Extreme-Astrophysics in an Ever-Changing Universe
Time-Domain Astronomy in the 21st Century

Celebrating Prof. J. H. Seiradakis’ 40-yr Career

Ierapetra, 16 - 20 June 2014
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20:00-21:00: Venue Inaguration & Concert by Local Traditional Band.
21:00-22:00: "The Antikythera Mechanism" Public Talk (in Greek) by John Seiradakis
20:00-23:00: Conference Dinner
20:00-21:00: Evening Talk by Prof. Jocelyn Bell Burnel
RAKI NIGHT for those interested. Participation is optional
ABSTRACTS

Monday 16

**Pulsar Timing Arrays**

Monday 16 June 2014 09:00

Prof. MCLAUGHLIN, Maura (West Virginia University)

In this talk, I will review the concept of pulsar timing arrays, and discuss their many applications. I will then provide an overview of worldwide pulsar timing programs and the scale and sensitivity of the pulsar timing array efforts, with particular attention to the International Pulsar Timing Array (IPTA). I will discuss the most recent results from pulsar timing arrays, highlighting the gravitational wave detection efforts in particular. Finally, I will describe the anticipated future growth in participants, telescopes, pulsars, and sensitivity of the IPTA, highlighting the transformational advances that it will enable over the next decade.

**Detecting Gravitational Waves with Pulsars: Taming the Interstellar Medium**

Monday 16 June 2014 09:40

Prof. STINEBRING, Dan (Oberlin College & ASTRON)

Gravitational waves are much in the news, and that trend will continue as detectors on Earth and the Galactic-scale Pulsar Timing Array close in on detecting very different sources in widely separated gravitational wavelength bands. I will update the audience on international progress toward the goal of detecting orbiting supermassive black holes with a Pulsar Timing Array. In particular, I will highlight some of the challenges that we face correcting for time-variable delays as pulsars move through the interstellar medium.

**Recent Highlights from the Pulsar Working Group of LOFAR**

Monday 16 June 2014 10:00

Dr. NOUTSOS, Aristeidis (MPIfR, Bonn)

The Low Frequency Array (LOFAR) is an international collaboration, operating a phased array of radio antennas spread across Europe, sensitive in the 10 – 250 MHz...
LOFAR has recently entered its second cycle of scientific operations, where observations of pulsars, amongst other sources, are now regularly performed. In this talk, I will present a brief summary of the highlights from the work of the Pulsar Working Group of LOFAR, based on data from the commissioning phase and Cycle 1.

**Pulsar broadening measurements at low frequencies with LOFAR**  
Monday 16 June 2014 10:20

Mr. ZAGKOURIS, Kimon (University of Oxford)

Pulsars are highly energetic and fast rotating neutron stars. They are so dense and small that are effectively point sources. This enables us to use them as probes of the interstellar medium. Their broadband radio emission reveals that the electron distribution in our Galaxy is inhomogeneous. We see this through the observation of the average pulse shape of pulsars, which often acquires a widening exponential tail when observed at low radio frequencies. The frequency dependence of this broadening of the pulse reveals details of the physics of the scattering media. LOFAR is the biggest radiotelescope in the world capable of observing at low frequencies (10-240 MHz). We have observed a sample of 22 pulsars that showed evident broadening of the pulse profile. We used a CLEAN based method to measure the scattering time-scale (\(\tau_s\)) associated with each pulsar profile for a range of frequencies. Furthermore we calculated the frequency dependency of \(\tau_s\) at these low frequencies. In this talk we present the \(\tau_s\) measurements for these 22 pulsars, some of which have never been measured before. We also present our findings regarding the frequency-\(\tau_s\) dependency at low frequencies and the discrepancies compared to the theoretical expected values.

**The Centrality of Pulsar Core Radiation**  
Monday 16 June 2014 11:10

Prof. RANKIN, Joanna (University of Vermont)

The idea that pulsars have a central "pencil" beam of radiation within their cone(s) goes back to Don Backer in the early 1970s, when he also surmised that some pulsars must have two cones as well as this central core beam. More systematic studies of pulsar beamforms over the succeeding decade or so confirmed Don's surmise from multiple directions, showing that pulsar beams were comprised of inner and outer cones and core in every combination. They also showed that core beams reflected emission at very low altitudes above the surface of the neutron star. Over time a string of properties became attached to core components and their emission—for instance, that they tend to be prominent in faster, more distant pulsars, that they have angular widths reflecting that of the pulsar polar cap, and that only in cores do we see large, antisymmetric circular polarization. Few studies, however, followed up to investigate the single pulse properties of cores. Partly this reflected the earlier difficulty of studying fast, highly dispersed pulsars, but what studies there were failed to generate the palpable interest that, for instance, conal drifting subpulses did. Krishnamohan & Downs' (1983) study of the Vela pulsar is a strong exception, and only now are we beginning to understand how far it was ahead of its time.
Over the last few years we have learned that some core emission shows intensity-dependent aberration/retardation, such that the emission gets stronger and earlier with height above the star—as if it directly reveals the amplifier or plasma maser at the root of the pulsar machine. Other work has shown that core emission first has its polarization oriented \( \parallel \) to the projected magnetic field direction in the emission region. This means that such "parent" core emission propagates as the extraordinary (X) mode, which is not subject to refraction and propagates more easily in the dense plasma deep within the polar flux tube. Other ordinary (O) mode emission, both core and conal, is apparently secondary to this "parent" core X radiation. Finally, core emission occurs prominently in some MSPs, and it is probably present but more difficult to recognize in many others. Therefore, understanding the core's role in MSPs is an important key to timing them with great precision.

**Search for thermal X-ray radiation from hot polar cap in pulsars**
Monday 16 June 2014 11:50

Prof. GIL, Janusz

The physics of polar cap and inner acceleration region is reviewed. Conditions for generations of thermal radiation from hot polar caps is considered. Observational methods of detecting such radiation are discussed. Clear cases of detection of thermal black body radiation from pulsar polar caps are presented and their characteristics are discussed.

**Single pulse statistical analysis of magnetar AXP 1809-194**
Monday 16 June 2014 12:10

Ms. XYLAKI, Theodora (Aristotle University of Thessaloniki)

Neutron stars are one of the possible final stages in the life of massive stars and their existence was confirmed through the discovery of the first pulsar in 1967. Pulsars are rapidly rotating neutron stars with large magnetic fields and they emit highly periodic signals that allow us to observe them. Conditions in the interior of neutron stars are extreme and so far no complete theory exists that can describe matter in these conditions. If an equation of state was to be found for the description of matter in such states, neutron stars would be physicists' laboratories for the study of matter in these extreme conditions. Also pulsars are a very good probe of the interstellar medium. These are some of the reasons pulsars were and are studied thoroughly. Magnetars are also neutron stars that have extremely strong magnetic fields \( \sim 10^{15} \) G, which are several orders of magnitude greater than the magnetic field of a typical pulsar. They were proposed to explain Soft Gamma Repeaters (SGRs) and Anomalous X-ray Pulsars (AXPs) and observations have shown that magnetars are probably a particular stage in the lifespan of neutron stars. Using appropriate algorithms as well as coding a part of the “jhspuls” program in “matlab”, single pulses from the magnetar AXP J1810-197 and the pulsars PSR
1133+16 and PSR 0329+54 have been statistically investigated. The results were then compared.

The Highest Time Resolution Measurements in Radioastronomy: Crab Pulsar Giant Pulses
Monday 16 June 2014 12:30

Prof. HANKINS, Tim (Physics Department, New Mexico Institute of Mining and Technology)

We have observed the Crab radio pulsar at frequencies up to 43 GHz with the widest possible bandwidths. Our observations have found isolated and unresolved structure of 0.4 nanoseconds duration in single pulses arriving in the pulsar's Main Pulse phase region. These tiny but very bright radiating entities are consistent with the hypothesis that the Crab Main Pulse radio emission results from collapsing solitons in the turbulent magnetospheric plasma. The Interpulse phase region has not shown nanostructure. Dynamic spectra of the Interpulses contain multiple, regular, narrow bands of emission whose frequency spacing is proportional to their center frequency. Although several models for the banded Interpulse emission have been proposed, none are fully consistent with the observations.

White Dwarfs in Binary Systems
Monday 16 June 2014 14:30

Prof. MARSH, Thomas (Department of Physics, University of Warwick)

The last decade has seen a huge increase in the numbers and variety of binary stars containing at least one white dwarf component. We now know of thousands of white dwarf / main-sequence binaries, including almost one hundred eclipsers, and even have a few examples of eclipsing pairs of white dwarfs, including one with an orbital period of 12.7 minutes. From the numbers of double white dwarfs discovered, we now know that they will be a key source population for space-based gravitational wave observatories. Binary evolution qualitatively alters the natures of white dwarfs: there is evidence that the lowest mass, the highest mass and the most magnetic white dwarfs are all primarily produced through binary evolution. I will review what we are learning about the white dwarfs and their companions in these systems, the evolution required to produce them, and also evidence for possible planetary-mass companions orbiting white dwarf binaries.
The MeV Properties of the Gamma-Ray Binary LS 5039
Monday 16 June 2014 15:10

Dr. COLLMAR, WErner (Max-Planck-Institut für extraterrestrische Physik)

The COMPTEL experiment on CGRO observed the Gamma-ray sky at energies between 0.75 MeV and 30 MeV between April 1991 and June 2000. The first COMPTEL source catalog lists 32 steady sources, among them an unidentified one labeled GRO J1823-12. It is located near $l/b = 17.5/-0.5$ deg and positionally consistent with the prominent gamma-ray binary LS 5039. LS 5039, a neutron star or black hole binary, was established as a gamma-ray source at TeV (HESS) and GeV (Fermi) energies during recent years, showing a peculiar orbit-modulated emission. Given this timing information we reanalysed the COMPTEL data of GRO J1823-12. We found its MeV-flux modulated along the LS 5039 binary orbit of about 3.9 days, which identifies this COMPTEL source as its counterpart, at least for the majority of its MeV emission. We shall present the orbit-averaged as well as orbit-resolved MeV analyses, i.e. lightcurves and spectra. The COMPTEL results, put into multifrequency context, provide new constraints on the modeling of the high-energy emission pattern of LS 5039.

A catalogue of Galactic black holes in X-ray binaries
Monday 16 June 2014 15:30

Dr. CORRAL-SANTANA, Jesus M. (Pontificial Universidad Catolica de Chile (PUC))

Since the 1960's almost 60 transient X-ray binaries (XRTs) have been detected through outburst episodes by the X-ray satellites. However, only 18 out of them have been dynamically confirmed to harbour accreting black holes (BHs). In this contribution, I want to present the results of one of the latest BHs confirmed, Swift J1357.2-0933: a BH system with an extreme inclination and a 2.8-h orbital period. With this latest addition, with all information available for XRTs – candidates and confirmed – since 1966. The aim of this catalogue is (i) to collect all the known parameters of the XRTs found in the bibliography, (ii) to show statistics about the distribution, dynamics and observational features of all the Galactic XRTs known so far and update it with further objects and (iii) to provide the tools to design new and more efficient observational strategies based on the information provided by the catalogue.
Black Hole Magnetospheres and The orthogonal GRB model
Monday 16 June 2014 15:50

Mr. NATHANAIL, Antonios (Academy of Athens)

We revisit the Blandford & Znajek (1997) process and solve the fundamental equation that governs the structure of the steady-state force-free magnetosphere around a Kerr black hole. The solution depends on the distributions of the magnetic field angular velocity omega and the poloidal electric current I. These are not arbitrary. They are determined self-consistently by requiring that magnetic field lines cross smoothly the two singular surfaces of the problem, the inner 'light surface' located inside the ergosphere, and the outer 'light surface' which is the generalization of the pulsar light cylinder. We find the solution for various configurations (monopole, dipole, paraboloid), through a numerical iterative relaxation method analogous to the one that yields the structure of the steady-state axisymmetric force-free pulsar magnetosphere (Contopoulos, Kazanas & Fendt 1999). We explore the analogy with the axisymmetric pulsar. We present the Orthogonal GRB model.

40 Years of Micro-Quasars
Monday 16 June 2014 16:40

Prof. SPENCER, Ralph (University of Manchester)

The discovery and development of understanding of micro-quasars have occurred during John's career. The highly transient nature of these objects was dramatically demonstrated by the intense radio outburst in September 1972 on Cygnus X-3, which happened just as John joined the PhD course at Jodrell Bank. Studies of these enigmatic objects revealed relativistic jets and analogies with the more powerful quasars, but with evolutionary timescales which are more compatible with those of human lifetimes or even PhD courses. They arise through accretion onto a compact object – a neutron star or black hole, where the release of gravitational energy heats the disk give rise to X-ray radiation, and complex MHD processes in the inner disk lead to the ejection of radio emitting jets. I will describe some of the properties and underlying physics discovered over the last few decades and indicate where future observations might lead.

Systematic search for GRB precursors in Fermi, Swift and BATSE GRB catalogs
Monday 16 June 2014 17:20

Ms. CHARISI, Maria (Columbia University)

Gamma-ray bursts show complex temporal profiles. Sometimes distinct emission episodes are observed before the main burst (precursors), the origin of which remains elusive. We developed a fully automated search technique to systematically search for precursor activity in long GRBs detected by the three biggest GRB surveys
Fast variability, hysteresis and accretion states in neutron star X-ray binaries
Monday 16 June 2014 17:40

Dr. MUñOZ-DARIAS, Teo (University of Oxford)

X-ray observations of stellar-mass black holes in X-ray binaries have clearly established the existence of several states, which are tightly connected with the phenomenology observed at longer wavelengths (e.g. radio jets). I will present a systematic study of a large sample of neutron star low mass X-ray binaries, where we find that the hysteresis patterns between Compton dominated and thermal dominated states, typically observed in black holes, are also common in these systems. Hysteresis loops are found when looking at the evolution of both X-ray colour and fast variability of ten systems accreting at moderate rates. I will show that hysteresis does not require of large changes in luminosity and it is the natural form that state transitions take below 30% of the Eddington luminosity (Ledd). At higher accretion rates neutron stars remain in a thermal dominated, low variability state characterized by flaring behaviour and fast colour changes. Only at luminosities close to Ledd, high variability levels are seen again, in correspondence to an increase in the fractional contribution of the Comptonization component. I will compare this behaviour with that observed in black holes, showing that the spectral, timing and multi-wavelength properties of a given source can be determined by its location in the fast variability-luminosity diagram, which suggest a common accretion state scheme for both neutron star and black hole systems.

A pulsar wind nebula associated with PSR J2032+4127 as the powering source of TeV J2032+4130
Monday 16 June 2014 18:00

Dr. MOLDON, Javier (ASTRON Netherlands Institute for Radio Astronomy)

The very-high-energy gamma-ray source TeV J2032+4130, in the Cygnus region, was the first source discovered of a population of extended TeV sources without low-frequency counterparts. In its field there is a pulsar, namely PSR J2032+4127, which has been detected by Fermi in gamma-rays and by the GBT in radio. We report on the discovery of a new pulsar wind nebula (PWN) associated with PSR J2032+4127 through radio and X-ray observations. Moreover, a multi-epoch VLBI campaign was conducted in order to measure the pulsar proper motion and to find its relation with the radio nebula and the TeV extended source. All these results together, combined with a theoretical modelling of the system, enable us to propose a conceivable physical scenario where the extended radio, X-ray and TeV emissions are well accounted for.
Syzygies: Solar Eclipses, Transits of Venus and Mercury, and Occultations by Pluto

Tuesday 17 June 2014 09:00

Prof. PASACHOFF, Jay (Williams College)

Three astronomical objects in a row is known as a syzygy, and I was surprised to discover that several types of observing projects I have been involved in fit this definition. In 2004, I took my students and colleagues to Thessaloniki to observe the transit of Venus, since I had met John Seiradakis at an astronomy-education meeting in Athens previously and it seemed like a good collaboration to pursue. It was the first transit of Venus visible from Earth since 1882, and we got excellent observations over the six hours. Once back in the U.S., John and I gave a joint video class between Williamstown and Thessaloniki, and a student of his asked if we were coming to Greece for the 2006 solar eclipse. John and I reconnoitered the next year on the island of Kastellorizo, the only Greek territory within the band of totality, and I wound up taking a large team of students and colleagues there for the eclipse. My high-speed photometric CCD used for eclipse observations, including those on Kastellorizo, turned out to be useful for observing occultations of distant, faint stars by Pluto, and I work with MIT and Williams College colleagues and students to study Pluto’s atmosphere by how it affects the starlight at ingress and egress. That project is particularly relevant to preparation for the arrival of NASA’s New Horizons spacecraft at Pluto in July 2015. My eclipse and transit research has been supported by the Atmospheric and Geospace Sciences Division of the U.S. National Science Foundation (NSF) and the Committee for Research and Exploration of the National Geographic Society. My occultation research has been supported by the Planetary Sciences Division of the U.S. National Aeronautics and Space Agency (NASA). A current transit observation as observed with the Hubble Space Telescope in reflection off Jupiter is supported by a grant from NASA through the Space Telescope Science Institute.

Data Mining the Optically Variable Sky since 1950

Tuesday 17 June 2014 09:40

Dr. MADSEN, Greg (Institute of Astronomy, University of Cambridge)

The next generation surveys of the time variable sky will have unprecedented sensitivity and areal coverage, but will be limited in their ability to detect variability on time scales longer than the lifetime of the surveys. We present a new precision, multi-epoch photometric catalog that spans 60 years by combining the USNO-B and SDSS DR9 catalogs. We recalibrate the photometry of the original USNO-B catalog for 44 million optical point sources that lie in the DR9 footprint of the northern sky; the recalibrated objects span 14 < m < 20 and are accurate to 0.1 mag. We carefully discard spurious objects and those with inaccurate magnitudes and find 250,000 stars and quasars that show significant (>4-sigma) changes in brightness between the USNO-B and SDSS DR9 epochs. We discuss the historical value of the catalog.
Radio observations of Flare stars: past present and future
Tuesday 17 June 2014 10:00

Prof. DAVIS, Richard (JBCA University of Manchester)

The early work at JBO will be reviewed followed by the first interferometric observations at 408 MHz which enabled several beams to be formed pointing at the flare star, background extragalactic reference source and several blank sky regions. This enabled the signals to be separated with an accuracy of < 1 arcsec. This will be followed by work at the VLA for several years at several low frequencies. Finally work both with LOFAR and SKA will be considered and the range of studies possible with these new telescopes will enable a large improvement of the generic studies of the most interesting stars.

Broad Strokes Across Time Domain Astronomy
Tuesday 17 June 2014 10:20

Dr. BELANGER, Guillaume (European Space Astronomy Centre (ESA/ESAC), Science Operations Department)

Time domain astronomy concerns itself with the study of the temporal properties of astrophysical sources. In this day, astronomy and astrophysics are subdivided into a wide range of fields and subfields that distinguish themselves from one another mostly based on the instrumentation and everything that stems from that, but also on the science topics that can be addressed and thus of interest in a particular branch. The expression “time domain astronomy” is, for this reason, understood differently by different people working in different areas. In this paper we approach time domain astronomy as seeking to characterise one of three things—constancy (and transience), periodicity, and intrinsic variability—and present methods to treat and explore the data based on the statistical likelihood. For each of these three facets of time domain astronomy, examples are taken from different branches and wavelength scales, from ground-based radio and near-infrared (VLA and VLT) telescopes, to X-ray and γ-ray (XMM-Newton and INTEGRAL) observatories. We show how a range of different methods, whose shared fundamental characteristic is the use of the statistical framework of likelihood analysis, can be applied with different aims to different kinds of data in different branches of astronomy to explore the properties of the data in the time domain.
Fast Radio Bursts and other transient signals
Tuesday 17 June 2014 11:10

Dr. JOHNSTON, Simon (CSIRO)

Fast (millisecond duration) bursts of radio emission have had a long and chequered history but the field really took off with the "Lorimer Burst" nearly a decade ago. Since then, large-scale surveys have been undertaken to find more fast bursts and to understand their nature. Although more have been found, their nature is still elusive. Are they atmospheric in origin? Extra-galactic? Galactic? The jury is still out. I will review the history of FRBs, talk about the discoveries from the Parkes HTRU survey, and speculate about the future of this field.

Choose your own adventure! - Fast radio bursts.
Tuesday 17 June 2014 11:50

Mr. RAVI, Vikram (University of Melbourne)

High time resolution observations with the Parkes telescope have, over the last decade, revealed a sample of unassociated millisecond-duration radio transients with signatures of cold plasma propagation consistent with cosmological origins. This discovery has sparked a menagerie of theoretical and observational efforts to identify their origins. In this talk, I will focus on what may be and is being learned from targeted searches for these 'fast radio bursts' (FRBs). I will outline some theoretical ideas on what may cause FRBs, including a suggested association with certain classes of gamma-ray bursts. I will also present results from a new FRB observation at Parkes, including an extensive follow-up campaign.

A Galactic origin for the fast radio burst FRB010621
Tuesday 17 June 2014 12:10

Dr. MADSEN, Greg (Institute of Astronomy, University of Cambridge)

The recent detection of fast radio bursts has generated strong interest in identifying the origin of these bright, non-repeating, highly dispersed pulses. The principal limitation in understanding the origin of these bursts is the lack of reliable distance estimates; their high dispersion measures imply that they may be at cosmological distances ($0.1 < z < 1.0$). Here, we discuss new distance constraints to FRB010621 first reported by Keane. We use velocity resolved Hα and Hβ observations of diffuse ionized gas towards the burst to calculate an extinction-corrected emission measure along the line of sight. We combine this emission measure with models of Galactic rotation and of electron distribution to derive a 90% probability of the pulse residing in the Galaxy. However, we cannot differentiate between the two Galactic interpretations: a neutron star with unusual pulse amplitude distribution or Galactic black hole annihilation.
Exploring Free Floating Planets with Microlensing
Tuesday 17 June 2014 12:30

Ms. FRAGKOU, Vasiliki

About three years ago, the MOA microlensing team announced the discovery of a free floating planet population with the method of gravitational microlensing (Sumi T., et al. 2011, 2011Natur.473..349S). In this work, the possibility of these planets being in reality bound but getting confused as free floating because of the shape of their light curve, is tested. Using simulations of gravitational microlensing, we simulate binary lensing events produced by several combinations of parameters for the source star, the lens star and the planet, the light curves of which, afterwards, are fitted to the light curve of a single lensing event. After rejecting some of the simulated events because of their unclear light curve, we determine which of the simulated binary microlensing events produce a light curve that cannot be differentiated to that of a free floating planet, their fitting parameters, the parameters that produced them and their relative frequency. Our results indicate that, for Jupiter mass free-floating planets, we expect less than 0.1 out of the 1000 events analysed by MOA to look like free floating systems yet be caused by bound planets within 100 AU of their host star. As a result, the comparison of our results with the results of the MOA team, reveals that the population of exoplanets that the MOA team detected, consists either from actually unbound planets or from bound planets with sky-projected separations from their host, longer than 100 AU.

High-speed optical astrophysics
Tuesday 17 June 2014 14:30

Prof. DHILLON, Vik (University of Sheffield)

The advent of frame transfer CCDs and fast, low-noise CCD controllers has ushered in a new era of high time-resolution optical astrophysics. I shall review the design, performance and scientific output of two instruments utilising these detectors - ULTRACAM and ULTRASPEC - which together have been awarded nearly 500 nights of telescope time over the past decade on some of the largest telescopes in the world. I shall then describe the design of the next generation high-speed imager, HiPERCAM, recently funded by an ERC Advanced Grant and due to see first light in 2017.

Aqueye Plus: a very fast single photon counter for astronomical photometry equipped with an Optical Vortex coronagraph
Tuesday 17 June 2014 15:10

Prof. BARBIERI, Cesare (University of Padova, Dept. of Physics and Astronomy)

We developed two very high speed single photon counting photometers, Aqueye and Iqueye as prototypes of "quantum" photometers for the extremely large telescopes of
the next decade. The instruments, based on single photon avalanche photodiodes (SPAD) and a 4-fold split-pupil concept, have been successfully used to obtain data of the highest quality on optical pulsars at the 182cm telescope in Asiago and at the ESO 3.5m NTT in La Silla. Furthermore, we utilized the Orbital Angular Momentum and associate Optical Vorticity to achieve high performance astronomical coronagraphy OVC. Our researches give birth to a spin-off enterprise which developed an innovative adaptive mirror for astronomical and industrial applications. These three items, namely single photon counting multicolor photometry, OVC and adaptive optics module, have been now combined in an improved version of Aqueye, called Aqueye Plus, for the Asiago 1.8m telescope. The present paper describes the instrument and its first performances.

Examining the third body hypothesis in the eclipsing binary AV CMi
Tuesday 17 June 2014 15:30

Mr. KARPOUZAS, Konstantinos (Aristotle University of Thessaloniki); Mr. TSIARAS, Aggelos (Aristotle University of Thessaloniki)

We present a new method for determining the orbit of a possible third body in the eclipsing binary system AV CMi. We fitted the previous transit lightcurves and our own, using the Pal transit model alongside with eccentric orbit simulations, to account for any indications of transit timing variations.We also examined the possibility of a transit event around the component which the third body is not orbiting and found that such scenario is possible.Therefore we introduce a new transit event called "strange transit" and analyze it's properties. Our aim was to help define whether there is an actual third companion, or the transits are due to a blend as proposed in previous literature.

The Large Observatory for X-ray Timing (2.0)
Tuesday 17 June 2014 15:50

Dr. ROBERTO, Mignani (INAF/IASF)

The Large Observatory for X-ray Timing (LOFT) has been a top contender in the last ESA call for mid-size mission (M3). LOFT will be proposed again in the next call (M4) with a lunch window on the mid 2020s. LOFT will carry aboard a Wide Field Monitor (WFM) that will observe simultaneously 1/3 of the sky in the 2-50 keV energy range. The WFM is an ideal instrument to look for and monitor hundreds of X-ray transients with a factor of 20 higher sensitivity than the All Sky Monitor Aboard the Rossi X-ray Timing Explorer. The detection of these transients will trigger follow-up observations with the Large Area Detector (LAD), the other instrument aboard LOFT, to search for micro-variability down to the ms-second time scales. In parallel, it will trigger follow-up observations with other motoring observing facilities operating at radio and optical wavelengths. In this talk I will summarise the characteristics of the mission and discuss its synergies with other multi-wavelength facilities operating in the same time frame.
BEACON - Motivation, status and new technical developments
Tuesday 17 June 2014 16:40

Dr. FREIRE, Paulo (Max Planck Institut für Radioastronomie)

In this talk I describe the BEACON project, which is currently being funded by the European Research Council. I start with a discussion of the scientific motivation of the project and its aims, which are to be achieved by improving timing of binary pulsars: this will have important consequences for our knowledge of the properties of gravity, gravitational waves and have broader implications for the study of dark matter and dark energy. I then focus on the technical aspects of the project: the development of an ultra broadband (0.6 -3.0 GHz) receiver for the Effelsberg 100-m radio telescope and the development of new pulsar back-ends capable of processing the whole band in real time. I then address the challenges to the effective operation of such a receiver, and how we expect to overcome them. If his challenges are overcome, we will have a fantastic new pulsar observing system, which will yield an abundant scientific harvest

SUPERB: A real-time multi-telescope pulsar and fast transient survey
Tuesday 17 June 2014 17:20

Dr. BARR, Ewan (Swinburne University of Technology)

April 22nd this year saw the commencement of the SUrvey for Pulsars and Extragalactic Radio Bursts (SUPERB) with the Parkes radio telescope. This state-of-the-art, large-scale, multi-telescope survey is the most technologically advanced survey of its type, implementing a number of novel real-time data processing techniques that allow for 'live' discovery and on-the-fly, mutli-wavelength follow up. Using cutting edge GPU searching codes and a variety of machine learning methods, SUPERB is capable of immediately identifying new pulsars (including those in binary systems) and radio transients, including the elusive Fast Radio Bursts (FRBs). The entire survey will be shadowed by the newly recommissioned Molonglo radio telescope. This revitalised instrument will provide an extra dimension to the SUPERB survey, giving the first potential of an cross-site, multi-frequency detection of an FRB, conclusively confirming or denying their astrophysical origin. With agreements in place with several optical telescopes and high-energy satellites, we have the capability to fully exploit any FRB detected in the survey, providing a wealth of information that will provide a leap forward in solving the mystery of these enigmatic sources. Here I will present an overview of the SUPERB survey, its scientific goals, methodologies and expected yields. I will also provide an overview of the current state of recommissioning and science operations at the Molonglo radio telescope.
Real-time discovery of pulsars and fast transients
Tuesday 17 June 2014 17:40

Dr. KARASTERGIOU, Aris (University of Oxford)

Time domain data processing for the discovery of radio pulsars and fast radio transients is rapidly moving into an era where data storage and offline post-processing is no longer practical. This is true both in terms of technical limitations, and in terms of fulfilling scientific objectives such as rapid follow-up. In this talk, I will describe these scientific objectives as we move towards the Square Kilometre Array, and give examples of technical developments to enable real-time processing and discovery.
Model Constraints from Multiwavelength Variability of Blazars
Thursday 19 June 2014 09:00

Prof. BOTTCHER, Markus

In this talk, I will provide an overview of our current state of understanding of the origin of high-energy and multi-wavelength emission from blazars. Special emphasis will be placed on multiwavelength variability patterns predicted by a variety of model scenarios, and the potential of exploiting flux, spectral, and polarization variability patterns as diagnostics to constrain the location of the high-energy emission region and the mechanism of particle acceleration and generation of high-energy gamma-ray emission.

Time dependent modeling of AGN emission from inhomogeneous jets with particle diffusion and localized acceleration
Thursday 19 June 2014 09:40

Dr. CHEN, Xuhui (University of Potsdam)

We study the multiwavelength variability of AGN emission with our time-dependent multi-zone leptonic model, with special emphasis on particle acceleration, transport, and jet inhomogeneity. In the code, a Fokker-Planck equation is used to describe the electrons accelerated through a second-order Fermi process. A Monte Carlo method is used for the radiative transfer, so that light travel time effects are taken into account. To account for inhomogeneity, we use a 2D axi-symmetric cylindrical geometry for both relativistic electrons and magnetic field. We found small isolated acceleration regions in a much larger emission volume are sufficient to accelerate particles to high energy. Diffusive escape from these regions provides a natural explanation for the spectral form of the jet emission. Various possible geometries and locations of the acceleration region are evaluated to further assess the structure of the relativistic jets and the energy dissipation processes in them. It is noticed that if the acceleration region is not located at the center of the emission region, the resulted electron energy distribution follows a broken power-law, where the change in power-law index, which is a result of both particle cooling and escape, is less than 1, the traditionally assumed value.
Multi-frequency linear and circular radio polarization monitoring of jet emission elements in Fermi blazars
Thursday 19 June 2014 09:50

Mr. MYSERLIS, Ioannis

The jet radio emission in blazars -- the aligned subset of Active Galactic Nuclei -- is attributed to incoherent synchrotron processes due to particles moving relativistically in its magnetic field. Under the assumption of some degree of B-field uniformity, the emission can be highly linearly as well as circularly polarized. The degree of polarization depends also on the optical depth of the emitting region. According to synchrotron theory, the transition from optically thick to thin emission (or vice versa) is expected to be accompanied by a minimization of the polarization degree, rotation of the polarization angle by exactly 90 degrees and reversal of the circular polarization handedness. Monitoring the spectral evolution of radio outbursting events is tracing this very transition and hence probes the signature of the emission process in the polarization behaviour as described above. Subsequently, high-cadence, multi-frequency polarization monitoring in the radio regime offers a unique tool for studying the microphysics of jet plasma emission elements such as optical depth evolution as well as magnetic field strength, orientation and uniformity. Furthermore, radio polarization monitoring, combined with radiative transfer predictions for the emission, absorption, Faraday rotation and conversion coefficients, allow inferring the physical characteristics and plasma state of the emitting region (e.g. cold or ultra-relativistic plasma). Here, we present the full Stokes analysis and a data reduction machinery for the radio emission of blazars observed in the framework of the F-GAMMA program. Example cases of our results will be discussed.

RoboPol: Rotations of polarization plane in optical emission of blazars
Friday 20 June 2014 10:20

Dr. BLINOV, Dmitry (FORTH, University of Crete)

The RoboPol project is a long-term monitoring program of optical flux and linear polarization of a large sample of blazars. The sample is defined according to unbiased and objective selection criteria and contains gamma-ray bright blazars detected by Fermi-LAT, as well as a comparison sample of, otherwise similar, gamma-ray–quiet blazars. The main goal of the project is to investigate possible connection of rotations of polarization plane in optical emission with gamma-ray activity of blazars. In this talk we report on results of the first season of RoboPol's operation. During the season we detected a number of EVPA rotations comparable to the previously known set of such events found in literature. We analyse frequency of polarization swings in blazars and their connection to flaring activity in optical and gamma. We conclude
that behaviour of EVPA shows a variety of patterns and can not be explained by a single unified model.

**NGC 1194: warped disk or a double black hole candidate?**  
Friday 20 June 2014 10:40

Dr. FEDOROVA, Elena (National Taras Shevchenko University of Kyiv, Astronomical Observatory)

We analyze the X-ray properties of Compton thick Seyfert 1.9 radio quiet AGN in NGC 1194 from the data of INTEGRAL (ISGRI), XMM-Newton (EPIC), Swift (BAT and XRT) and Suzaku (XIS) observations. The model of the overall 0.3-500 keV continuum includes the transmitted (heavily absorbed) and Compton-reflected primary emission of the AGN central engine, thermal component emitted by the plasma surrounding the active nucleus or the bulge region, and iron emission lines. We have disclosed here a flux variability within the wide range of energies 20-200 keV, not accompanied by the spectral changes. We also have revealed here the set of unusually shaped iron emission lines between 6 keV and 7.5 keV and propose several models, including the reflection from double black hole disks, for explanation of their properties.

**Selected topics in relativistic jet simulations**  
Thursday 19 June 2014 11:30

Dr. MIMICA, Petar (University of Valencia)

Relativistic jets have been known for almost 100 years, but it is still not known with certainty how they are launched, accelerated and collimated. It is also a matter of scientific debate how they interact with the surrounding medium, or what they are made of. There is a long and rich history of jet observations and the theoretical models which attempt to explain them. In recent decades simulations have become an additional (an nowadays indispensable) tool for modeling and understanding many of the jet properties. I cover selected aspects of relativistic jets, focusing mainly (but not exclusively) on jets from active galactic nuclei. After introducing modern numerical methods used in relativistic jet simulations, I give an overview of some of their features such as the formation and properties of shocks in jets, the generation and propagation of components, the influence of strong magnetic fields, and the interaction with the ambient medium, with an emphasis on the methods for computing emission from simulated jets.
Jets from small-scale magnetic fields and the implications for the blazar emission

Thursday 19 June 2014 11:50

Prof. GIANNIOS, Dimitrios (Purdue)

The recent observations of powerful, minute-timescale flares from several blazars pose serious challenges to theoretical models for the blazar emission. The fast flaring requires extremely compact regions in the jet that boost their emission towards the observer with very large Doppler factors. In this talk, I will introduce the magnetic reconnection model for the blazar flaring. I argue that, for the physical conditions prevailing in blazar jets, the reconnection layer fragments leading to the formation of fast-moving plasmoids. I show that radiation emitted from the reconnection event can account for the observed "envelope" of ~day-long blazar activity while radiation from large plasmoids powers the fastest observed TeV flares. The model is applied to several blazars with observed fast flaring. The inferred distance of the dissipation, blazar, zone from the black hole is ~1pc. The magnetic reconnection in the jet may be result of jet instabilities or small-scale magnetic fields imprinted to the flow from the black hole. I will present force-free simulations that demonstrate that large scale jets can be produced by small-scale fields originating from the accretion disk. Accretion of these magnetized loops to the black hole leads to powerful jet ejection events as well as episodes of magnetic reconnection close to the black hole.

The role of time-dependent injection in blazar flares

Thursday 19 June 2014 12:10

Dr. ZACHARIAS, Michael (LSW Heidelberg)

Blazars exhibit flares on various time scales. Especially very short flares on the order of minutes in some frequency bands are challenging for both observations and theoretical modeling. In this presentation I outline the implications of time-dependent injection on flaring events. Since the particle population cannot reach equilibrium nonlinear effects occur, which have significant impacts on the resulting spectral energy distribution (SED) and the light curves. For example, the SED exhibits broken power-laws in all components due to a change in the cooling behavior and without the need of complicated electron injections. Since the nonlinear cooling is much faster than linear cooling, it is, therefore, a good explanation for fast flares. Since the particles do not reach equilibrium the maximum energy of both the electrons and the emitted radiation decrease. This implies that the observed SED depends sensitively on the observation time, and extensive temporal coverage of a flare in a broad range of the electromagnetic spectrum is necessary.
Broad-band variability properties of cataclysmic variables and their connections to XRBs/AGN
Thursday 19 June 2014 10:20

Dr. SCARINGI, Simone (K.U. Leuven)

X-ray binaries (XRBs) and Active Galactic Nuclei (AGN) have been shown to display X-ray aperiodic variability on a broad range of timescales. Cataclysmic variables (CVs, where the compact accretor is a white dwarf) are also known to display optical aperiodic variability (referred to as flickering), however the sophisticated X-ray timing techniques developed to study XRBs and AGN have not been fully exploited to study optical lightcurves of CVs. In this talk I will present new observational results obtained with the space-based Kepler observatory, as well as the ground-based ULTRACAM instrument, showing how the optical broad-band timing properties of CVs are in many ways similar those observed in X-rays for both XRBs and AGN. These recent observations have led to the discovery of the rms-flux relation in CVs, as well as frequency-varying QPOs and Fourier-dependent time lags, all suggesting a common physical origin for the broad-band variability observed throughout all accreting compact objects, irrespective of mass, size or type.

New Opportunities for Time Domain Astronomy with the Fermi Gamma-ray Space Telescope
Thursday 19 June 2014 14:30

Dr. THOMPSON, David (NASA Goddard Space Flight Center)

Time domain astronomy has been a primary focus of the two instruments on the Fermi Gamma-ray Space Telescope since its launch in 2008. Three factors are enabling improvements in the Gamma-ray Burst Monitor (GBM) and Large Area Telescope (LAT) time domain astronomy capabilities: (1) Operations and analysis. The LAT Pass 8 gamma-ray analysis and the GBM continuous time-tagged event data mode provide substantial enhancements in data quantity and quality. (2) Science. Scientific discoveries, including new gamma-ray source classes and time variability in sources previously thought to be steady, have opened new windows for time domain research with Fermi. (3) Synergy. New multiwavelength and multi-messenger facilities that have started operation or will be coming on line in the next few years offer expanded opportunities for collaborative science.

Understanding Powerful Jets at Different Scales in the Fermi Era
Thursday 19 June 2014 15:20

Dr. GEORGANOPOULOS, Markos (UMBC (University of Maryland, Baltimore County))

I will discuss progress being made in understanding the emission sites of powerful jets at the pc and kpc scales, focusing on the use of Fermi data.
Long-term monitoring of Bright TeV Blazars with FACT
Thursday 19 June 2014 15:30

Dr. DORNER, Daniela (Universität Würzburg)

For more than two years, the First G-APD Cherenkov Telescope (FACT) has been monitoring bright blazars at TeV energies. Usually, these sources are studied in the gamma-ray regime with rather limited sampling and biased towards high flux states. Being dedicated to the monitoring of few selected blazars, FACT offers a denser, unbiased and more complete sampling. In addition, the duty cycle is enlarged by the use of novel photosensors which do not suffer ageing when exposed to strong ambient light. A quick look analysis has been set up to provide flare alerts to other instruments within the same night. Over the last years, Mrk501 and Mrk421 have been observed for more than 500 hours each with FACT providing an interesting data sample for flare studies and multi-wavelength studies. Results of two years of monitoring will be presented.

Gamma-ray Variability of Fermi LAT Detected AGN
Thursday 19 June 2014 15:50

Dr. CIPRINI, Stefano (ASI ASDC and INAF OAR, Rome, Italy)

Since its launch the Fermi Large Area Telescope (LAT) performs regular time-domain monitoring of the gamma-ray emission from bright and variable blazars and other AGNs, on time scales from hours to years. For the first time in history of astronomy, the Fermi mission is allowing to detect and study the high-energy flux signals above 100MeV from a variety of gamma-ray sources; the extreme physical ambient, events and processes hosted in blazars in particular. Some highlights of the gamma-ray variability properties in terms of power density spectra, autocorrelations, duty cycles, flux/spectral hardness correlations are presented, together with an outlook of the general properties of the gamma-ray AGN detected in the third Fermi LAT source catalog. Together with observations at other wavelengths, it is furthermore possible to study variability and multifrequency correlation properties in a much more systematic and detailed way than ever before, shedding light on the variability phenomenon across the electromagnetic spectrum and spatial scales.

Active Galactic Nuclei evolution
Thursday 19 June 2014 16:40

Dr. PADOVANI, Paolo (ESO)

I will review the evolution of Active Galactic Nuclei (AGN) across the electromagnetic spectrum, highlighting the very substantial decline in power experienced by these sources over cosmic time. I will also try to focus on the "big picture", pointing out the open issues, which are still present in our understanding of the drivers of AGN evolution.
The Impact of Galaxy Clusters on the AGN Activity
Thursday 19 June 2014 17:20

Dr. TREMOU, Evangelia (Yonsei University Observatory)

By probing nuclear regions and overall properties of AGN hosts as a function of their environments, we aim to observationally examine how AGN activities are related to their surroundings. We have selected a representative sample of AGN hosts residing in cluster environment. The selected galaxies are located in a range of density regions showing various morphology in 1.4 GHz continuum. High resolution observations with the Korean VLBI Network (KVN) allow us to access the inner region of the AGN without suffering from dust extinction and synchrotron self-absorption. Since a number of our targets are weak to be detected at K-band (22GHz) within its coherence time, we applied phase referencing (fast antenna position switching) to calibrate fast atmospheric phase fluctuations. In this talk, we will present our first results from our KVN observations, while we will discuss in detail the applied observational technique and our immediate future plans.

Ultra-high resolution VLBI and broadband radio study of the prominent gamma-ray blazar PKS 1502+106
Thursday 19 June 2014 17:40

Mr. KARAMANAVIS, Vassilis (Max-Planck-Institut für Radioastronomie)

Blazars are among the most variable and most broad-band emitters of radiation in the Universe. The detailed processes that give rise to those characteristics though, remain still unclear. In August 2008, Fermi/LAT discovered the blazar PKS 1502+106 showing a rapid and strong gamma-ray outburst followed by bright and variable flux over the next months. This activity at high energies triggered an intensive multi-wavelength campaign indicating that the outburst was accompanied by a simultaneous flare at optical/UV/X-rays with a significantly delayed counterpart at radio bands as observed by the F-GAMMA program. Taking advantage of the densely sampled 2.6 to 345 GHz light curves and spectra of the F-GAMMA program along with broad-band data up to Fermi gamma-ray energies and with the addition of ultra-high angular resolution VLBI imaging at 86 and 43GHz, we attempt to shed light on the physical processes at work during the high-energy flare. Consequently, PKS 1502+106 turns out to be a key source in the framework of detailed studies of the physical connection between the radio and gamma-ray emission, particularly probing the emission mechanism, size and location of the gamma-ray emitting region. In this talk the findings of the mm-VLBI study using the Global Millimeter VLBI Array (GMVA) data between 2009 and 2012, will be presented. Furthermore the analysis of the radio light curves and spectra will be discussed.
One of the defining characteristics of AGNs is their X-ray emission, but the origin and spatial extent of this emission is still unknown. Several scenarios describe the accretion flow and the production of the observed X-ray radiation, and each of them predict different extensions and geometries of the corona relative to the disk based on the different physics that triggers the X-ray emission. Therefore, observational constraints on the size and the location of the X-ray continuum emission relative to the accretion disk are crucial to understanding the physics of AGN. These kind of measurements are challenging in large part because we have lacked the means to resolve the central engine. However, microlensing in multiply imaged gravitationally lensed quasars allows us to zoom in on the structure of AGN and explore their physics in more detail. Quantitative microlensing X-ray size constraints exist for 5 systems, setting the first upper limits for these emitting regions. In my talk I will briefly describe the methodology, the results from our previous CXO monitoring program, and the next frontier of exploring possible correlations of the X-rays sizes with black hole mass and spectral index, as well as to set constraints on the scaling of the size with X-ray energy.
The Event Horizon Telescope: Imaging and Time Resolving Black Holes
Friday 20 June 2014 09:00

Presenter: Dr. DOELEMAN, Shep

A convergence of high bandwidth radio instrumentation and Global mm and submm wavelength facilities are enabling assembly of the Event Horizon Telescope (EHT): a short-wavelength Very Long Baseline interferometry (VLBI) array, which can observe the nearest supermassive black holes with Schwarzschild Radius resolution. Initial observations with the EHT have revealed event horizon scale structure in SgrA*, the 4 million solar mass black hole at the Galactic Center, and in the much more luminous and massive black hole at the center of the giant elliptical galaxy M87. Over the next 2-3 years, this international project will add new sites and increase observing bandwidth to focus on astrophysics at the black hole boundary. EHT data products will have an unprecedented combination of sensitivity and resolution with excellent prospects for imaging strong GR signatures, detecting magnetic field structures through full polarization observations, time-resolving black hole orbits, new testing GR, and modeling black hole accretion, outflow and jet production. This talk will briefly review the technical roadmap and timeline for building out the EHT, and describe the latest EHT observations.

The Galactic Center Black Hole and its Environment
Friday 20 June 2014 09:40

Prof. ECKART, Andreas (University of Cologne)

The Galactic Center is the closest nucleus of a galaxy allowing us to study the interaction of the super massive back hole with the immediate stellar and inter-stellar nuclear environment. The Galactic Center super-massive 4 million solar mass black hole SgrA* shows flare emission from the millimeter to the X-ray domain. A detailed analysis of the infrared light curves allows us to address the accretion phenomenon in a statistical way. The analysis shows that the near-infrared optically thin flux variations are dominated by a single state power law, with the low states in SgrA* are limited by confusion though the unresolved stellar background. The NIR variations is linked with the observed sub-mm and X-ray variability. The SgrA* also allows us to
study the interaction of the SMBH with the immediate interstellar and gaseous environment of the central stellar cluster. This included the fast moving infrared excess source (G2/DSO) which is widely interpreted as a core-less gas and dust cloud approaches SgrA* on an elliptical orbit. It nature is unclear. It may be similar to nearby similar stellar dusty sources or may consist predominantly of gas and dust. Particularly in this case an enhanced accretion activity onto SgrA* is expected. Here the interpretation of recent data and upcoming observations are discussed. We discuss how the NIR imaging capabilities of GRAVITY at the VLTI and LINC-NIRVANA at the LBT contribute to the investigation of the low variability states of SgrA*.

The interaction between Super Massive Black Holes and Globular Clusters: a possible explanation to the lack of high mass Nuclear Star Clusters
Friday 20 June 2014 10:20

Dr. ARCA SEDDA, Manuel (Sapienza University of Rome)

Almost all galaxies of every type of the Hubble sequence host in their centers a Compact Massive Object, in the form of either massive or supermassive black holes (SMBH) and/or very dense and massive stellar clusters, commonly referred as Nuclear Star Clusters (NSCs). The actual relation among SMBHs and NSCs is poorly known, but it is clear that the presence of both of them depends on the host mass: galaxies with mass below $10^{10}\text{M}_{\odot}$ have a well resolved stellar nuclei (a NSC), while heavier galaxies, with masses above $10^{11}\text{M}_{\odot}$, seem to contain only a central SMBH; NSCs and SMBHs co-exist in boundary of these regions of mass of the host galaxy.

A possible scenario for the formation of a NSC is the so-called “migratory dry-merger” scenario, in which globular clusters decay toward the center of the host galaxy under the action of dynamical friction process and there merge, to form a very massive stellar cluster.

Within this framework, a possible explanation for the lack of NSCs in high mass galaxies is the destruction of the incoming GCs by the intense tidal field of the central SMBH, suppressing the formation of the central stellar cluster. In this talk we show recent results of high resolution, direct, N-body simulations, by which we investigated the effects of a central SMBH on a single “typical” globular cluster orbiting around it. By varying either the mass of the SMBH and the mass of the host galaxy, according to the known correlation existent between the SMBH-galactic host masses, we found that for masses of the SMBH above $\ldots$, the tidal torque exerted by the SMBH is strong enough to disrupt an incoming cluster, avoiding its full decay toward the galactic centre. Consequently, we can determine an upper limit to the mass of the central black hole, and thus to the mass of the host, above which the formation of a NSC is impossible in the migratory model.
Astrophysical Sources of Gravitational Waves
Friday 20 June 2014 11:10

Prof. KOKKOTAS, Kostas

Gravitational wave detectors already operating and achieved impressive sensitivity levels. Their upgrade, next year, will provide the first unambiguous direct detection of gravitational waves. We plan to review the status of gravitational waves research both from the experimental and theoretical point of view. We will discuss the most likely sources of gravitational waves, while emphasis will be given to the various ways that neutron stars emit gravitational waves.

A stringent limit on the spatial and temporal variations in the fine-structure constant from analysis of emission line multiplets in the early universe
Friday 20 June 2014 11:50

Presenter: Dr. LE, Duc Thong (CNS)

One of the key questions of modern physics concerns the possibility that physical constants vary over space and time during the history of the universe. The Standard Model of physics is built on these constants, but it does not provide an explanation for their values, nor requires their constancy over space and time. Here we set a new limit on possible spatial and temporal variations of the fine-structure constant $\alpha = e^2/(4\pi\varepsilon_0\hbar c)$, by comparing fine splitting transitions in [NeIII], [NeV], [OIII], [OI] and [SII] multiplets observed in the early universe with those measured in the laboratory. Based on optical spectra observations of 14 Seyfert 1.5 galaxies in the low-z range $0.035 < z < 0.281$, we deduced a constraint of $\Delta\alpha/\alpha = (4.50\pm5.53) \times 10^{-5}$. This is at present the tightest limit on $\Delta\alpha/\alpha$ at early cosmological epochs.

Kerr black holes with scalar hair
Friday 20 June 2014 12:10

Prof. HERDEIRO, Carlos (Aveiro University)

We present a family of solutions of Einstein's gravity minimally coupled to a complex, massive scalar field, describing asymptotically flat, spinning black holes with scalar hair and a regular horizon. These hairy black holes (HBHs) are supported by rotation and have no static limit. Besides mass $M$ and angular momentum $J$, they carry a conserved, continuous Noether charge $Q$ measuring the scalar hair. HBHs branch off from the Kerr metric at the threshold of the superradiant instability and reduce to spinning boson stars in the limit of vanishing horizon area. They overlap with Kerr black holes for a set of $(M,J)$ values. A single Killing vector field preserves the solutions, tangent to the null geodesic generators of the event horizon. HBHs can exhibit sharp physical differences when compared to the Kerr solution, such as $J/M^2>1$, quadrupole moment larger than $J^2/M$ and larger orbital angular velocity at the innermost stable circular orbit. Families of HBHs connected to the Kerr geometry should exist in scalar (and other) models with more general self interactions.
Anisotropic fluid from nonlocal tidal effects
Friday 20 June 2014 12:30

Dr. CULETU, Hristu (Ovidius University)

The Shiromizu et al. covariant decomposition formalism is used to find out the brane properties rooted from the 5-dimensional Witten- bubble spacetime. The non-local tensor $E_{ab}$ generated by the 5-dimensional Weyl tensor (which carries informations about the gravitational waves) gives rise at an anisotropic energy-momentum tensor on the brane with negative energy density and $p = -\rho/3$ as equation of state, where $\rho$ is the isotropic pressure. The tidal acceleration is towards the brane and that is in accordance with the negative energy density on the brane. The anisotropic fluid has vanishing "bulk" viscosity but the shear viscosity coefficient is $\eta$- and $\tau$- dependent. The brane is endowed with an apparent horizon which represents the radial null geodesic.

Different manifestations of neutron stars
Friday 20 June 2014 14:30

Presenter: Dr. KEANE, Evan

In this talk I will review the growing number of diverse classes within the 'neutron star zoo'. I will describe how these groups are, and are not, evolutionarily linked to one another, and address questions as to the evolutionary pathways of neutron stars. The different sources manifest themselves in a wide range of ways, that span the entire electromagnetic spectrum, with each window having been, to this point, probed to highly variable degrees. Within the most well-studied band (i.e. radio) neutron stars are seen to exhibit an astonishingly wide variety of behaviour. Obtaining a full understanding of the full census promised by upcoming instruments, requires a detailed strategy of followup study, which I will outline. Of course, as well as investigating how these sources work, they can simply be utilised as laboratories, as the numerous different sources cover a similarly diverse array of astrophysical environments. I will review the astrophysical tests which can be performed using these sources as tools and briefly describe the search strategies needed to efficiently identify the most interesting undiscovered sources.

Giant component or the burst activity of pulsar PSR J0653+8051
Friday 20 June 2014 15:10

Prof. MALOFEEV, Valery (Pushchino radio astronomical observatory ASC Lebedev Physical Institute)

The investigation of PSR J0653+8051 at frequency 111 MHz (Pushchino, Russia) has been made using Large Phase Array. This pulsar shows three components in the
range 102-4850 MHz. We detected a few dozen very strong individual pulses exceeding the amplitude of the mean profile more 110. Usually this pulsar demonstrates weak signal on the level 3-5 sigma in mean profile. The detail analysis showed that all strong individual pulses with s/n ratio 5-20 sigma arrived on the longitude of the central component only. This effect is very seldom, because we detected such giant components during the burst activity only two days from more than eight hundred days of observations. We calculated the period and their derivative and obtained interesting behavior the exact time of arrival for central component during all period of observations.

New look at the pulsar radio spectra
Tuesday 17 June 2014 15:30

Dr. KIJKAK, Jarek (Kepler Institute of Astronomy, University of Zielona Gora, Poland)

The discovery of gigahertz-peaked spectra pulsars (GPS, Kijak et al 2011a) revealed new aspects in the field of pulsar spectra. So far we know ten objects that show high-frequency turnovers (at the frequencies of 1 GHz and above), two of them being radio magnetars (Kijak et al. 2013). This may not seem much when compared this number to the total number of pulsars known, but that may be due to selection effects and our general lack of knowledge about the spectra of the majority of known pulsars. It is apparent that the GPS pulsars tend to adjoin some interesting environments (SNR's, PWN's, dense HII regions) and our understanding is that it is the interaction of pulsar radiation with these peculiar surroundings that causes the spectra to turnover. The case of PSR B1259-63 binary pulsar, in which the shape of the spectrum changes with the orbital phase (Kijak et al 2011b), seems to confirm that theory. The most plausible explanation in this case seems to be the thermal free-free absorption which takes place in the strong stellar wind. In case of the isolated GPS pulsars the untypical conditions of their environments may also give rise to similar absorption effects. Our recent modeling work showed that in such case the absorption is highly dependant on the environment geometry.
Natal Supernova "Kicks" are Parallel to Pulsar Rotation Axes

Prof. RANKIN, Joanna (University of Vermont)

The double ambiguity of "kick" orientation and orthogonal polarization mode has frustrated interpretation of pulsar observations aimed at illuminating both pulsar emission or supernova physics. However, the study of radio pulsars with core beams, which appear to be emitted at lower altitudes along the magnetic axis, seem to resolve these ambiguities. The polarization mode associated with the later "native" core emission is polarized $\perp$ to the proper-motion direction in most cases. This radiation is also polarized $\perp$ to a pulsar's rotation axis at the "fiducial" instant when its beam faces the Earth. Therefore, most pulsars are born with proper-motion directions which are $\parallel$ to their rotation axes.

Core/Double Cone Emission Beam Geometry in MSP J0337+1715

Prof. RANKIN, Joanna (University of Vermont)

Most slow pulsars have emission beams in the form of two conal beams surrounding a central core beam, all with angular dimensions scaling with the size of a pulsar's polar cap. Whether millisecond pulsar emission beams shared this structure has been unclear, with many suggestions that they did not. The recently discovered MSP J0337+1715, a 2.7-msec pulsar in a triple system, however, does appear to exhibit core/double cone beam geometry. Using the widths and spacings of the components, the emission heights can be estimated both geometrically and via the aberration/retardation. Overall, the pulsar's structure provides a fascinating tomographic picture of its emission region.

Application of PCA to light curves of three optical pulsars

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This paper describes a new method for determining the optimal period of pulsars and consequently their light curves, by means of the widely known Principal Component Analysis (PCA) applied to the so-called waterfall diagram, which is a bi-dimensional representation of the pulsar photometric data. In our method, the PCA was applied to
sets of arrival times of photons from the brightest optical pulsars (Crab, B0540-69, Vela) measured with our fast photon counters Aqueye and Iqueye. Comparison with the results obtained with more usual techniques show that not only the periods determined via the PCA agree with the previous ones, but that actually their errors are smaller.

**Influence of the magnetic field on the spectral properties of blazars in the internal shocks scenario**

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Blazars are a type of radio-loud active galactic nuclei (AGN) whose (relativistic) jets are pointing very close to the line of sight towards the observer. We assume that the emission from these sources originated from the collision of cold plasma shells, whose magnetohydrodynamic evolution is approximated by numerically solving one-dimensional Riemann problems. In previous studies [1, 2] we focused on the signature of the magnetization of colliding shells on the light curves and spectra. In the present work [3] we extend our coverage of the parameter space by varying parameters such as the jet viewing angle, bulk Lorentz factor, and relative Lorentz factor. We reproduce the standard double-peaked blazar spectrum for unmagnetized shells, but also if the shells are very magnetized and ultarelativistic. We also show that a fair fraction of the blazar sequence can be explained by varying the shell magnetization. Finally, we compare our synthetic observations with those from the Fermi 2LAC catalog of blazars.

References


**The Cosmic Battery and Astrophysical Magnetic Discs**

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We apply the mechanism of cosmic Battery (Contopoulos & Kazanas 1998) in advection-dominated accretion flows (ADAF) for different values of parameter f that measures the degree to which the flow is advection-dominated (Narayan & Yi 1994). We show that the Poynting-Robertson drag effect in all cases of ADAF around black holes that we examined generates strong azimuthal electric currents that give rise to significant magnetic fields.
On Detecting Transient Phenomena

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Transient phenomena are interesting and potentially highly revealing of details about the processes under observation and study that could otherwise go unnoticed. It is therefore important to maximize the sensitivity of the method used to identify such events. In this article we present a general procedure based on the use of the likelihood function for identifying transients that is particularly suited for real-time applications, because it requires no grouping or pre-processing of the data. The method makes use of all the information that is available in the data throughout the statistical decision making process, and is suitable for a wide range of applications. Here we consider those most common in astrophysics which involve searching for transient sources, events or features in images, time series, energy spectra, and power spectra, and demonstrate the use of the method in the case of a weak X-ray flare in a time series and a short-lived quasi-periodic oscillation in a power spectrum. We derive a fit statistic that is ideal for fitting arbitrarily shaped models to a power density distribution, which is of general interest in all applications involving periodogram analysis.