**Spring Interdepartmental Meeting 2016**

***Date:*** **March, 14th, 2016**

# *Place:* seminar room “behind 2M Telescope”, 49°54'55.9"N 14°46'47.1"E

***Programme:***

13:00 – 13:15 **Vladimír Karas**: **On the direct detection of gravitational waves**

13:15 – 13:20 News from Department of Galaxies and Planetary Systems (J. Palouš)

13:20 – 13:45 **Devaky Kunneriath: The past activity of the Galactic centre**

13:45 – 13:50 News from Department of Interplanetary Matter (P. Spurný)

13:50 – 14:15 **Petr Scheirich: Evolution of binary near-Earth asteroids**

14:15 – 14:30 coffee break

14:30 – 14:35 News from Department of Solar Physics (M. Sobotka)

14:35 – 15:00 **Stanislav Gunár: High-resolution fine-structure synthetic imaging of an entire prominence using 3D whole-prominence fine structure modelling**

15:00 – 15:05 News from Department of Stellar Physics (M. Šlechta)

15:05 – 15:30 **Martin Jelínek: Study of Gamma-Ray Bursts With Robotic Telescopes**

15:30 – 15:45 coffee break

15:45 – 16:30 News from Headquarters and Discussion (V. Karas)

***List of abstracts:***

**Devaky Kunneriath: The past activity of the Galactic centre (Sgr A\*)**

Despite the low level of current activity in the Galactic centre, X-ray reflection from molecular clouds in the Sgr A\* region indicates that the supermassive black hole was orders of magnitude brighter just a few hundred years ago than it is currently. We investigate the idea of the Galactic centre minispiral as the origin of gaseous material for the enhanced past activity of Sgr A\*.
Collisions between clumps of gas in the minispiral can reduce their angular momentum and set some of the clumps on a plunging trajectory towards the supermassive black hole. We demonstrate that the amount of material contained in the minispiral is sufficient to sustain the luminosity of Sgr A\* at the required level. We also study the possibility of the formation of thermal instability in the two-phase minispiral region, enhancing the accretion of clouds by the central black hole.

**Petr Scheirich: Evolution of binary near-Earth asteroids**

To date, about 50 binary near-Earth asteroids, 20 Mars-crossing and 80 small Main Belt binary asteroids are known, most of which were observed within our programme. For three of them we have data spanning more than 14 years, which allow us to study their long-term evolution.

Orbits of natural satellites of asteroids are subject to tidal evolution and the so-called BYORP effect, causing shrinking or expanding of orbit due to solar radiation pressure. If the BYORP
effect is removing angular momentum from the orbit of the satellite, a counterbalance of BYORP and mutual tides can result in a long-term stable solution. I will show the observational evidence of two Binary asteroids with tidally locked satellite and one with long-term evolution of the satellite's orbit.

The observations of long-term evolution have important implications for asteroid geophysics. From the equilibrium between mutual tides and the BYORP effect we can derive a rigidity of the main body, allowing us to reveal whether it has monolithic structure or it is the so-called 'rubble-pile'.

**Stanislav Gunár: High-resolution fine-structure synthetic imaging of an entire prominence using 3D whole-prominence fine structure modelling**

The newly developed 3D whole-prominence fine structure (WPFS) model (Gunár & Mackay 2015) allows us for the first time to simulate entire prominences/filaments including their numerous fine structures. This model combines a 3D magnetic field configuration of an entire prominence obtained from non-linear force-free field simulations, with a detailed description of the prominence plasma. The plasma is located in magnetic dips in hydrostatic equilibrium and is distributed along hundreds of fine structures within the 3D magnetic model. The prominence plasma has realistic density and temperature distributions including the prominence-corona transition region.

To produce the high-resolution synthetic H-alpha images of the WPFS model we use a novel fast approximate radiative transfer visualization technique (Heinzel et al. 2015).  This allows us for the first time to produce images of the prominences in emission on the solar limb and filaments in absorption against the solar disk using a single model. The prominence plasma and magnetic field are described in the WPFS model on scales that allow us to produce synthetic images with resolution matching that of the state-of-the-art Hinode/SOT observations, or indeed that of the upcoming solar observatories, such as DKIST or Solar-C. Moreover, to complement the prominence/filament synthetic images we have consistent information about the magnetic field and plasma parameters everywhere in the modelled prominences. This allows us to investigate the apparent puzzling nature of the observed

prominence and filament fine structures. We can also study the connections between the local configuration of the magnetic field and the observable structure of the finest prominence/filament features. In addition, we are able to investigate the prominence evolution. We can consistently study the influence of the varying photospheric flux distribution on the prominence magnetic field configuration and its effect on the observable prominence plasma.

**Martin Jelínek: Study of Gamma-Ray Bursts With Robotic Telescopes**

I will talk about gamma-ray bursts (GRBs), observed as brief flashes of gamma radiation of cosmic origin. The phenomena, now considered one of the most energetic phenomena in the universe, was discovered in 1967.

Nowadays, with specialized satellites, GRBs are detected and localized automatically, and triggers are generated and sent to ground-based robotic telescopes. This way, a multi wavelength studies, employing data ranging from gamma-rays through X-rays and optical to radio wavelengths, permit a complex view onto these events, since the discovery of the afterglows -- the emission on other wavelengths in 1997.

I will provide a very brief introduction into the GRB physics, followed by a few examples of studies of individual gamma-ray bursts. Then I will briefly present an effort done to summarize all the successful GRB follow-ups performed by BOOTES-1B and BOOTES-2 during the past decade. The last few minutes will be dedicated to the Compact Low Resolution Spectrograph (COLORES), a lightweight FOSC instrument we developed and have been successfully operating at BOOTES-2 since 2012.