

Astrobiologia – ten years after

20 wrzesnia 2007

- 12:30 - 13:00 Opening – the quest for terrestrial planets – Ewa Szuskiewicz (Institute of Physics, University of Szczecin)
- 13:00 – 13:30 Cosmic Rays of Ultra High Energies and the Pierre Auger Observatory - Maria Giller (Department of Experimental Physics, University of Łódź)
- 13:30 – 14:00 Habitable zones and their evolution - Michał Różyczka (CAMK PAN, Warsaw)
- 14:00 – 15:00 Obiad
- 15:00 – 15:30 Searches for interstellar molecules of potential prebiotic importance - Zbigniew Kisiel (Institute of Physics PAN, Warsaw)
- 15:30 – 16:00 Absorption features originated in translucent interstellar clouds - Tomasz Weselak (Kazimierz the Great University, Bydgoszcz)
- 16:00 – 16:30 Spectrometric sounding of Venusian clouds - Venus Express Mission - Maria Błęcka (CBK PAN, Warsaw)
- 16:30 – 17:00 Przerwa na kawę
- 17:00 – 17:30 Titan's atmosphere and ionosphere - what have we learnt from Cassini - Marek Banaszekiewicz (CBK PAN, Warsaw)
- 17:30 – 18:00 Planets around evolved stars - Andrzej Niedzielski (CA UMK, Toruń)
- 18:00 – 18:30 The radial velocity search for planets in binary and multiple stellar systems – Maciej Konacki (CAMK PAN, Toruń)

Abstracts

COSMIC RAYS OF ULTRA HIGH ENERGIES AND THE PIERRE AUGER OBSERVATORY

Maria Giller

Department of Experimental Physics, University of Łódź

The biggest experiment to measure the highest energy cosmic rays is being built in Argentina. The method is to detect the extensive air showers (cascades of secondary particles, produced by single cosmic ray particles in the atmosphere) by an array of 1600 charged particle detectors, located every 1500 m on a huge surface of the pampa, at 1450 m above sea level. Another detectors are four multi-telescope "eyes", registering images of the fluorescence light bursts, emitted by individual showers. These measurements allow to determine the energy spectrum and arrival directions of cosmic rays of the highest energies ($>10^{19}$ eV) and thus, hopefully, clarify their origin.

HABITABLE ZONES AND THEIR EVOLUTION

Michał Różyczka

CAMK PAN, Warsaw

I review the theory of habitable zones (also called ecospheres), emphasizing the following points:

1. The theory of habitable zones helps to choose appropriate targets for planned missions which will look for biosignatures in extrasolar planetary systems.
2. The location of a habitable-zone depends not only on luminosity and effective temperature of the star, but also on the adopted model of the planet.
3. Hydrogen-burning is the only evolutionary phase in which stars can create and maintain conditions suitable for the emergence and development of life.
4. Searches for extrasolar biospheres should be focused on stars with masses not much larger than one solar mass.
5. Even if the planet orbits a solar-like star within its ecosphere, it may easily happen that conditions appropriate for life to emerge on its surface will not be maintained long enough. This is because the long-term evolution of planet's climate depends on a multitude of very complicated processes which must be rather carefully balanced.

SEARCHES FOR INTERSTELLAR MOLECULES OF POTENTIAL PREBIOTIC IMPORTANCE

Zbigniew Kisiel

Institute of Physics PAN, Warsaw

Interstellar chemistry leads to the formation of many prebiologically important molecules and is therefore of the fundamental interest to Astrobiology. Many organics can be produced in the gas phase, or can be formed by reactions on the surfaces of dust grains and likewise evaporated to the gas-phase where they can be detected by millimeter-wave observations. A summary of the status of several searches for potential prebiotic molecules in the hot molecular cores will be presented, as well as of laboratory investigations that are an enabling step for such searches.

ABSORPTION FEATURES ORIGINATED IN TRANSLUCENT INTERSTELLAR CLOUDS

Tomasz Weselak

Kazimierz the Great University, Bydgoszcz

Description of absorption spectral features originated in both atomic and molecular species, observed in the spectra of reddened O and B-type stars, is presented. Recent results concerning mutual relations between abundances of simple, identified species such as CH and CN molecules and carriers of the major 5780 and 5797 diffuse interstellar bands (DIBs) are presented. Unsolved problems, such as identification of the carriers of DIBs (likely complex, carbon-bearing molecules), are considered from the observer's point of view. Apparently a vast majority of molecular species and dust particles (causing reddening) are concentrated in quite small, dense clumps embedded in warm phase of interstellar medium, revealed by the H and K lines of CaII. An interpretation of interstellar absorption spectra requires thus to relate Doppler components of various spectral features sharing the same radial velocities – likely originated in the same environments along any sightline. The observational material for this presentation was acquired using echelle spectrographs situated in both: Northern and Southern hemispheres.

SPECTROMETRIC SOUNDING OF VENUSIAN CLOUDS - VENUS EXPRESS MISSION

Maria Błęcka
CBK PAN, Warsaw

Venusian clouds make the major contribution to attenuating incident solar radiation and to the thermal state of the atmosphere. The clouds and haze are mainly composed of sulphuric acid aerosols and some other components but the nature, temperature and structure of clouds is not completely clear. The interpretation of spectroscopic data is not straightforward because observed spectra are the results of a combination of different contributions e.g. radiation transmitted, scattered and emitted in the atmosphere. The main purpose of the presentation is an interpretation of the measurements through their comparison with spectra numerically simulated by means of a radiation transfer model. Presented work is directly connected with visible and infrared spectroscopic observations by VIRTIS during Venus Express mission.

TITAN'S ATMOSPHERE AND IONOSPHERE - WHAT HAVE WE LEARNT FROM CASSINI

Marek Banaszkiewicz
CBK PAN, Warsaw

The highly reduced Titan's atmosphere is dominated by molecular nitrogen with a modest contribution of methane and with many hydrocarbons and nitriles as minor components. Exogenous water molecules supply rare oxygen-bearing atmospheric compounds. The ionization of this dense atmosphere by solar photons, electrons from the Saturn magnetosphere and cosmic rays gives rise to a number of ion species that eventually form a very rich chemical mixture through reactions with neutral species. The current status of Titan's atmospheric research will be presented with an emphasis on comparing the modelling effort with the data obtained from the Cassini mission.

PLANETS AROUND EVOLVED STARS

A. Niedzielski

CA UMK, Toruń

After more than a decade of discovering planets around sun-like stars, it has become apparent that to achieve a satisfying level of understanding of planet formation and evolution, the surveys have to be extended to other types of stars. Because of paucity of spectral features and their rotational broadening, extending studies of planetary system formation and evolution to stellar masses substantially larger than $1 M_{\odot}$ is observationally difficult. An indirect way to remove this difficulty is to conduct surveys of post-MS giants. These evolved stars have cool atmospheres and many narrow spectral lines, which can be utilized in RV measurements to give an adequate precision level.

As discoveries of planets around post-MS giants, in numbers comparable to the current statistics of planets around MS-dwarfs will certainly provide the much needed information on planet formation around intermediate mass MS-progenitors and will create an experimental basis with which to study dynamics of planetary systems orbiting evolving stars we have joined the existing surveys with our own long-term project to search for planets around evolved stars with the 9.2-m Hobby-Eberly Telescope and its High Resolution Spectrograph. Generally, all our targets, a total of approx. 1000 GK-giants brighter than ~ 11 mag, occupy the area in the HR-diagram, which is approximately defined by the MS, the instability strip, and the coronal dividing line.

In this paper, we describe our survey and the detection of a planetary-mass companion to the K0-giant HD 17092.

THE RADIAL VELOCITY SEARCH FOR PLANETS IN BINARY AND MULTIPLE STELLAR SYSTEMS

Maciej Konacki

CAMK PAN, Toruń

About forty of the current sample of 240 of extrasolar planets are in binary stellar systems. This is quite a surprising result given that binary stars have been omitted from the radial velocity surveys (because the secondary will contaminate the spectrum of the primary and thereby limit the precision). Despite the limited sample, it has been noted that there may be a deficiency of "high" mass planetary companions with short period orbits around single stars whereas the opposite may be true for planets in binary systems. Clearly, it may not be possible to grasp the diversity of extrasolar planets without addressing the binary and multiple star systems.

I will describe the challenges of detecting planets in multiple stellar systems, the techniques that have been developed to address them, the ongoing surveys for planets in dynamically challenging environments and what we have learned from them so far. In particular, I will discuss my ongoing radial velocity search for planets in binary and multiple stellar systems.