies are to be considered for application on a CubeSat. Some promising candidates for this purpose are presented including performance measurement results.

Istvan Racz

Brightness distribution of GRB host galaxies using survival analysis

Authors: I. Racz; Z. Bagoly; L. G. Balazs; L. V. Toth; I. Horvath
We studied the relationship between the Swift GRB data and the optical brightness of the host galaxy measured by the Keck telescope. We calculated the unbiased distribution of the hostś optical brightness by making use the survival analysis. Based on the sample obtained from merging the Swift GRB table and the Keck optical data we studied also the dependence of this distribution on the GRB's data.

Zsolt Bagoly

GRBs and the large scale structure

The spatial distribution of GRBs help expose the large scale structure of the Universe. The homogeneous and isotropic distribution of 361 GRBs with measured precise position and redshift were used to trace the large scale sctructure. We identified a large clustering of GRBs at redshift z $\sim$ 2. The excess cannot be attributed to known selection biases only.

Dominik Hertel

The 2011 giant outburst of 4U0115+634 as seen with Suzaku

We present an analysis of X-ray spectra of the high mass X-ray binary 4U 0115+634 as observed with Suzaku in 2011, July. We moedeled the X-ray spectra with an absorbed cutoff power law modified by iron fluorescence lines and cyclotron resonance features. Our results are consistent with the recent conclusion that the centroid energy of the fundamental cyclotron line of 4U 0115+634 remains constant for all absorved flux ranges, contrary to earlier claims.

Richard Urban

Metadata for digitized astronomical plates

Metadata for digitized astronomical plates represent important issue for investigations using these databases. Description of metadata creation method used for digitization with digital camera will be presented. Metadata from envelopes of astronomical plates are manually transcribed into an electronic database. Currently more than 2000 records of these plates are placed in electronical archive. For more information please visit website www.astroplates.cz .

Ivo Veřtát

Small satellite development at the University of West Bohemia

Identification of all fundamental weaknesses of standardized small satellites, called CubeSats, and the development of new solutions were the main goals of our project. The project focused on efficiency and reliability of solar power generation and accumulation, radiation susceptibility of electronics system and sufficient radio transmission data throughput toward the ground control station.

Rene Hudec

LE X ray monitors as payloads for picosatellites

LE X ray monitors as payloads for picosatellites will be discussed

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Lukas Hudec

In Situ Digitization of Astronomical Photogtaphic Archives

Alternative method for In Situ Digitization of Astronomical Photogtaphic Archives will be discused together with obtained results

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