Plenary talks:

Dr. Spiro Antiochos
NASA/GSFC, USA

The Origins of Explosive Activity in the Coronae of the Sun and Stars

Stellar coronae are characterized by bursts of energy release most commonly observed as intense X-Ray flares. For the Sun, and possibly for some stars, we have observed that these bursts often involve giant coronal mass ejections and can range in scale by many orders of magnitude. All these forms of activity share the common underlying origin that magnetic free energy first builds up in the corona and then is released impulsively to the plasma in the form of heating, mass motions, and/or particle acceleration. We present recent high-resolution observations from NASA/ESA/JAXA space missions showing that the energy buildup process appears to be similar for flaring activity ranging across orders of magnitude in scale and energy. Furthermore, the observations demonstrate conclusively that magnetic reconnection is the energy release process. We also present the latest MHD numerical simulations of solar flares that, for the first time, include self-consistently both the energy buildup and explosive release. The models show that current sheet formation leading to reconnection and energy release occurs almost continuously in the corona, but explosive energy release occurs only when there is strong feedback between the reconnection and the global ideal evolution. Capturing this multiscale feedback accurately remains as the greatest challenge to understanding and eventually predicting many observed phenomena in space physics and astrophysics. The observations and models demonstrate that the corona is an amazing example of a magneto-plasma system that constantly self-organizes into an eruptive state. This work was supported by the NASA Living With A Star Program.

Prof. Evangelie Athanassoula
Laboratoire d'Astrophysique de Marseille, FRANCE

Formation and evolution of galactic discs: starting with a major merger

I will use N-body simulations to follow the formation and evolution of Milky-Way type galaxies in the framework of a scenario starting with the merging of two protogalaxies, each with its own hot gaseous halo and dark matter halo. Various components -- a thin and a thick disc, a classical bulge, a discy pseudo-bulge, bar(s), spirals etc -- form and evolve and their properties reproduce well those observed. Comparisons with observations include kinematics, dynamics, morphology, photometry and population synthesis. I will also briefly describe the dynamics of these substructures and in particular of the thin and thick discs and of their bars.

Prof. Nikolaos Stergioulas
University of Thessaloniki, GREECE

Spectral classification of gravitational wave emission and EOS constraints in binary neutron star mergers

The gravitational wave emission from binary neutron star merger events can be used to constrain the equation of state of very high density matter. Neutron star merger remnants are expected to survive for at least many dynamical timescales in the majority of events. We introduce a spectral classification scheme for the post-merger gravitational wave emission, interpreting the main features as due to a dominant quadrupole oscillation, a quasi-linear combination frequency and a transient feature due to a spiral deformation. These features satisfy empirical relations with the radius of nonrotating stars, allowing for an accurate radius determination with maximal uncertainty of a few percent. We discuss the prospects of observing post-merger gravitational wave emission with current and planned detectors.

Prof. Gerry Gilmore
Institute of Astronomy, University of Cambridge, UK

GAIA – from asteroids to gravitational waves

Astrometry from space has unique advantages over ground-based observations: the all-sky coverage, relatively stable and temperature- and gravity-invariant operating environment delivers precision, accuracy and sample volume several orders of magnitude greater than ground-based results. Even more importantly, absolute astrometry is possible. The European Space Agency Cornerstone mission Gaia is delivering that promise. Gaia provides 5-D phase space measurements, 3 spatial coordinates and two space motions in the plane of the sky, for a representative sample of the Milky Way's stellar populations (over 1 billion stars, being ~1% of the stars over 50% of the volume). Full 6-D phase space data is delivered from line-of-sight (radial) velocities for the 300million brightest stars. These data make substantial contributions to astrophysics and fundamental physics on scales from the Solar System to cosmology. A few example results will be given.

Best PhD

Georgios Vasilopoulos
Yale Department of Astronomy

Study of highly magnetized accreting neutron stars in the Magellanic Clouds and beyond

High-mass X-ray binaries (HMXBs) are systems hosting highly magnetized Neutron stars (NSs) and are perhaps the most variable X-ray emitters. On the other hand, Ultra luminous X-ray (ULX) sources are the most bright X-ray binaries, that have long been thought to host the elusive intermediate mass black holes. Remarkably, within the last years there has been undisputed evidence that at least a ULXs are powered by accreting neutron stars (NS) that are rotating with spin periods close to 1 s. Thus, establishing a connection between HMXBs and ULXs. Within my study I focus on the spectral and temporal signatures of accretion onto a NS (in HMXBs and ULXs) for a range of accretion rates that span over 5 orders of magnitude, and up to 100 times the Eddington limit. Moreover, I investigated the X-ray spectral and temporal properties of pulsating and non-pulsating ULXs in the context of NS accretion. I revisit the spectral properties of eighteen well-known ULXs, in search of indications that favor or reject this hypothesis of NSs being the engines of ULXs. I investigated different spectral components and their dependency on the accretion rate, while recognizing unambiguous patterns of variability that are shared in the regime of extreme accretion. My findings offer an additional and compelling argument in favor of NSs as prime candidates for powering ULXs, as has been also postulated by theory. Finally, I will present the properties of the ULXP NGC300 ULX1, a ULX pulsar showing unprecedented spin evolution from ~126 s down to 16 s between 2014 and 2018, with a NS spin-up rate that yields constant accretion rate, even at epochs where the observed flux of the system has decreased by a factor of at least 50.

Session S1: Heliophysics and Solar System

1. **Name**: Dr. Angelos Vourlidas (JHU/APL)
   Coauthors: No coauthors were included.
   Title: "Touching the Sun": The Parker Solar Probe Mission
   Abstract:
   One of the great mysteries of astrophysics is the physical process that heats the solar corona and drives the solar wind. For decades, progress on solving this problem has been hampered by the 'disconnected' nature of the observations; remote sensing of the near-Sun corona, in-situ sampling at Earth. The evolution of the solar wind and its more energetic transients in the inner heliosphere was accessible only through modeling. While the STEREO mission made great strides since 2007, the mechanisms of the generation and early evolution of the solar wind still elude us. This is about to change thanks to an unprecedented space mission, the Parker Solar Probe (PSP) launched in August 2018 and currently in its third perihelion. The mission is designed to attack the solar wind problem head-on by direct sampling of the corona from the 'inside' with a suite of remote sensing and in-situ instruments. In this talk, I describe the capabilities and science objectives of the PSP mission, present some of the initial observations and discuss the exciting science prospects in solar physics research in the next 10 years. PSP will be the first spacecraft to enter the atmosphere of a star, reaching within 6 million km from the solar surface. The mission design will tie together in-situ sampling and high contrast imaging from 'within' the solar corona with high resolution observations from space and ground. A new era in solar and space physics awaits us.

2. **Name**: Dr. Olga Malandraki (NOA/IAASARS)
   Coauthors: Khabarova Olga (Heliophysical laboratory, IZMIRAN, Moscow, Russia)
   Bruno Roberto (IAPS-INAF, Roma, Italy)
   Zank Gary P. (CSPAR, and Department of Space Science, University of Alabama in Huntsville, Huntsville, AL 35805, USA)
   and the ISSI team -405 (http://www.issibern.ch/teams/structpartaccel/index.html)
   Title: Current sheets, magnetic islands and associated particle acceleration in the solar wind as observed by Ulysses near the ecliptic plane
   Abstract:
   Recent studies of particle acceleration in the heliosphere have revealed a new mechanism that can locally energize particles up to several MeV/nuc. Stream-stream interactions as well as the heliospheric current sheet – stream interactions lead to formation of large magnetic cavities, bordered by strong current sheets (CSs), which in turn produce secondary CSs and dynamical small-scale magnetic islands (SMIs) of ~0.01AU or less owing to magnetic reconnection. It has been shown that particle acceleration or re-acceleration occurs via stochastic magnetic reconnection in dynamical SMIs confined inside magnetic cavities observed at 1 AU. The study links the occurrence of CSs and SMIs with characteristics of intermittent turbulence and observations of energetic particles of keV-MeV/nuc energies at ~5.3 AU. We analyze selected samples of different plasmas observed by Ulysses during a widely discussed event, which was characterized by a series of high-speed streams of various origins that interacted beyond the Earth's orbit in January 2005. The interactions formed complex conglomerates of merged interplanetary coronal mass ejections, stream/corotating interaction regions and magnetic cavities. We study properties of turbulence and associated structures of various scales. We confirm the importance of intermittent turbulence and magnetic reconnection in modulating solar energetic particle flux and even local particle acceleration. Coherent structures, including CSs and SMIs, play a significant role in the development of secondary stochastic particle acceleration, which changes the observed energetic particle flux time-intensity profiles and increases the final energy level to which energetic particles can be accelerated in the solar wind.

3. **Name**: Dr. Petros Syntelis (University of St Andrews)
Coauthors: Archontis Vasilis (University of St Andrews)
Tsinganos Kanaris (University of Athens)
Antolin Patrick (University of St Andrews)
Title: Recurrent CME-like eruptions
Abstract:
We report on three-dimensional (3D) magnetohydrodynamic (MHD) simulations of recurrent eruptions in emerging flux regions. We find that reconnection of sheared field lines, along the polarity inversion line of an emerging bipolar region, leads to the formation of a magnetic flux rope (MFR) that eventually becomes eruptive. This process is repeated in a recurrent manner. Our analysis indicates that the torus instability initiates the eruption and that tether-cutting reconnection of the field lines, which envelop the FR, triggers the rapid acceleration of the eruptive field. Using large numerical domains, we perform a small parametric study and find that i) eruptions with kinetic energy ranging from 10^{26} to 10^{28} erg, which are energies of nano/mini CMEs up to the energies of small coronal mass ejections, and, that ii) the kinetic and magnetic energies of the eruptions scale linearly in a log-log plot. Also, we show the initial phase of the merging of two colliding successive eruptions. Indications of Kelvin-Helmholtz instability is be found at the flanks of some eruptions.

4. **Name**: Dr. Athanasios Kouloumvakos (IRAP/UPS Toulouse)
Coauthors: Rouillard Alexis P. (IRAP, CNRS, CNES, Toulouse, France)
Wu Yihong (IRAP, CNRS, CNES, Toulouse, France)
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Vourlidas Angelos (John Hopkins APL, Laurel, MD 20723, USA)
Plotnikov Illya (IRAP, CNRS, CNES, Toulouse, France)
Afanasiev Alexandr (University of Turku, Finland)
Önel Hakan (Leibniz Institute for Astrophysics Potsdam, Babelsberg, Germany)
Title: Connecting coronal shock wave properties from modeling and observations with those of solar energetic particles
Abstract:
During COROSHOCK project we have developed and exploited a new catalog of coronal pressure waves modeled in 3D. We combine, shock wave reconstruction techniques using coronal observations --along with global MHD models of the solar corona-- to derive the 3D distribution and temporal evolution of critical physical shock parameters such as Mach numbers, compression ratios, and shock geometry. Our sample comprises of modeled shocks that observed during solar cycle 24 and are associated with major solar energetic particles (SEPs) events, each distributed over a broad range of longitudes. To study the potential role of these waves in accelerating SEPs measured in situ, we model in a time-dependent manner how the shock wave connects magnetically with spacecraft making in situ measurements of SEPs. This allows us to compare modeled shock parameters deduced at the magnetically well-connected regions, with different key parameters of SEPs. Our approach accounts for projection effects associated with remote-sensing observations and constitutes the most extensive study to date of shock waves in the corona and their relation to SEPs. I will discuss the implications of that work for understanding particle acceleration in the solar corona.

5. **Name**: Dr. Theodoros Sarris (University of Thrace)
   Coauthors: No coauthors were included.
   Title: Daedalus: A Low-Flying Spacecraft for the Exploration of the Lower Thermosphere - Ionosphere
   Abstract:
   The Daedalus mission has been proposed to the European Space Agency (ESA) in response to the call for ideas for the Earth Observation programme's 10th Earth Explorer. It was selected in 2018 as one of three candidates for a Phase-0 feasibility study. The goal of the mission is to quantify the key electrodynamic processes that determine the structure and composition of the upper atmosphere, the gateway between the Earth's atmosphere and space. An innovative preliminary mission design allows Daedalus to access electrodynamics processes down to altitudes of 150 km and below. Daedalus will perform in-situ measurements of plasma density and temperature, ion drift, neutral density and wind, ion and neutral composition, electric and magnetic fields and precipitating particles. These measurements will unambiguously quantify the amount of energy deposited in the upper atmosphere during active and quiet geomagnetic times via Joule heating and energetic particle precipitation, estimates of which currently vary by orders of magnitude between models. An innovation of the Daedalus preliminary mission concept is that it includes the release of sub-satellites at low altitudes: combined with the main spacecraft, these sub-satellites will provide multi-point measurements throughout the Lower Thermosphere-Ionosphere region, down to altitudes below 120 km, in the heart of the most under-explored region in the Earth's atmosphere.

6. **Name**: Dr. Georgios Balasis (National Observatory of Athens)
   Coauthors: Papadimitriou Constantinos (National Observatory of Athens)
   Boutsi Adamantia Zoe (National Observatory of Athens)
   Title: Investigating dynamical complexity at Swarm altitudes using information-theoretic measures
   Abstract:
   Recently, many novel concepts originated in dynamical systems or information theory have been developed, partly motivated by specific research questions linked to geosciences, and found a variety of different applications. This continuously extending toolbox of nonlinear time series analysis highlights the importance of the dynamical complexity to understand the behavior of the complex Earth's system and its components. Here, we propose to apply such new approaches, mainly a series of entropy methods to the time series of the Earth's magnetic field measured by the Swarm constellation. Swarm is an ESA mission launched on November 22, 2013, comprising three satellites at low Earth polar orbits. The mission delivers data that provide new insight into the Earth's system by improving our understanding of the Earth's interior as well as the near-Earth electromagnetic environment. We show successful applications of methods originated in information theory to quantitatively studying complexity in the dynamical response of the topside ionosphere, at Swarm altitudes, to space weather events.

7. **Name**: Dr. Alexios Liakos (IAASARS, NOA)
   Coauthors: Bonanos Alceste (IAASARS, NOA)
   Xilouris Manolis (IAASARS, NOA)
   Boumis Panayotis (IAASARS, NOA)
   Bellas-Velidis Ioannis (IAASARS, NOA)
   Dapergolas Anastasios (IAASARS, NOA)
   Koschny Detlef (ESA, ESTEC & TU Munich, Germany)
   Moissl Richard (ESA, ESAC)
   Title: Scientific results from the first phase of the NELIOTA lunar monitoring campaign
   Abstract:
   The scientific results of the first 2.5 years of the NELIOTA lunar monitoring campaign are presented. Using the 1.2 m Kryoneri telescope and the fast frame cameras of the NELIOTA system, more than 55 lunar impact flashes have been recorded to date. The physical parameters of the flashes and the impactors have been estimated using reasonable assumptions. The peak temperatures of the flashes range between 1,700-5,700 K, the masses of the projectiles between 0.7 g and 8 kg and their sizes between 1 and 20 cm, depending on the value adopted for the luminous efficiency. NELIOTA on average detects one impact flash every 1.6 hours. Correcting for observational biases, it is estimated that approximately 7 flashes per hour would be observable over the full lunar surface. The mass-frequency distribution of sporadic meteoroids in the vicinity of Earth is determined, which has implications for designing the shielding of satellites, as well as for future space missions to the Moon.

8. **Name**: Dr. Anezina Solomonidou (ESA)
Coauthors: Coustenis Athena (Paris Observatory)
Lopes Rosaly (NASA/JPL)
Malaska Michael (NASA/JPL)
Le Gall Alice (LATMOS/IPSL)
Title: Ocean worlds: Titan's geology and astrobiology
Abstract:
Looking for habitable conditions in the outer solar system, in particular in Saturn and Jupiter, our research focuses on the natural satellites (ocean worlds) rather than the planets themselves. Indeed, the habitable zone as traditionally defined may be larger than originally conceived. The strong gravitational pull caused by the giant planets may produce enough energy to sufficiently heat the interiors of orbiting icy moons. The outer solar system satellites then provide a conceptual basis within which new theories for understanding habitability can be constructed. Measurements from the ground but also by the Voyager, Galileo, and the Cassini spacecrafts revealed the potential of these satellites in this context, and our understanding of habitability in the solar system and beyond can be greatly enhanced by investigating several of these bodies together. Their environments seem to satisfy many of the "classical" criteria for habitability, the development, and sustainability of life. Studying the geology of these moons provides hint into the connection between their interiors, surfaces, and atmospheres (in the case of Titan). In addition, we use the lesson learnt from the Cassini mission on a variety of the Saturnian icy moons, to build the new outer solar system mission to Jupiter and its moons, ESA's JUICE mission. Cassini's Visual and Infrared Mapping Spectrometer (VIMS) and the Titan Radar Mapper (RADAR) investigated Titan's surface since 2004, unveiling a complex, dynamic, and Earth-like surface. Understanding the distribution and interplay of geologic processes on Titan is important for constraining models of its interior, surface-atmospheric interactions, and climate evolution. We focus on understanding the origin of the major geological units on Titan. We discuss the nature of significant mid-latitude units (undifferentiated plains, hummocky/mountainous terrains, candidate cryovolcanic sites, labyrinth terrains, dunes etc) based on their surface albedo behavior and spectral evolution with time. Using a radiative transfer code, we find that temporal variations of surface albedo occur for some areas. Tui Regio and Sotra Patera, both candidate cryovolcanic regions, change with time, becoming darker and brighter respectively in surface albedo. In contrast, we find other areas, such as the undifferentiated plains, interpreted as sedimentary in nature, and areas suggested to be covered by evaporites do not present any significant changes. Furthermore, by testing a large number of areas for the different geomorphological units, we have identified three main categories of albedo values and spectral shapes, indicating significant differences in the composition among the various units. We compare with linear mixtures of three components (water ice, tholin-like, and a dark material) at different grain sizes. Our results show a latitudinal dependence of Titan's surface composition, with water ice being the major constituent at latitudes beyond 30ºN and 30ºS, while Titan's equatorial region appears to be dominated partly by a tholin-like or by a very dark unknown material. The albedo differences and similarities among the various geomorphological units give insights on the geological processes affecting Titan's surface and, by implication, its interior. Our results support the hypothesis that both endogenic and exogenic processes have played important roles in shaping Titan's geologic evolution. Such a variety of geologic processes and their relationship to the methane cycle make Titan important for astrobiology and habitability studies and particularly significant in solar system studies.

9. **Name:** Prof. Kleomenis Tsiganis (Department of Physics, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece)
Coauthors: the HERA Investigation Team
Title: The HERA mission to the binary NEA (65803) Didymos
Abstract:
HERA is an ESA mission of opportunity with the primary objective of observing and validating the outcome of a NASA-lead kinetic impactor experiment (DART) on the binary Near-Earth Asteroid (65803) Didymos. The two missions combined constitute the international AIDA collaboration. HERA will closely examine the physical and dynamical state of the target asteroid – the smaller (~170m) of the two members of the Didymos binary – a few years after the DART impact, thus allowing us to evaluate our technology of choice for impact mitigation. In this talk we are going to present an overview of HERA as well as recent results from the Dynamics' working group (WG3), relevant to the estimation of the 'beta' factor of momentum transfer efficiency – an intrinsically unknown quantity that we need to derive in order to probe the limits of applicability of the kinetic impact technique.

10. **Name**: Dr. Georgios Tsirvoulis (University of Belgrade/LTU)

    Coauthors: No coauthors were included.

    Title: Discovery of a young subfamily of the (221) Eos asteroid family

    Abstract:

    We report the discovery of a young cluster of asteroids that originated by the breakup of an asteroid member of the (221) Eos family. By applying the Hierarchical clustering method to the catalog of proper elements we have identified 26 members of this new small group of asteroids. We have established that the statistical significance of this cluster is >99 per cent; therefore it corresponds to a real asteroid family, named the (633) Zelima cluster, after its lowest numbered member. The orbits of its members are dynamically stable, a fact that enabled us to use the backward integration method, in two variants, to identify potential interlopers and estimate its age. Applying it first on the orbits of the nominal family members we identified three asteroids as interlopers. Then we applied it on a set of statistically equivalent orbital and physical clones of each member to determine the age of the cluster, with a result of 2.9 ± 0.2 Myr.

11. **Name**: Ms. Athanasia Toliou (AUTh / LTU)

    Coauthors: No coauthors were included.

    Title: Inclination excitation in the asteroid belt during the dissipation of the protoplanetary gas disk.

    Abstract:

    We study the problem of secular resonance sweeping through the inner solar system, during its early phases of evolution, when the protoplanetary gas disk is still present. We develop a semi-analytical method to compute the g and s-secular frequencies and their time evolution, during the decay of the gas disk, for a system of two giant planets and a planetesimal disk spreading from 0.3 to 4 AU. We construct maps of secular resonances and define the paths that secular resonances follow over time. Realistic surface density profiles, that are in agreement with both theory and observations, for the protoplanetary disk are used to investigate the excitation in eccentricity and inclination of simulated particles, due to the sweeping of the secular resonances during the dissipation of the disk. They disk decays either exponentially or according to recent photo-evaporation models. We find that, for different initial planetary configurations, consistent with recent evolution models (i.e. 'Nice model'-like resonant systems), the s=s6 and s=s5 secular resonances can sweep through parts or even the entire asteroid belt, providing a significant amount of inclination excitation. The level of this excitation depends on the adopted planetary configuration, the disk evaporation mode and time-scale, and the presence or not of mild chaos in the planetary orbits. Next, we perform simulations in which we explore the synergy between a variety of mechanisms that are at play during the dissipation of the protoplanetary gas disk, assuming various multi-resonant giant planet configurations. In accordance with previous studies, we aim to reproduce the orbital excitation of the main belt asteroids, as well as the mixing of taxonomic types and the decay of mass in the main belt region. We consider an initially dynamically cold disk of planetesimals that interacts with two giant planets and Mars-sized terrestrial planet embryos (undergoing Type I migration), whose secular frequencies are modified by the, uniformly or not, decaying disk. We define criteria of success to test the model's ability in reproducing the desired dynamical features of the current Solar System. Although each simulation has a different degree of success, they all show a generic outcome: (a) at least part of the asteroid belt is sufficiently excited in inclination and (b) embryos can efficiently evacuate the asteroid belt and accumulate in the terrestrial planets region, that could eventually lead to the formation of a system similar to the current one.

12. **Name**: Evangelos Paouris
    Coauthors: A. Vourlidas (The Johns Hopkins University Applied Physics Laboratory), A. Papaioannou & A. Anastasiadis (Institute for Astronomy, Astrophysics, Space Applications & Remote Sensing of the National Observatory of Athens (IAASARS-NOA))
    Title: Quantifying the reliability of CME speeds derived from single viewpoint observations
    Abstract:
    Images of Coronal Mass Ejections (CMEs) are primarily acquired by space-based coronagraphs. The images capture the outward flow of density structures emanating from the Sun by observing Thompson-scattered sunlight from the free electrons within these structures. Thereby, CMEs spotted by coronagraphs are projections of their real 3D structure, on the field of view (FOV) of the coronagraph. As a result, all of the CME characteristics (e.g. linear speed, angular width), which are calculated based on these images, suffer from projection effects and their reliability remains an open question. In this work we apply a geometrical method for the de-projection of the linear CME speed of a sample of 4319 CMEs from the CDAW catalog, associated with solar flares (3341 C-class, 866 M-class and 112 X-class solar flares) We aim towards a robust quantification of the reliability of the CME properties from L1 (SOHO/LASCO) single viewpoint measurements. In addition, we compare the intensity, the location of solar flares, and the CME kinematic characteristics. In particular, 482 M-class solar flares associated with CMEs with an angular width 20°< w < 120°, show a dependence of the mean CME linear speed with the longitude of the parent solar flare, indicating less projection effects of CMEs near the solar limb. This study is crucial for Space Weather applications since the reliable identification of the CME linear speed has a direct effect on the time of arrival of CMEs at Earth.

13. **Name**: Prof. Loukas Vlahos (University of Thessaloniki)
    Coauthors: No coauthors were included.
    Title: Solar Eruptions and their Space Weather Impact
    Abstract:
    The physical processes, which drive powerful solar eruptions, play an important role in our understanding of the Sun–Earth connection. I will firstly discuss how magnetic fields emerge from the solar interior to the solar surface, to build up active regions, which commonly host large-scale coronal disturbances, such as coronal mass ejections (CMEs). Then, I discuss the physical processes associated with the driving and triggering of these eruptions, the propagation of the large-scale magnetic disturbances through interplanetary space and the interaction of CMEs with Earth's magnetic field. The acceleration mechanisms for the solar energetic particles related to explosive phenomena (e.g. flares and/or CMEs) in the solar corona are also discussed. The evolution of the large-scale current sheets and their fragmentation will lead to strong turbulence and turbulent reconnection during solar flares and turbulent shocks. In other words, the acceleration mechanism in flares and CME-driven shocks may be the same, and their difference will be the overall magnetic topology, the ambient plasma parameters, and the duration of the unstable driver. My aim will be to encapsulate the present state-of-the-art in research related to the genesis of solar eruptions, their role to accelerate energetic particle and their space-weather implications.

14. **Name**: Dr. Kostas Tziotziou (IAASARS/National Observatory of Athens)
Coauthors: Tsiropoula Georgia (IAASARS, NOA)
Kontogiannis Ioannis (AIP, Germany)
Title: Dynamics of an intricate and persistent quiet-Sun small-scale vortex
Abstract:
Vortex flows have been extensively observed over a large range of spatial and temporal scales in several photospheric and chromospheric lines and, hence, layers of the solar atmosphere and widely found in numerical simulations. However, only recently vortex flows have been reported in observations of the chromospheric Halpha line also showing, in our case, unique dynamical characteristics manifested as a complex substructure (in the form of several intermittent smaller swirls) and an unprecedented long duration. We discuss such a persistent 1.7-hours small-scale vortex flow seen in high spatial and temporal resolution observations obtained with the Swedish Solar Telescope in several wavelengths along the Halpha and Ca II 8542 Å lines as well as in simultaneous UV and EUV SDO/AIA channels and HMI magnetograms. We explore its intricate dynamics with a temporal analysis and its oscillatory behaviour using a wavelet analysis and search for signatures of waves looking at phase differences between different heights and physical parameters obtained from a cross-wavelet analysis. We try to understand its relation to previously reported in literature short-duration small-scale magnetic swirls and discuss possible generating physical mechanisms of this unusual persistent vortex flow. Comprehension of these abundant on the solar surface structures is another crucial step in our effort to understand how mass and energy transport occurs to higher atmospheric layers in quiet-Sun regions.

15. **Name**: Dr. Kostas Moraitis (Observatoire de Paris)
Coauthors: Sun Xudong (University of Hawaii)
Pariat Etienne (LESIA, Observatoire de Paris)
Linan Luis (LESIA, Observatoire de Paris)
Title: Magnetic helicity and eruptivity in active region 12673
Abstract:
In September 2017 the largest X-class flare of Solar Cycle 24 occurred from the most active region (AR) of this cycle, AR 12673. The AR attracted much interest because of its unique morphological and evolution characteristics. This work is interested in studying the evolution of the relative magnetic helicity and of the two components of its decomposition, the non-potential, and the volume-threading one, in the time interval around the highest activity of AR 12673. Special emphasis is given on the study of the ratio of the non-potential to total helicity, that was recently proposed as an indicator of ARs eruptivity. For these, we first approximate the coronal magnetic field of the AR with two different optimization-based extrapolation procedures, and choose the one that produces the most reliable helicity value at each instant. We then follow an accurate method to compute the various helicity, and energy budgets of AR 12673, and finally, we examine the evolution patterns of all quantities of interest. The first observational determination of the evolution of the non-potential to total helicity ratio seems to confirm the quality it has in indicating eruptivity; this ratio increases before the major flares of AR 12673, and afterwards it relaxes to smaller values.

16. **Name**: Mr. Eugene Zhuleku (Max Planck Institute for Solar System Research)
    Coauthors: No coauthors were included.
    Title: EUV and X-ray loops above active regions of different activity levels
    Abstract:
    The corona of the Sun and Sun-like stars, as observed in the EUV and X-ray, is dominated by magnetic loops. For the Sun we can model these magnetic structures in detail, e.g. reproducing the intensity distribution along loops or the 3D spatial structure. Stellar observations, on the other hand, extend the limited range of (magnetic) activity covered by solar structures. Thus, stellar observations can give constraints to models not available by solar observations. Hence, we model coronal active regions and their loops with different levels of activity to investigate to what extent this can recover observed stellar relations, e.g. between X-ray luminosity and surface magnetic flux. With 3D MHD models of solar active regions we can recover many aspects of the loop-dominated coronal structure and dynamics. Our goal is to study how coronal loops respond to higher levels of surface magnetic activity representative for a more active star. We present a series of numerical experiments where we change the surface magnetic flux in the photosphere while keeping other model parameters the same. Using the Pencil Code we solve the MHD equations assuming the corona is heated mainly by Ohmic dissipations. The currents are induced by driving the surface magnetic field through photospheric motions. From our 3D models we can synthesize the EUV and the X-ray emission and investigate the relation between coronal emission and magnetic flux. Depending on the magnetic flux at the surface, the modelled coronae reach peak temperatures ranging from 1 to 10 MK. The average temperature and density of the coronal part of the computational domain somewhat follows the well-known RTV scaling laws. EUV and X-ray emission we synthesise from the model increases steeply with the unsigned magnetic flux at the surface. Our findings indicate that a higher magnetic flux at the surface allows for a higher efficiency in energy transport into the upper atmosphere in the fieldline braiding or fluxtube tectonics scenario. This implies that the upward Poynting flux is modulated by surface magnetic flux.

17. **Name**: Mr. Argyrios Koumtzis (University of Thessaloniki)
    Coauthors: Vlahos Loukas (Aristotle University of Thessaloniki)
    Title: Power law flare statistics driven by photospheric turbulence
    Abstract:
    One of the challenging open questions in the analysis of solar explosions is their statistical characteristics. The turbulent photospheric motions that act as a driver for the formation of fragmented currents have been suggested as a possible explanation. Another potential explanation is suggested by the concept of Self-Organized Criticality (SOC). In this work, we address three questions: (1) Can we find the statistical properties of the photospheric turbulent driver of the energy release in solar active regions? (2) What are the statistical properties of the solar explosions if if they are driven by photospheric turbulent flows when solar active regions are far from the SOC state? (3) How are the statistical properties of ARs when it is in the SOC state and also driven by the turbulent driver? We use a state of the art nonlinear force free extrapolation method to reconstruct the magnetic field topology of the active region (AR 11158) above the photosphere. The extrapolated magnetic fields from a sequence of magnetograms are used to extract information for the turbulent photospheric driver. We then use a Cellular Automaton model, developed almost thirty years ago, to explore the applicability of the concept of SOC in the interpretation of the flare statistics, when the solar active regions are driven by the turbulent photosphere and are either far from or very close to the SOC state. According to our analysis, the statistics of the driver of the solar active regions, as extracted from the extrapolated magnetic fields, follows a double power law probability distribution function. The peak luminosity and total released energy distributions of the solar explosions obey power laws even in the beginning of the simulations, much before the active region reaches its dynamic equilibrium state. There are available observations of the flares in this active region which are in encouraging agreement with our results.

18. **Name**: Mr. Konstantinos Karampelas (KU Leuven)
Coauthors: No coauthors were included.
Title: Simulations of decayless oscillations in coronal loops: dynamics and heating
Abstract:
Recent observations with the Atmospheric Imaging Assembly (AIA) instrument on the SDO spacecraft have revealed the existence of low-amplitude decayless transverse oscillations in coronal loops. Numerical studies have managed to reproduce these oscillations in the form of footpoint driven standing waves in coronal loops, and to treat them as a possible mechanism for wave heating of the solar corona. By performing 3D MHD simulations of straight flux tubes in a coronal environment, we study the manifestation of the Kelvin-Helmholtz instability and its effects on the dynamics and energetics of such loops, and compare with pre-existing work on large-amplitude decaying oscillations. Our past studies show that the developed KH-eddies extend across the loop cross-section, disrupting the initial loop profile into a turbulent one. This spreads the initially localised wave heating process over the entire loop cross-section. Qualitatively studies have shown that ohmic heating is stronger near the loop footpoints, while viscous heating is more prominent near the velocity antinodes (in our setups, the loop apex). Furthermore, the KHI induced mixing of plasma, in the presence of a temperature gradient, can potentially hide the effects of wave heating. Finally, we create synthetic observations of our data through forward modelling. The out-of-phase movements due to the KHI, and the LOS effects prevent us from establishing a clear correlation between the input energy flux and the observed amplitudes of decayless oscillations. We conclude that the underlying energy fluxes from low amplitude decayless kink oscillations can be of the order of the radiative losses for the Quiet Sun.

19. **Name**: Dr. Georgia Tsiropoula (IAASARS, NOA)
Coauthors: No coauthors were included.
Title: The solar chromosphere: outstanding problems and new opportunities
Abstract:
The solar chromosphere is the highly dynamic interface between the Sun's surface and the hot corona. The chromosphere guides and regulates the mass and energy flow to the corona, is the seat of the acceleration and the composition of the solar wind and is the source of most of the UV flux impinging on Earth. In this layer most of the non-thermal energy that powers the solar atmosphere is transformed into heat making the understanding of chromospheric heating mechanisms even more challenging than the coronal heating ones. These mechanisms include various MHD processes, different kinds of propagating waves, as well as magnetic reconnection. The chromosphere is dominated by magnetic fields featuring a wealth of structures, from spicules, mottles, fibrils and swirls, with scales approaching – or below – the current diffraction limit (~ 70 km), to large features, such as filaments and prominences. The considerable challenges associated with understanding the chromosphere have motivated high resolution imaging and spectroscopy observations – from state-of-the-art ground-based telescopes to space missions – as well as rapid recent progress in sophisticated 3D radiation-(mhd)hydrodynamic simulations. These recent advances will provide sensitive diagnostics of the thermal, dynamic and magnetic properties of the solar chromosphere and growing theoretical insight. Outstanding problems and new opportunities related to the understanding of the solar chromosphere will be discussed.

20. **Name**: Dr. Georgios Chintzoglou (Lockheed Martin Solar and Astrophysics Lab)
Coauthors: No coauthors were included.
Title: The Origin of Major Solar Activity: Collisional Shearing between Nonconjugated Polarities of Multiple Bipoles Emerging within Active Regions
Abstract:
Active regions (ARs) that exhibit compact polarity inversion lines (PILs) are known to be very flare productive. However, the physical mechanisms behind this statistical inference have not been demonstrated conclusively. We show that such PILs can occur owing to the collision between two emerging flux tubes nested within the same AR. In such multipolar ARs, the flux tubes may emerge simultaneously or sequentially, each initially producing a bipolar magnetic region (BMR) at the surface. During each flux tube's emergence phase, the magnetic polarities can migrate such that opposite polarities belonging to different BMRs collide, resulting in shearing and cancellation of magnetic flux. We name this process "collisional shearing" to emphasize that the shearing and flux cancellation develop owing to the collision. Collisional shearing is a process different from the known concept of flux cancellation occurring between polarities of a single bipole, a process that has been commonly used in many numerical models. High spatial and temporal resolution observations from the Solar Dynamics Observatory for two emerging ARs, AR 11158 and AR 12017, show the continuous cancellation of up to 40% of the unsigned magnetic flux of the smallest BMR, which occurs at the collisional PIL for as long as the collision persists. The flux cancellation is accompanied by a succession of solar flares and CMEs, products of magnetic reconnection along the collisional PIL. Our results suggest that the quantification of magnetic cancellation driven by collisional shearing needs to be taken into consideration in order to improve the prediction of solar energetic events and space weather.

21. **Name**: Mr. Ioannis Dimitrios Kontogiannis (AIP)
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Tziotziou Kostas (IAASARS/NOA)
Gontikakis Costis (RCAAM/AA)
Kuckein Christoph (AIP)
Verma Meetu (AIP)
Denker Carsten (AIP)
Title: Flux emergence in the quiet Sun, observed from the photosphere to the corona
Abstract:
We study the emergence and evolution of new magnetic flux in the vicinity of quiet Sun network. Our data set includes high-resolution spectropolarimetric, spectroscopic and spectral imaging observations from ground-based (Dutch Open Telescope) and space-born instruments (TRACE, Hinode, SoHO), providing a multi-wavelength, tomographic view of the region from the photosphere up to the corona. The new flux emerges through a series of granular-scale events, which follow the photospheric horizontal flows, with speeds up to 1.7 km/s and eventually form a small-scale flux system. The magnetic flux of the region is highly imbalanced, which means that a large part of the structure consists of very small-scale magnetic elements below detection limit. This is also corroborated by spectropolarimetric inversions, which show a complicated magnetic configuration below the emerging flux system. The newly emerging magnetic flux interacts almost immediately with the pre-existing chromospheric magnetic field, pushing it aside and gradually merging with it, since Doppler-shifted absorption features are formed above and at the crests of the structure. Soft X-ray observations also reveal this interaction, which leads to the formation of a small coronal bright point. Roughly 60 min after the region appeared at the photosphere it reached its maximum extent and magnetic flux. Then a coronal bright point was formed with a lifetime that exceeded one hour. It exhibited intense spatial and temporal variations and EUV spectroscopy reveals that it reaches temperatures higher than 1 MK. During the coronal brightening, blue-shifted, elongated, chromospheric structures were also detected in Ha. We conclude that the emerging structure is not monolithic, but highly deformed by the sub-photospheric flows, leading to an episodic emergence of smaller-scale bipoles. The formation of the coronal bright point is attributed to the reconnection between the newly formed and the pre-existing magnetic field, confirming recent findings from sophisticated simulation experiments. The cool chromospheric ejections may partially account for the temporal and spatial variability observed in coronal emission. Multi-wavelength, high resolution observations can help us understand how new magnetic flux shapes the dynamics of the quiet Sun.

22. **Name**: Dr. Costis Gontikakis (RCAAM, Academy of Athens)
Coauthors: Vial Jean-Claude (Institut d'Astrophysique Spatiale, CNRS-Université Paris-Sud France)
Title: Analysis of resonant scattering and opacity effects in solar EUV spectra emitted by transition region plasma
Abstract:
This work presents evidence of resonant scattering and opacity effects measured in the Si IV 1393.757AA, 1402.772AA doublet spectral lines, emitted by active region NOAA 12529 and observed with the Interface Region Imaging Spectrograph (IRIS) instrument on 18 April, 2016. More than 4000 individual Si IV profiles (2.4% of the total observed profiles) were found, where the intensity ratio 1393.757/1402.772 is higher than 2, indicating resonant scattering, along with about 500 profiles where this ratio is between 1.3 and 1.6, indicating opacity. On the other hand, 15 individual profiles show differentially shaped (DS) profiles. Cases with opacity were found along fibrils with an opacity tau~1.5 to 3. Cases with resonant scattering are also found along fibrils and on small grains. There, the resonant scattering was caused by an advantageous combination of strong incident light along with a rather lower electron density. DS profiles are formed by two or more emitting plasma volumes, having different line of sight velocities, while they are affected, each volume with a different percentage, by resonant scattering. In conclusion this work shows that resonant scattering and opacity should not be neglected in the study of the transition region, at least when active regions are analyzed.

Posters:

1. **Name:** Dr A. Anastasiadis (Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS), National Observatory of Athens, I. Metaxa & Vas. Pavlou St., GR-15236, Penteli, Greece)
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   Title: The Advanced Solar Particle Events Casting System (ASPECS) activity
   Abstract:
   Solar Energetic Particle (SEP) events can adversely affect space and ground-based systems. The space weather effects associated with SEP events include communication and navigation systems, spacecraft electronics and operations, space power systems, manned space missions, and commercial aircraft operations. As a result, there is a clear need for the development of a scheme which provides advanced warning and forecast of SEP events, their characteristics and time profiles. In this work, a new web based service for the prediction of solar eruptive and energetic particle events is presented. The ASPECS (Advanced Solar Particle Event Casting System) activity is designed to advance the technology development of a Solar Particle Radiation Advanced Warning System (SAWS). It will collate and combine outputs from different modules providing forecasts of solar phenomena, solar proton event occurrence and solar proton flux and duration characteristics; tailored to the needs of different spacecraft and launch operators, as well as the aviation sector. The predictions will start with the solar flare forecasting and continuously evolve through updates based on near-real time inputs (e.g. solar flare and coronal mass ejections data/characteristics) received by the system. User requirements include a derivation of energies and thresholds important for different user-groups and warning levels. A thorough validation process will provide results on the system's forecasting accuracy and will be used to tailor the modules and the use of different data sources and algorithms for different forecast horizons and SEP energies. This work was supported through the ESA Contract No 4000120480/17/NL/LF/hh "Solar Energetic Particle (SEP) Advanced Warning System (SAWS)"

2. **Name**: Ms. Adamantia-Zoe Boutsi (IAASARS/NOA)
 Coauthors: Balasis Georgios (National Observatory of Athens)
 Daglis Ioannis A. (Physics Department, National and Kapodistrian University of Athens)
 Title: Wavelet spectral analysis of the ENIGMA magnetometer array and solar wind time series around the strongest magnetic storms of solar cycle 24
 Abstract:
 Magnetic storms are undoubtedly among the most important phenomena in space physics and also a central subject of space weather. The HellENIc GeoMagnetic Array (ENIGMA) is a network of 4 ground-based magnetometer stations in the areas of Thessaly, Central Greece, Peloponnese and Crete in Greece that provides geomagnetic measurements for the study of pulsations, resulting from the solar wind - magnetosphere coupling. ENIGMA magnetometer array enables effective remote sensing of geospace dynamics and the study of space weather effects on the ground (i.e. Geomagnetically Induced Currents - GIC). ENIGMA contributes data to SuperMAG, a worldwide collaboration of organizations and national agencies that currently operate approximately 300 ground-based magnetometers. Here we study the Earth's magnetic field time variations measured by ENIGMA, when the most intense magnetic storms (i.e. Dst < -150 nT) of solar cycle 24 occurred (i.e. March, June and December 2015, and August 2018), along with the corresponding variations of solar wind parameters and geomagnetic activity indices. We apply spectral analysis techniques based on wavelet transforms and calculate the Hurst exponent of these time series. Our results show the existence of two different patterns: (i) a pattern associated with the intense magnetic storms, which is characterized by higher Hurst values, and thus, higher organization of the magnetosphere; (ii) a pattern associated with the quiet-time magnetosphere, which is characterized by lower Hurst values, and thus, lower organization of the magnetosphere.

3. **Name**: Mr. Ioannis Dakanalis (University of Athens, IAASARS/NOA)
 Coauthors: Tsiropoula Georgia (NOA)
 Tziotziou Kostas (NOA)
 Kontogiannis Ioannis (AIP)
 Title: Solar synoptic Halpha observations at NOA and case study of the September 2017 solar eruptive events impact on the ionosphere
 Abstract:
 We present full-disk solar observations from the upgraded solar telescope of the Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS) of the National Observatory of Athens (NOA), as well as, results from our research regarding the response of the Earth' s ionosphere above Europe, due to the solar eruptive phenomena of September 2017. Following the need for ground-based synoptic observations of the Sun, we provide Halpha-line observations of the solar disk with emphasis on the chromospheric phenomena, presenting full-disk and close-up (in regions of interest) observations. The images are taken with a dedicated 10mm aperture solar telescope, equipped with an internal etalon of bandpass < 0.7 A, along with a CCD camera of 1600 x 1200 resolution and 4 x 4 micrometers pixel dimension. The resulted near real-time solar observations are available in a web-based server (HELIOSERVER) developed in the IAASARS, which also includes complementary information from space solar observatories such as SDO/NASA and SWPC/NOAA' s, ACE and GOES satellites, and, also, provides real-time monitoring of ionospheric conditions and solar energetic particle events (SEP) forecasting tools. The impact of solar eruptive phenomena in the ionosphere above Europe, is presented for a case study concerning eruptive events of September 2017 through the behavior of several important ionospheric parameters such as foF2, MUFD, fmin and TEC. Data from the European Digital Upper Atmosphere Server (DIAS) were used for the analysis and study of that impact, as well as, time series of these critical parameters from other digisondes around the globe. Ground-based monitoring of the solar activity along with its effect in the ionospheric conditions serves the ever important need for synoptic observations, especially in the territory of Europe. This work is funded by the KRIPIS/PROTREAS project.

4. **Name**: Dr. Alexander Hillaris (University of Athens)
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   Kontogeorgos Athanasios (Department of Physics, University of Ioannina, 45110 Ioannina, Greece)
   Title: Spikes detected in Type II metric Radio Bursts
   Abstract:
   In this work we report the detection of Type II- associated spike-like structures, in dynamic spectra obtained with the Artemis-JLS (ARTEMIS-IV) solar radio spectrograph. We selected 4 events recorded by the Artemis-JLS/SAO receiver in the 270-450 MHz range; the high time resolution (10ms) of this receiver facilitates fine structure detection and analysis on dynamic spectra. The spike-like structures observed were found to co-exist with herringbones or pulsations. More than 600 hundred short narrowband spikes were identified and their parameters (duration, bandwidth) main features were computed. These structures mainly appear in chains which drift almost parallel to the harmonic emission band of the Type II front, which is within the frequency range of the SAO receiver. Single isolated bursts have been rarely detected. The average duration and relative bandwidth were about 96 ms and 1.7% respectively. These values are almost equal to those embedded in Type IV bursts, in the same frequency range. A small-scale reconnection along the front of the Type II burst could be the origin of the detected spikes.

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   Armatas Spyros (Department of Physics, University of Athens, 15783 Athens, Greece)
   Title: Metric type III bursts associated with narrowband spikes
   Abstract:
   We examine associations between type III burst and spike groups from high resolution observations of the ARTEMIS-IV multichannel Radiospectrograph. Both groups associate well with the impulsive phase of the corresponding SXR flare; furthermore, most of the spike groups appear about the starting frequencies of the type III groups and coincide in time and frequency with the narrowband members of the type III family.

6. **Name**: Mr. Ioannis Dimitrios Kontogiannis (AIP)
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   Diercke Andrea (AIP)
   Dineva Ekaterina (AIP)
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   Title: Observing the Sun with the GREGOR telescope
   Abstract:
   We present a data set of extremely high-quality, imaging, spectroscopic and spectropolarimetric observations taken by the GREGOR telescope, along with some science cases which can be addressed. Situated at the Observatorio del Teide, Tenerife Spain, the GREGOR telescope is the biggest solar telescope in Europe, with a 1.5 m primary mirror diameter. Its suite of instruments allows the tomographic observation of the solar atmosphere from the photosphere up to the upper chromosphere along with the magnetic fields that permeate these layers. The observations follow the evolution of a decaying active region, which contains one pore with a light bridge, a few micro-pores and extended clusters of magnetic bright points. The high resolution photospheric imaging reveals, in unprecedented detail, the complex interactions between granular-scale convective motions and a range of scales of magnetic field concentrations. The pore itself shows a strong interaction with the convective motions which eventually leads to its fragmentation and decay, while, under the influence of the photospheric flow field, micro-pores appear and disappear. Compressible waves are guided towards the upper atmosphere along the magnetic field lines of the various magnetic structures within the field of view. The state-of-the-art multiwavelength GREGOR observations allow us to track and understand the physical processes during the decay phase of an active region.

7. **Name**: Dr. Athanasios Kouloumvakos (IRAP/UPS Toulouse)
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   Wu Yihong (IRAP, CNRS, CNES, Toulouse, France)
   Title: Evolution of the coronal shock properties during long-duration gamma-ray events: A case study of the 2017 September 10 solar eruption
   Abstract:
   In this study, we focus on the gamma-ray event and the Ground Level Enhancement (GLE) event of September 10, 2017 solar eruption. We combine, shock wave reconstruction techniques using coronal observations --along with global MHD models of the solar corona-- to derive the 3D distribution and temporal evolution of critical shock parameters. We model, how the shock wave connects magnetically with the solar surface and we compare the evolution of the modeled shock parameters, with the properties of the observed long-duration gamma-ray emission. We demonstrate a relationship between the temporal evolution of the modeled shock wave parameters and the properties of the measured gamma-ray emission for both the early and late-phase of >100 MeV gamma-ray emission which lasts almost 12 hours. This suggests that, for this event, the expanding shock wave can be considered as a primary accelerating agent of the high-energy protons responsible for the >100 MeV gamma-ray emission. A relationship is also found between the evolution of the shock parameters along magnetic field lines that are well connected with Earth and the GLE72 temporal characteristics.

8. **Name**: Dr. Georgios N. Kouziokas (University of Thessaly)
   Coauthors: No coauthors were included.
   Title: Quantum Artificial Intelligence in Galactic Cosmic Ray Intensity Forecasting
   Abstract:
   The galactic cosmic rays are energetic charged particles originated from outside the solar system which arrive at the Earth, as an effect of the changes of the interplanetary magnetic field because of the solar cycle. In this study, a Quantum Artificial Intelligence methodology is proposed in order to predict galactic cosmic ray intensity by taking into consideration the solar activity regarding the number of the sunspots. Different number of qubits were applied to achieve the optimal results. The Quantum Machine Learning model was constructed by developing a quantum circuit with several quantum gates. The proposed model was trained by implementing the gradient descent algorithm. The cosmic ray data were retrieved from Neutron Monitor Database (NMDB), collected by the Earth neutron monitor stations. The final results of the research have shown a very good prediction accuracy of the galactic cosmic ray intensity.

9. **Name**: Ms. Evangelia Liokati (University of Ioannina)
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   Title: Magnetic Helicity and Free Magnetic Energy of two Differently Evolving Solar Active Regions
   Abstract:
   "Free" magnetic energy (that is relating to the electric current density) and relative magnetic helicity play an important role in solar active region magnetic activity and dynamics. The former is released in the course of flares, coronal mass ejections (CMEs), and smaller-scale dissipative events while the latter can either be removed from active regions in the form of CMEs or is transferred during reconnection events to larger solar scales via existing magnetic connections. In this presentation we use vector magnetograms obtained by the Helioseismic and Magnetic Imager (HMI) on board Solar Dynamics Observatory (SDO) to study the temporal patterns of accumulation of both free magnetic energy and relative magnetic helicity in two solar active regions with significantly different magnetic flux evolution. Both active regions produced large flares close to the solar disk center, but this activity resulted from very different magnetic evolution: primarily magnetic flux emergence in the first active region and primarily magnetic flux cancellation in the second one. Our study enables an assessment of the distinct roles of the free energy and helicity changes in the initiation of both confined and eruptive events.

10. **Name**: Dr. Olga Malandraki (NOA/IAASARS)
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Title: The HESPERIA real-time Solar Energetic Particle prediction tools
Abstract:
Solar Energetic Particles (SEPs), ranging in energy from tens of keV to a few GeV, constitute an important contributor to the characterization of the space environment. SEP radiation storms may have durations from a period of hours to days or even weeks and have a large range of energy spectrum profiles. They pose a threat to modern technology strongly relying on spacecraft and are a serious radiation hazard to humans in space, and are additionally of concern for avionics and commercial aviation in extreme cases. The High Energy Solar Particle Events forecasting and Analysis (HESPERIA) project, supported by the HORIZON 2020 programme of the European Union, has furthered our prediction capability of high-energy SEP events by developing new European capabilities for SEP forecasting and warning, while exploiting novel as well as already existing datasets. The HESPERIA UMASEP-500 tool makes real-time predictions of the occurrence of >500 MeV and Ground Level Enhancement (GLE) events from the analysis of soft X-ray flux and high-energy differential proton flux measured by the GOES satellite network. Regarding the prediction of GLE events for the period 2000-2016, this tool had a Probability of Detection (POD) of 53.8% and a False Alarm Ratio (FAR) of 30.0%. For this period, the tool obtained an Advanced Warning Time (AWT) of 8 min taking as reference the alert time from the first NM station; using the time of the warning issued by the GLE Alert Plus tool for the afore mentioned period as reference, the tool obtained an AWT of 15 min (Núñez et al. 2017). Based on the Relativistic Electron Alert System for Exploration (REleASE) forecasting scheme (Posner, 2007), the HESPERIA REleASE tools generate real-time predictions of the proton flux (30-50 MeV) at the Lagrangian point L1, making use of relativistic electrons (v>0.9c) and near-relativistic (v<0.8c) electron measurements provided by the SOHO/EPHIN and ACE/EPAM experiments, respectively. Analysis of historic data from 2009 to 2016 has shown the HESPERIA REleASE tools have a low FAR (~30%) and a high POD (63%). Both HESPERIA tools are operational through the project's website (http://www.hesperia.astro.noa.gr) at the National Observatory of Athens and presented in the recently published book on 'Solar Particle Radiation Storms Forecasting and Analysis, The HESPERIA HORIZON 2020Project and Beyond', edited by Malandraki and Crosby, Springer, Astrophysics and Space Sciences Library, 2018,freely available at https://www.springer.com/de/book/9783319600505.

11. **Name**: Ms. Konstantina Moutsouroufi (University of Athens)
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Dougherty Michele (Imperial College London)
Title: A Magnetospheric Stress Index: Construction and application to the Kronian magnetosphere using long-term Cassini measurements.
Abstract:
A planet's magnetosphere is being shaped by the forces applied to it, both externally and internally. When a magnetosphere is being stressed by changes in external or internal pressures, its magnetic field lines are correspondingly being deformed in almost all of its range. In order to study the dynamic changes in Saturn's magnetosphere, it is useful to have a quantitative measure of its average stress, which can be compared it to the measured fluctuations during individual passes. The most extensive and detailed measurements on Saturn's systems were provided by the Cassini mission and have expanded our understanding of the planets' magnetosphere. In the present study we introduce and calculate a Magnetospheric Stress Index using measurements of Saturn's magnetic field, obtained throughout the Cassini mission (2004-2017) near the equatorial plane of the magnetosphere, between 4 and 8 planet radii (Rs). The proposed index is similar to indices that have been developed to monitor the Earth's and Jupiter's magnetospheric stresses. The index indicates any unusual deviations from the average magnetospheric conditions and distinguishes them from smaller deviations expected due to usual fluctuations in the solar wind. Hence, the proposed index depicts the temporal magnetospheric deformation, despite the limitation of single-spacecraft measurements, mostly far from the magnetopause.

12. **Name**: Mr. Apostolos-Evgenios Pavlos (NOA/IAASARS & DUTh)
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    Livadiotis George (Space Science & Engineering, SWRI)
    Title: Non-Extensive Statistical Analysis of Energetic Particle Flux Enhancements Caused by the Interplanetary Coronal Mass Ejection - Heliospheric Current Sheet Interaction
    Abstract:
    We present significant results concerning properties of acceleration of energetic particles associated with the dynamics of regions filled with small-scale magnetic islands (SMIs) with a typical size of ~0.01-0.001 AU at 1 AU. We study the energetic particle non-extensive fractional acceleration mechanism producing kappa distributions and the intermittent turbulence mechanism producing multifractal structures related with the Tsallis q-entropy principle. We analyze ~0.5 MeV ion time-intensity profiles observed by the STEREO A spacecraft during a rare, widely discussed event. In order to understand the properties of energetic particles and the particle acceleration mechanism, the statistical characteristics are obtained and the results refer to the estimation of the Tsallis q-triplet. The study reveals significant differences in statistical and dynamical features between the periods identified, indicating an important differentiation in the energetic ion intensities in terms of changes of the entropy production, relaxation dynamics and meta-equilibrium stationary states. A significant difference was found in the q-triplet parameters of the dynamical system between the quite region and the energetic particle flux enhancement regions. This finding reveals the relation of energetic particle enhancement and fractional acceleration processes with the topological phase transition process to the self-organized plasma instabilities states corresponding to meta-equilibrium stationary states.

13. **Name**: Mr. Panagiotis Pyrnaris (University of Thrace)
    Coauthors: No coauthors were included.
    Title: Daedalus measurement simulations and error analysis
    Abstract:
    The Daedalus mission has been proposed to the European Space Agency (ESA) in response to a call for ideas for ESA's 10th Earth Explorer. It was selected in 2018 as one of three candidates, and currently undergoes a Phase-0 feasibility study. The goal of the mission is to quantify key electrodynamic processes that determine the structure and composition of the upper atmosphere, the gateway between the Earth's atmosphere and space. One of the key processes that have large discrepancies between estimation methodologies and global models is Joule heating. In this work we present the methodology towards determining Joule Heating and Pedersen conductivity in-situ along Daedalus' orbit. Estimates of these two quantities require simultaneous measurements of ion drifts, neutral winds, electric field, magnetic field and composition. We model these measurements along Daedalus' orbit through the use of empirical models (HWM14, MSISE00, IRI16 and IGRF-12) and we present an error propagation model that estimates errors in Joule Heating and Pedersen conductivity based on expected or assumed Daedalus measurement random and systematic errors for the various instruments and the corresponding measurements.

14. **Name**: Ms. Katerina Stergiopoulou (Swedish Institute of Space Physics (IRF))
Coauthors: Andrews David (Swedish Institute of Space Physics (IRF))
Title: Mars Express observations of cold plasma structures in the Martian magnetotail
Abstract:
The Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) instrument is a low frequency radar on board Mars Express (MEX), which measures the propagation time delay of a transmitted pulse from the spacecraft to the Martian ionosphere where it is reflected as it enters the dense plasma. Simultaneously, interactions with the tenuous plasma in the vicinity of the spacecraft yield the local electron plasma frequency[1]. The determination of the altitude and structure of the ionospheric peak is feasible when MARSIS operates in Active Ionospheric Sounding (AIS) mode for altitudes below 1200 km[1]. We investigate the variability of plasma structures in the Martian tail using Mars Express measurements. We focus on five non-consecutive orbits from September 2016, namely 16130, 16133, 16136, 16144 and 16148 during which MEX passed through the induced magnetotail. These were specifically chosen as special operations of MARSIS on MEX were made only on these orbits. Operated in Active Ionospheric Sounding mode, MARSIS functions as a local sounder allowing us to determine the local plasma density in the upper ionosphere, as the sounder excites oscillations at the plasma frequency and its higher harmonics. We show that the electron density well above the ionospheric peak is highly variable and patchy thermal plasma is present deep in the tail, transported from day to night. Mars Atmosphere and Volatile EvolutioN (MAVEN) Solar wind data are used as well to help us evaluate a possible correlation between the observed plasma structures and Solar wind variations, taking into account the time delay due to the ionospheric response time. The crustal magnetic fields are also studied, as an additional factor that affects the day-to-night transport process through the terminator and modifies the flow and behaviour of the nightside ionospheric plasma. Relatively few studies have fully exploited the presence of simultaneous measurements from two spacecraft at Mars for the purposes of making short time-scale comparisons between Solar wind variations and changes in the induced magnetosphere and ionosphere. With this study we aim to show that the varied nature of the nightside plasma structures is not controlled by any simple parameter, even given the best possible knowledge of the upstream Solar wind.
References [1] Gurnett D. A. et al. (2005), Radar soundings of the ionosphere of Mars, Science, 310(5756):1929-33.

15. **Name**: Dr. Petros Syntelis (University of St Andrews)
Coauthors: No coauthors were included.
Title: Energy release and atmospheric response during flux cancellation
Abstract:
Recent observations at high spatial resolution have shown that magnetic flux cancellation occurs on the solar surface much more frequently than previously thought. In Priest et al. 2018 we proposed magnetic reconnection driven by photospheric flux cancellation as a mechanism for chromospheric and coronal heating. In particular, we estimated analytically the amount of energy released as heat and the height of the energy release during flux cancellation. In Syntelis et al. 2019, we set up a two-dimensional resistive MHD simulation of two canceling polarities in the presence of a horizontal external field and a stratified atmosphere in order to check and improve upon the analytical estimates. Computational evaluation of the energy release during reconnection is found to be in good qualitative agreement with the analytical estimates. In addition, we performed an initial study of the atmospheric response to reconnection. We find that, during the cancellation, either hot ejections or cool ones or a combination of both hot and cool ejections can be formed, depending on the height of the reconnection location. The hot structures can have the density and temperature of coronal loops, while the cooler structures are suggestive of surges and large spicules.

16. **Name**: Mr. Stylianos Tourgaidis (Democritus University of Thrace)
    Coauthors: No coauthors were included.
    Title: Leucippus: A nano-satellite mission for the study of wave-particle interactions
    Abstract:
    In the near Earth space, inside the radiation belts which surround the Earth, energetic particles constitute a threat for the safe operation of satellites which we use daily for communication, transportation, weather forecasting and many other applications. These satellites can suffer from malfunctions from energetic particles which are either naturally occurring in relation to solar phenomena or which can also be man-made. One of the promising ways of active satellite protection that is under investigation is the so called Radiation Belt Remediation, i.e. the remediation of the radiation belts to lower energetic particle flux levels after a sharp increase. One such remediation scheme is based on the interaction of energetic particles with electromagnetic waves. The proposed mission that is presented herein aims to demonstrate the change of precipitation rates of energetic particles to the atmosphere in response to electromagnetic waves. The mission consists of a constellation of two nano-satellites: The satellite-transmitter, which uses an innovative VLF source and the satellite-receiver which will quantify the changes in the particle fluxes and in their pitch-angles due to the operation of the transmitter. This active experiment will explore and demonstrate the effectiveness of kHz waves in scattering energetic electrons inside the Earth's magnetosphere through pitch-angle scattering.

17. **Name:** Mr. Stylianos Tourgaidis (Democritus University of Thrace)
    Coauthors: No coauthors were included.
    Title: Daedalus mission orbital parameter optimization
    Abstract:
    The Daedalus mission has been proposed to the European Space Agency (ESA) in response to a call for ideas for ESA's 10th Earth Explorer. It was selected in 2018 as one of three candidates for a Phase-0 feasibility study. The goal of the mission is to quantify the key electrodynamic processes that determine the structure and composition of the upper atmosphere, the gateway between the Earth's atmosphere and space, focusing in particular at altitudes between 100 and 200 km. In this work we present preliminary simulations of the science team assessment on the optimal Daedalus mission orbital parameters, including lifetime estimates with respect to apogee - perigee selection, launch date considerations and propulsion maneuvers. To achieve its scientific goals, Daedalus should perform several perigee descents (dips), lowering its perigee by use of propulsion; an orbital maneuver campaign is presented. In addition, the Daedalus mission concept includes the release of sub-satellites, enabling the descent to lower altitudes and second point measurements; a constellation analysis and multi-point sampling scheme is presented. Finally, latitudinal and local time sampling and coverage is presented. The analysis of the proposed orbit was carried out through a combinational use of several software, including ESA's DRAMA, NASA's GMAT and custom simulation tools.

Session S2: Extragalactic Astronomy and Astrophysics

1. **Name:** Dr. Kalliopi Dasyra (University of Athens)
   Coauthors: No coauthors were included.
   Title: Outflows and inflows in galaxies and in the vicinity of black holes
   Abstract:
   I will review the status of the field of galactic flows. Observations of molecular gas outflows with millimetre facilities have by now revealed new winds of particular interest with respect to their driving mechanism, gas acceleration, gas excitation, or mass content. Some collimated winds reveal the presence of previously unknown radio jets. In other winds, the gas is heated and dispersed; its mass ought to be derived under optically-thin assumptions. Recently-detected nuclear winds have been detected in the vicinity of also recently-detected molecular tori. The gas in the molecular tori can be used for the determination of the respective black hole masses. Inflows of gas towards the central engine have been observed. At much larger scales, large supplies of gas infalling from cosmic filaments to galaxies have been detected. Examples will be given for all above-mentioned results.

2. **Name**: Mr. Charalampos Sinnis (University of Athens)
   Coauthors: No coauthors were included.
   Title: Stability analysis of two–component magnetized astrophysical jets
   Abstract:
   Astrophysical jets are observed as stable structures, extending in lengths several times their radii. The role of various instabilities and how they affect the observed jet properties has not been fully understood. Using the ideal relativistic MHD equations to describe jet dynamics we aim to study the stability properties through linear analysis. Our jets consist of two components, a fast light inner spine engulfed by a slower heavier outer sheath. In order to find the growth rates for the instabilities we solve numerically the perturbed system. We seek to find any connection between growth rates and various characteristic parameters such as the magnetization and the pitch angle. Finally, we conduct a series of MHD simulations for the two–component configuration, and check whether there is correlation between the linearised system results and the numerical solution of the full problem.

3. **Name**: Ms. Ioulia Florou (University of Athens)
   Coauthors: Mastichiadis Apostolos (National & Kapodistrian University of Athens)
   Title: The onset of Supercriticality in expanding sources
   Abstract:
   Hadronic models of high energy emission from compact astrophysical objects are becoming more and more relevant the recent years. An overlooked property of these models is that they become supercritical by abruptly transforming the energy stored in the relativistic protons into radiation. Supercriticality manifests itself when the proton density exceeds a critical value. We seek to map the complete parameter space of this behaviour in cases where the source is expanding so adiabatic losses become important. We assume that the energy injected in the source is deposited into a Maxwellian distribution of relativistic protons connected to a power law extended to high energies. Given a set of initial parameters we follow the expansion of the source and search for those values that lead the system to a supercritical regime, giving emphasis for those closely related to GRBs.

4. **Name**: Ms. Stella Boula (University of Athens)
   Coauthors: Petropoulou Maria (Princeton University)
   Mastichiadis Apostolos (National and Kapodistrian University of Athens)
   Title: On the connection of radio and γ-ray emission
   Abstract:
   Blazars are a sub-category of radio-loud Active Galactic Nuclei having their jet pointing towards us and are known for their emission covering practically all frequencies of the electromagnetic spectrum. These sources, in some cases, exhibit a correlation between gamma-ray and radio emission, especially during flaring episodes. Adopting the hypothesis that high energy photons are by relativistic electrons close to the central black hole, we study the evolution of this population of particles as they move down the jet and lose energy by radiation and adiabatic expansion. In this scenario, gamma-rays are produced early on, when the electrons are still very energetic, while radio emission at a later time when the electrons have cooled and the emission region becomes optically thin to synchrotron self-absorption due to expansion. We will discuss the parameters entering our calculations (like the magnetic field strength, the density of relativistic electrons, etc) in connection to the observational data.

5. **Name**: Prof. Nektarios Vlahakis (University of Athens)
   Coauthors: No coauthors were included.
   Title: Relativistic jets from black holes and disks
   Abstract:
   Magnetic fields threading a rotating compact object or its surrounding accretion disk can efficiently tap the rotational energy of the source and power a jet through magnetic pressure gradient forces. The source of energy, black hole or disk, corresponds to two seemingly competing relativistic jet driving mechanisms. We discuss similarities and differences of the two cases, as well as two-component jets that have contributions from both.

6. **Name**: Ms. Stefania Kerasioti (University of Athens)
   Coauthors: Vlahakis Nektarios (University of Athens)
   Title: Modeling of polarized synchrotron radiation from magnetohydrodynamic AGN jets
   Abstract:
   Very long baseline interferometry offers high resolution images of parsec- scale structures of AGN jets. These maps along with systematic observations and polarization measurements, when associated with synchrotron radiation from highly energetic electrons, provide significant information on spatial and dynamical evolution of the emitting regions. To model polarized radiation we adopt a disk-driven jet configuration, based on a radial self-similar solution of the magnetohydrodynamical equations. The resolved spatial distribution of radiation is achieved by applying a light tracing code on jet structure, where all Stokes parameters are calculated considering both absorption and propagation effects. Time dependence is introduced by examining the case of radiation from a moving blob that evolves following the streamlines. Storing the results on maps we seek for signatures associated with magnetic and velocity field structure, opacity effects and thermal/ non- thermal particle distribution properties. We also discuss the characteristics, degeneracies and dependencies on different model parameters, of the time evolving, unresolved polarization quantities.

7. **Name**: Dr. Juan Antonio Fernández Ontiveros (National Observatory of Athens)
   Coauthors: No coauthors were included.
   Title: A Jet Revealed by its Interaction with the ISM: the Molecular Gas Outflow in the Nucleus of ESO 420-G13
   Abstract:
   Feedback mechanisms in Active Galactic Nuclei (AGN) are a key ingredient in current simulations to couple the evolution of supermassive black holes and their host galaxies. While powerful outflows in luminous AGN are able to cause a serious impact on their host galaxies, the overall occurrence of these events among common and fainter galaxies -more relevant to understand the global impact of feedback- is still to be determined. TWIST (Twelve micron WInd STatistics) is a CO(2-1) survey of 41 Seyfert galaxies drawn from the 12 µm sample, based on recent ALMA observations. The survey covers the knee of the local Seyfert IR luminosity function, and thus is representative of the bulk population. I will present the first results obtained for the Seyfert 2 nucleus in ESO 420-G13, where a jet-driven molecular gas outflow has been detected along the minor kinematical axis. The outflow carries a mass of os~3x10^7 Msun at 350-600 pc from the nucleus at an average wind velocity of ~150 km/s. The ionised phase of the wind is also detected in [NeII]12.8µm (< 350 pc). Based on the energy budget we discard star formation, supernovae, and AGN radiation as possible launching mechanisms. This is the second time ever that a jet is revealed thanks to its interaction with the ISM.

8. **Name**: Dr. Albert Bosma (LAM Marseille)
   Coauthors: No coauthors were included.
   Title: HI in galaxies and the dark matter problem
   Abstract:
   I will give an overview of the subject of dark matter in spiral galaxies. 21-cm HI line observations are essential in the determination of "flat" rotation curves extending well beyond the optical image, which indicate the presence of dark matter in the outer parts of galaxies. Additional observations of stellar velocity dispersions at high spectral resolution are needed to break the so-called "degeneracy" in the mass modelling (i.e., the need to determine independently the mass-to-light ratio of the stellar components of a galaxy). Attempts to determine the shape of dark matter haloes are difficult, since there is a lot of extraplanar HI, in particular in active star forming galaxies. The suite of HI surveys, to be undertaken by SKA pathfinders and precursors, will help develop this field of research.

9. **Name**: Dr. Panos Patsis (RCAAM, Academy of Athens)
   Coauthors: No coauthors were included.
   Title: The thickness of the spiral arms and how it affects their extent
   Abstract:
   We investigate the structure of the spiral arms out of the equatorial plane and the implications it has for the overall dynamics and morphology of disk galaxies. In particular we examine how the thickness of the spirals affects their extent. We show that the thickness of the arms affects their strength, their robustness as morphological features and subsequently their longevity. We present and compare the thick spirals of two models that refer mainly to normal, open, grand-design patterns. While the strong, symmetric part of these spirals seem to end at the inner 4:1 resonance, we discuss also the possibility to have weak extensions beyond that resonance, and the role of such extensions in reinforcing spiral waves. Finally, we give examples of how chaotic spirals could be integrated in this scenario and what could be their importance for the observed spiral morphologies of grand design galaxies.

10. **Name**: Dr. Paolo Bonfini (National Observatory of Athens & FORTH)
    Coauthors: No coauthors were included.
    Title: Post-merger signatures as age tracers of early-type galaxies
    Abstract:
    In the framework of the hierarchical galaxy formation scenario, massive early-type galaxies (ETGs) are considered the end points of the merger tree. Unfortunately, despite they represent the ideal "laboratories" to test models of mass assembly, their smooth morphologies and uniform stellar populations have long hindered the attempts to investigate their formation. However, a careful look reveals that ETGs present several tell-tale characteristics which can be used to follow their evolution. In fact, after a massive ETG is assembled through a major merger, its core is shaped by the action of a super-massive black hole (SMBH) binary which increasingly remove central stars. At the same time, the post-merger features present in the ETG outskirts (e.g. ripples, shells, streams, and tidal tails; commonly referred to as "fine structures"), progressively fade out as the galaxy potential relaxes. Similarly, it is expected that any dust accreted during the merger is initially diffused throughout the galaxy and then gradually settles towards the center. We hereby present the first study linking the temporal co-evolution of ETG "fine structures" and of the SMBH binaries which are assembled in the same merger which shaped the ETG. We show the existence of a scaling relation between "fine structure" prominence and stellar mass removed from the "core", consistently with the hierarchical galaxy formation scenario. We additionally present a new methodology to perform radiative-transfer modelling of dust rings in ETGs, and we demonstrate its application to the cases of NGC 4552 and NGC 4494. We caution on how dust rings can mimic stellar depleted "cores", and we discuss how the statistical study of rings can be exploited to investigate the progressive settling of dust towards the center of an ETG.

11. **Name**: Ms. Konstantina Zouloumi (RCAAM, Academy of Athens)
    Coauthors: No coauthors were included.
    Title: Invariant Manifolds and Chaos in the Milky Way and N-body models of barred galaxies
    Abstract:
    The manifold theory of the spiral structure of galaxies provides a dynamical mechanism supporting the spiral arms and the outer shell of the bar through the chaotic orbits around the co-rotation zone. An application of this theory can be considered in the analytical model of Milky Way. Using the Milky Way's phase portraits, we investigate the presence of chaos around the area of co-rotation. By analyzing the dynamic model of the Milky Way, we construct the invariant manifolds emerging from the periodic orbits around the unstable Lagrangian equilibrium points of the galactic disk. A parametric investigation is also introduced in the dynamic model of the Milky Way. Consequently, we can test the change in the structure of invariant manifolds and the corresponding effect on the morphology of Milky Way. The theory of manifold spirals has been recently applied in N-body simulations of secularly evolving barred galaxies. The results of this research lead to coexistence more than one pattern speed of the structures on the galactic disk. A recent research work has contributed to the development of the manifold theory of spiral structure in which multiple pattern speeds are incorporated on the galactic disk. We discuss the application of this work on numerical N-body simulations, where we can derive different pattern speeds of structures by Fourier analysis. We present a method by which we can extract the basic rotation frequencies of the galaxy structures.

12. **Name**: Dr. Manolis Xilouris (National Observatory of Athens, IAASARS)
    Coauthors: No coauthors were included.
    Title: DustPedia - A Definitive Study of Dust in the Local Universe
    Abstract:
    The European Space Agency has invested heavily in two cornerstone missions: Herschel and Planck. These space observatories provide us with an unprecedented opportunity to study, at far infrared wavelengths, the cold Universe beyond our Galaxy. These missions have produced a huge legacy data-set which we exploit within the framework of the European funded "DustPedia" project. This data-set provided us with the opportunity to study cosmic dust in galaxies and to answer fundamental questions about: the origin of the chemical elements, physical processes in the interstellar medium (ISM), its effects on the emitted stellar radiation, and its relation to star formation. In the course of our work we have developed tools and computer models that helped us relate observed cosmic dust emission to the physical properties of the dust (chemical composition, size distribution, temperature), the origins of dust (evolved stars, super novae, growth in the ISM) and the processes that destroy it (high energy collisions and shock heated gas). To help us interpret the data we use our own, world leading, Monte Carlo photon tracing radiative transfer model of galaxies and our state-of-the-art model of dust physical properties. In my presentation I will summarize the main findings achieved within the "DustPedia" project.

13. **Name**: Mr. Angelos Nersesian (National Observatory of Athens)
    Coauthors: No coauthors were included.
    Title: Revealing the dust heating processes in the local Universe
    Abstract:
    We have updated the advanced SED fitting code CIGALE so as to include the recently developed dust model THEMIS, which successfully explains the observed FUV-NIR extinction, the IR to submm dust thermal emission and the shape of the infrared emission bands. We use this tool to construct the multi-wavelength SEDs of 814 nearby galaxies with available photometry from the FUV to the submm wavelengths. This is the first dedicated study of dust heating for such a large, statistically significant sample. For this sample of galaxies (the DustPedia galaxies) we show how the mass of stars, dust, atomic gas, and SFR vary between galaxies of different morphologies and provide recipes to estimate these parameters given their Hubble stage (T). In addition, the stellar populations in each galaxy and their role in the dust heating is investigated by deriving the luminosity produced by the old and the young stars separately.

14. **Name**: Dr. Alexandros Maragkoudakis (University of Western Ontario)
    Coauthors: No coauthors were included.
    Title: PAHs and star formation in the H II regions of M83 and M33
    Abstract:
    IR emission features at 3.3, 6.2, 7.7, 8.6 and 11.3 µm are usually attributed to IR fluorescence from FUV pumped polycyclic aromatic hydrocarbons (PAHs). These features thus trace the FUV stellar flux and are used as a measure of star formation in the Universe. Here, we present results from a detailed study on the mid-IR emission features of H II regions in the star-forming galaxies M83 and M33, with the aim to investigate the IR spatial characteristics of star-forming regions in the Milky Way (MW), to star-forming complexes in nearby galaxies, and star-forming galaxies as a whole. As such, we build a control sample including star-forming regions in the MW, LMC, SMC, M101, as well as starburst nuclei and nearby galaxies of different activity types, and compare their mid-IR emission properties with those in the M83 and M33 H II regions. Our main results are as follows: i) We find that the PAH intensity ratios in M83 and M33 H II regions have similar correlations as those in individual H II regions within galaxies, starburst nuclei, and AGN host galaxies; ii) We introduce a new PAH charge-size diagnostic plane to efficiently examine the degree of ionization and the size distribution of PAHs in astrophysical sources; iii) We present two sets of PAH SFR calibrations based on the tight correlation between the 6.2, 7.7, and 11.3 µm PAH luminosities with the 24 µm luminosity and the combination of the 24 µm and Hα luminosities; iv) Based on the total luminosity from PAH and FIR emission, we argue that extragalactic H II regions appear as a linking component between the spectral properties of local H II regions and star-forming galaxies, and as such are more suitable templates in modeling and interpreting the large-scale properties of galaxies, compared to Galactic H II regions.

15. **Name**: Dr. Christos Efthymiopoulos (RCAAM, Academy of Athens)
Coauthors: No coauthors were included.
Title: Galactic tidal streams
Abstract:
IR emission features at 3.3, 6.2, 7.7, 8.6 and 11.3 μm are usually attributed to IR fluorescence. The geometry and kinematic features of the tidal streams emanating from small satellite galaxies offer a promising way to probe the environment in which galaxies and the streams evolve. In particular, they can serve to constrain the properties and substructure of their hosting dark matter halos. In the first part of the talk we will refer to recent developments in this field, motivated both by theoretical studies as well as observations of streams around the Milky Way or other galaxies. The second part will refer to ways to model the distribution function of a stream progenitor, as well as the structure

16. **Name**: Dr. Mirella Harsoula (RCAAM, Academy of Athens)
Coauthors: No coauthors were included.
Title: A Milky Way potential with two pattern speeds
Abstract:
It is commonly accepted, nowadays, the scenario of multiple pattern speeds in barred spiral galaxies. It has been shown through both observational data and N-body simulations that the bar, of a barred spiral galaxy, rotates faster than the spiral arms. The same seems to be true for the Milky Way. However, the Hamiltonian of such a system with two pattern speeds is non autonomous, in the rotating frame of the bar. We therefore, construct a new Hamiltonian, through normal form construction, via Lie series, eliminating the time dependence. This new Hamiltonian incorporates the two different pattern speeds. We find the new unstable equilibrium points L1 nd L2 of this Hamiltonian and calculate the apocentric manifolds emanating from these points, for different times. These manifolds support the spiral arm structure for most of the time. Therefore, we have tested the efficiency of the manifold theory in a galactic model with two pattern speeds.

17. **Name**: Dr. Thomas Bisbas (University of Athens & AUTh)
Coauthors: No coauthors were included.
Title: Cosmic-ray induced destruction of CO in star-forming galaxies
Abstract:
Molecular hydrogen plays the dominant role in the star-formation process of all galaxies. However, owing to its quantum mechanical properties, H2 is not readily observable by radiotelescopes and because of this, the CO molecule is widely used as a tracer (CO-to-H2 conversion method). I will present a study on the effect of cosmic-rays on the abundance distribution of CO in H2-rich clouds under conditions typical for star-forming galaxies and the Galactic Centre. By performing three-dimensional photodissociation and cosmic-ray dominated region simulations of a fractal cloud embedded in different cosmic-ray energy densities, we find that CO is very effectively destroyed in extreme ISM environments with cosmic-ray energy densities of the order of 50^1000 x the typical Milky Way value. This effect is strong enough to render Milky Way type Giant Molecular Clouds very CO-poor and thus CO-untraceable. CO rotational line imaging will then show much clumpier structures than the actual ones. We also identify OH as the key species whose gas temperature sensitive abundance could mitigate the destruction of CO at high temperatures. I will also present recent ALMA observations of galaxies with high star-forming rates supporting this model, indicating that atomic carbon is the most promising avenue for studying ISM in high-redshift Universe.

18. **Name**: Ms. Konstantina Anastasopoulou (University of Crete & FORTH)
    Coauthors: No coauthors were included.
    Title: Correlation between X-ray emission and stellar populations: the definitive study of nearby galaxies observed with XMM-Newton
    Abstract:
    We present the analysis of all galaxies within a radius of 200 Mpc observed with XMM-Newton. These galaxies are the result of cross-correlation between the XMM-Newton archive and the HECATE catalogue, the most complete galaxy catalogue (~165,000 galaxies) of the local universe incorporating robust distances and stellar population parameters. In our analysis we will use data from all objects observed by XMM-Newton, including those with no formal detections (i.e. upper limits). The sample contains 2500 galaxies observed in more than 2100 observations. Using the full set of archival XMM-Newton data we measure their integrated X-ray luminosity and spectral parameters, in order to study the correlation between X-ray luminosity, star-formation rate, and stellar mass. Since the existing X-ray correlations on star-formation rate and stellar mass have been based on a few dozens of galaxies, this much larger sample provides the opportunity to cover the full range of star-formation rate and stellar mass in the local Universe. In addition the large size of the sample enables us to characterize stochastic effects in these scaling relations.

19. **Name**: Mr. Konstantinos Kouroumpatzakis (University of Crete & FORTH)
    Coauthors: No coauthors were included.
    Title: Probing the building blocks of galaxies: sub-galactic scaling relations between X-ray luminosity, SFR and stellar mass
    Abstract:
    X-ray emission from star-forming galaxies is a new frontier for probing recent star-formation. X-ray emission, SFR, and stellar mass scaling relations are a unique probe of the connection between X-ray binaries and stellar populations. While most scaling relations are based on studies of the integrated emission of galaxies, very little is known about their validity and scatter in sub-galactic scales. We explored this connection using a sample representative of the star-formation activity in the local Universe (Star-Formation Reference Survey; SFRS) along with a comprehensive set of star-formation (radio, FIR, 24μm, 8 μm, Hα, UV, SED fitting) and stellar mass (K-band, 3.6 μm, SED fitting) indicators, and X-ray observations. We investigated the X-ray luminosity – SFR, X-ray luminosity – stellar mass scaling relations, as well as, calibrations between different SFR indicators (24μm, 8 μm, Hα) down to sub-galactic scales of ~1 kpc^2. This way we extend these relations to extremely low SFR (~10^-6 Msol/yr) and stellar mass (~10^6 Msol), reaching the regime of dwarf galaxies. We also quantified their scatter and their dependence on the age of the local stellar populations as inferred from the different age sensitive SFR indicators, and we compare them with predictions from X-ray binary population synthesis models. These results are particularly important for setting the benchmark for the formation of X-ray binaries in vigorous, but low SFR objects such as the numerous dwarf galaxies and galaxies in the early Universe.

20. **Name**: Mr. Konstantinos Kovlakas (University of Crete & FORTH)
Coauthors: No coauthors were included.
Title: A census of ultraluminous X-ray sources and host galaxies in the local Universe
Abstract:
Ultraluminous X-ray sources (ULXs) are off-nuclear point sources with luminosity exceeding the Eddington limit for an accreting stellar black hole (BH). Their study provides valuable input for accretion physics (e.g. geometrical beaming, super-Eddington accretion), evolution of binary stellar systems, study of the seeds of supermassive black holes (i.e. a fraction of ULXs may be intermediate black holes), effect of binaries in the early Universe science (e.g. heating at the epoch or reionization), and progenitors of gravitational wave sources. Statistical studies of ULX populations and their connection with the properties of their host galaxy, can constrain binary population synthesis models and advance our understanding of ULXs. We build the largest census of ULX populations in our local Universe by constructing HECATE - a local Universe (< 200 Mpc) catalog with distances and stellar population parameters for ~164000 galaxies - and cross-matching it with the new Chandra Source Catalog 2.0. We identify ~1700 ULXs in ~1200 galaxies. In our analysis we account for contamination by AGN in the host galaxies, contamination by foreground/background objects, and the Poisson nature of the data. We measure the rate of ULXs as function of: (a) the morphological type of the host galaxy, (b) star-formation rate, and (c) stellar mass. We also explore the excess of ULXs in dwarf galaxies and its dependence on metallicity. Finally, we discuss how these results can be used to constrain binary populations

21. **Name**: Dr. Ioanna Leonidaki (IA/FORTH & University of Crete)
Coauthors: No coauthors were included.
Title: SNR populations in our Galaxy and beyond: bridging the gap
Abstract:
I will outline the updated demographics on multi-wavelength surveys of extragalactic Supernova Remnant (SNR) populations in order to probe their properties (e.g. line ratios, luminosities, densities, temperatures) and their connection. With these studies we are allowed to cover a wider range of environments and Interstellar Medium (ISM) parameters than our Galaxy, providing us a more complete and representative picture of SNR populations. However, most of these studies are hampered by limited sensitivity and low resolution not allowing the detailed study of their multi-wavelength emission, excitation and interplay with the ISM. Galactic SNRs on the other hand are an ideal laboratory to probe their structure, their evolution and their interaction with their ambient medium because, due to their proximity, can be observed in parsec scales. Although a census of 294 Galactic SNRs is available in the radio band, surprisingly no study has been conducted so far to investigate the multi-wavelength properties of Galactic SNRs as a population. Therefore, we have embarked in creating for the first time a complete optical narrow-band atlas of the entire SNR population in our Galaxy. I will present the first results of this very promising campaign: the morphology, the excitation / shock-velocity maps, and the integrated emission of optically observed Galactic SNRs. Comparison with existing maps in the X-ray and radio bands will allow us for the first time to probe how their observational characteristics correlate with their age, and therefore their evolution. This project will also shed light on how SNRs energize the ISM and remedy the inherent biases of extragalactic SNR surveys.

22. **Name**: Dr. Ioannis Myserlis (MPIfR)

Coauthors: No coauthors were included.

Title: Coupling between the small and large scale magnetic field configuration in the relativistic jet of OJ 287

Abstract:

The blazar OJ 287 is one of the best candidates for hosting a binary supermassive black hole (SMBH) system, with a secondary SMBH crossing the accretion disk of a more massive SMBH every ~12yrs. Driven by this prediction, we initiated a dense and long-lasting monitoring program at different radio frequencies between 2.6 and 43 GHz using the Effelsberg 100-m radio telescope, to follow its evolution in total flux density, linear and circular polarization and test different facets of the binary SMBH model. Within the first year of observations, the source showed flaring activity, complex linear and circular polarization behavior and an extremely long EVPA rotation. We analyzed the single-dish radio data together with concurrent VLBI and optical polarization observations, which showed a similarly long EVPA rotation populated by shorter, but much faster, repeated rotations. The coupling of EVPA rotations seen across the radio and optical bands is consistent with a polarized emission component moving on a helical trajectory modulated by a large scale jet bending. Based on that model we used the polarimetric observations to constrain a number of physical parameters of both the small and large scale jet structure and its magnetic field's geometry.

23. **Name**: Dr. Liudmyla Berdina (IRA of NASU)

Coauthors: No coauthors were included.

Title: Microlensing effect as a unique tool or a disturbing factor in solving astrophysical problems

Abstract:

The paper is dedicated to investigation of the microlensing phenomenon, which is an important constituent in studying and interpreting transient events in gravitationally lensed quasars. Microlensing events contain a valuable information about the masses and velocities of compact objects populating the lensing galaxies, and allow to measure the angular dimensions of remote quasars with a resolution unachievable with any other methods. In order to estimate the microlens mass and mass distribution of microlenses, the large-scale distributions of the surrounding gravitational fields of galaxies or galaxy clusters should be taken into account in addition to the local microlensing parameters. The analytical method that allows accounting for the effect of a microlens position along the line-offsight quasar-lens-observer on the observed brightness of quasar macroimages is describe. Considering the microlensing effects in an environment with several spatial scales of inhomogeneities, one can anticipate more adequate results in reconstructing parameters of the hidden mass from observations of microlensing events. On the other hand, microlensing may be a disturbing factor in solving some problems, in which case it must be investigated to be properly eliminated. In particular, one of the most serious problems in the time delay determination is the presence of microlensing events, which distort the intrinsic quasar light curves differently in different quasar images. One of such cases is discussed in which a simple way to eliminate the microlensing constituent from the light curves of the lensed quasar images with the aim to obtain the unbiased estimates of the time delays in gravitationally lensed quasars and improve the accuracy of the results is demonstrated. For modern astrophysics, measurements of such time delays between the quasar brightness variations observed in its macroimages are of great interest. One of the most important applications of the obtained estimates is the definition of the Hubble constant.

24. **Name**: Mr. Elias Koulouridis (IAASARS/NOA)
    Coauthors: No coauthors were included.
    Title: Active Galactic Nuclei in galaxy clusters
    Abstract:
    There is compelling evidence that the presence of AGN is closely linked to the large-scale environment, and that galaxy mergers and interactions play an important role in AGN triggering and evolution. As the most massive self-gravitating entities of the universe, clusters are ideal laboratories to investigate the impact of dense environments on AGN demographics. Previous studies have shown that AGN in clusters are strongly affected by their environment, but in a complicated way. The AGN fraction was found to depend on the distance from the cluster centre, the mass of the cluster and the redshift. Interestingly, in contrast to the lack of AGN in the centres of massive clusters, a number of studies have found an excess of X-ray AGNs in the cluster outskirts, supporting the presence of an in-falling population triggered by galaxy mergers. In this talk I will focus on recent results from the XXL survey and from the five most massive and distant galaxy clusters in the Planck and South Pole Telescope (SPT) surveys. These results provide observational evidence of the physical mechanisms that drive AGN and galaxy evolution within clusters

25. **Name**: Dr. Eleni Vardoulaki (MPIfR)
    Coauthors: No coauthors were included.
    Title: Multi-component radio sources at 3-GHz VLA-COSMOS
    Abstract:
    We present the multi-component radio sources in the VLA-COSMOS Large Project at 3 GHz (Smolcic et al. 2017a; 0.75 arcsec resolution, 2.3 uJy/beam rms), i.e. the radio sources which are composed of two or more radio blobs. The classification of objects into multi-components was done by visual inspection of 351 of the brightest and most extended blobs from a sample of 10,899 blobs within the 2.6 sq. deg. of the VLA-COSMOS field at 3 GHz. For that purpose we used multi-wavelength information of the field, such as the 1.4-GHz VLA-COSMOS data and the UltraVISTA stacked mosaic available for COSMOS. We find 67 multi-component radio sources at 3 GHz: 58 sources with AGN powered radio emission and 9 star-forming galaxies. The increased spatial resolution of 0.75 arcsec has allowed us to resolve (and isolate) multiple emission peaks of 28 extended radio sources not identified in the 1.4-GHz VLA-COSMOS map. We find that multi-component objects at 3-GHz VLA-COSMOS inhabit mainly massive galaxies (> 10^10.5 Msun). The majority of the multi-component AGN lie below the main-sequence of star-forming galaxies (SFGs), in the green valley and the quiescent region. Furthermore, we cross-correlate with the X-ray groups in COSMOS (redshift range 0.08 < z < 1.53; Gozaliasl et al. 2019) and find a large number of disturbed/bent multi-component AGN which do not lie within X-ray groups. These objects probe environments with halo masses below what can be observed by current X-ray surveys (Mh < 1.5(1 + z) × 10^13 Msun). Finally, in the concept of automatic classification of radio sources in large radio surveys, we present preliminary results of the training of the deep learning algorithm CLARAN (Wu et al. 2018) with the multi-component sample at 3 GHz VLA-COSMOS.

26. **Name**: Mr. Ektoras Pouliasis (IAASARS, NOA)
    Coauthors: No coauthors were included.
    Title: Robust Identification of Active Galactic Nuclei through HST Optical Variability in GOODS-S: Comparison with the X-ray and mid-IR Selected Samples
    Abstract:
    Identifying Active Galactic Nuclei (AGNs) through their X-ray emission is efficient, but necessarily biased against X-ray-faint objects. We aim to characterize this bias by comparing X-ray-selected AGNs to the ones identified through optical variability and mid-IR colours. We present a catalogue of AGNs selected through optical variability using all publicly available z-band Hubble Space Telescope images in the GOODS-South field. For all objects in the catalogue, we compute X-ray upper limits or discuss detections in the deepest available ~7 Ms Chandra Deep Field South images and present the Spitzer/IRAC mid-IR colours. For the variability study, we consider only sources observed over at least five epochs and over a time baseline of up to ten years. We adopt the elevated median absolute deviation as a variability indicator robust against individual outlier measurements and identify 113 variability-selected AGN candidates. Among these, 26 have an X-ray counterpart and lie within the conventional AGN area in the Fx/Fopt diagram. The candidates with X-ray upper limits are on average optically fainter, have higher redshifts compared to the X-ray detected ones and are consistent with low luminosity AGNs. Out of 41 variable optical sources with IR detections, 13 fulfill the IR AGN colour selection criteria. This work emphasizes the importance of optical variability surveys for constructing complete samples of AGNs including the ones that remain undetected even by the deepest X-ray and IR surveys.

27. **Name**: Dr. Antonis Georgakakis (National Observatory of Athens)
    Coauthors: No coauthors were included.
    Title: Forward modeling the energetic Universe: towards a unified model for the multiwavebands properties of Active Galactic Nuclei
    Abstract:
    A semi-empirical model will be presented that describes the observed multi-wavelength properties of Active Galactic Nuclei from X-rays to the mid-infrared. This is used to understand the overlap and detailed physical properties of Active Galactic Nuclei selected at different parts of the electromagnetic spectrum. We focus on X-ray vs mid-infrared selections methods and review in a critical manner claims for systematic differences in the obscuration distribution and host-galaxy properties of AGN samples selected in the two wavebands. The methodology that will presented allows "unification" of X-ray and mid-infrared AGN selection methods and samples.

28. **Name**: Dr. George Livadiotis (Southwest Research Institute)
    Coauthors: No coauthors were included.
    Title: Thermodynamics of Astrophysical plasmas
    Abstract:
    Classical particle systems residing in thermal equilibrium have their particle velocity distribution function stabilized into a Maxwell-Boltzmann distribution. Astrophysical plasmas, however, are exotic particle systems characterized by a generalized description given by the kappa distribution function. The kappa distributions have become increasingly widespread across the physics of astrophysical plasma processes, describing particles in the heliosphere, from the solar wind and planetary magnetospheres to the heliosheath and beyond, the interstellar and intergalactic plasmas. A breakthrough in the field came with the connection of kappa distributions with thermodynamics, accomplished by the following findings: (1) kappa distributions maximize nonextensive entropy under the constraints of canonical ensemble; (2) particle systems exchanging heat and reaching thermodynamic equilibrium are stabilized always into a kappa distribution; (3) Polytropes - Systems characterized by a polytropic behavior - are uniquely consistent to kappa distributions and their statistical formalism. We will present the physical foundations and recent developments of kappa distributions in astrophysical plasmas.

29. **Name**: Prof. Vasiliki Pavlidou (University of Crete & FORTH)
    Coauthors: No coauthors were included.
    Title: PHAESTOS: Enabling charge particle astronomy with Galactic magnetic tomography
    Abstract:
    The sources of the highest-energy particles in the Universe remain an unresolved mystery. The reason is that charged-particle astronomy is severely complicated by magnetic deflections. I will discuss a radically new approach to charged-particle astronomy: constructing a 3-dimensional map of local Galactic magnetic field measurements, primarily through optopolarimetric magnetic tomography, and backtracking the paths that UHECR traverse through the Galaxy before reaching us, to improve agreement between their (corrected) arrival directions and the location of their sources on the sky. Effectively, this technique aims to improve the charged-particle point-spread-function by a factor of several, boosting the sensitivity to individual sources by a similar factor, and allowing us to probe the cosmic-ray composition at the highest energies without reference to the development of extensive air showers in the atmosphere. This approach is becoming possible for the first time thanks to two experimental breakthroughs: the unparalleled wealth of stellar distances that the Gaia mission is in the process of providing; and recent advances in optopolarimetry of point sources that make possible systematic large-area surveys of stars. This technique would act multiplicatively on the return from current and future cosmic-ray observatories, ground- and space-based.

30. **Name**: Dr. Ioannis Liodakis (Stanford University)
    Coauthors: No coauthors were included.
    Title: Prospects for detecting X-ray Polarization in blazar jets
    Abstract:
    X-ray polarization can be an important new probe of the magnetic field geometry and acceleration physics in blazar jets, but near-future missions will have limited sensitivity. I will discuss how we can use existing lower energy data and jet simulations in the context of a basic synchro-Compton model to predict the X-ray polarization level of different sources and identify the most attractive candidates for NASA's upcoming mission: the Imaging X-ray Polarimetry Explorer (IXPE) scheduled to launch in Q1 2021. Our results allows us to construct the most stringent tests of emission models in blazar jets that can provide answers to long standing questions regarding jet formation and composition.

31. **Name**: Prof. Apostolos Mastichiadis (University of Athens)
    Coauthors: No coauthors were included.
    Title: Neutrino Emission from Blazars
    Abstract:
    The recent IceCube detection of high energy neutrinos coming from the direction of blazar TXS 0506+056 poses interesting questions on the models for high energy emission from Active Galactic Nuclei (AGN). While the overall picture was expected, at least within some categories of theoretical models, the fine details seem more difficult to understand. In the present talk ws will review the successes and the open questions of these models and discuss whether there is a need for introducing viable alternatives.

Posters

1. **Name**: Mr. Ioannis Anastasiadis (University of Athens)
   Coauthors: No coauthors were included.
   Title: Astrophysical jets from rotating black holes
   Abstract:
   One of the main mechanisms driving relativistic plasma jets, is based on the electromagnetic extraction of rotational energy of the black hole, as suggested by Blandford & Znajek. We study the characteristics of the jets using a semi-analytical solution of the General Relativistic Magnetohydrodynamic (GRMHD) theory, that describes the jet near the rotation axis. The model is built by expanding the rotating black hole metric and the forces, to first order in the magnetic flux function. The goal is to solve for the bulk acceleration and the shape of the jet, and understand how these depend on the magnetic field and the spin of the black hole.

2. **Name**: Ms. Anamaria Gkini (University of Thessaloniki)
   Coauthors: No coauthors were included.
   Title: Host galaxy differences of Seyfert I and Seyfert II AGN
   Abstract: ---

3. **Name**: Ms. Vasileia-Aspasia Masoura (National Observatory of Athens)
   Coauthors: No coauthors were included.
   Title: The dependence of star formation on AGN activity and absorption
   Abstract:
   Studies of recent decades have led to the conclusion that there is an inextricable link between galaxies and the Supermassive Black Holes (SMBHs) located in their centre. However, it is still unclear how the activity of the SMBH affects the properties of the host galaxy. Furthermore, there is a scientific debate whether the absorption we observe in some AGN is a geometric effect or an evolutionary phase in the galaxy's lifetime. In my talk, I will present our results on the correlation between the SMBH activity and the SFR of the host galaxy. We use the largest (~3,500) X-ray AGN sample, from the XMM-XXL and the XMM-ATLAS fields in a wide range of redshift and luminosities. We disentangle the effects of stellar mass and redshift on the SFR and show that the AGN enhances the star formation of its host galaxy when the galaxy lies below the main sequence and quenches the star formation of the galaxy it lives in when the host lies above the main sequence. Finally, I will discuss preliminary results of our work regarding the connection between the star-formation and the AGN absorption. Investigating the existence of such a correlation will shed light on the nature of the AGN absorption.

4. **Name**: Mr. Michalis Papachristou (University of Athens & National Observatory of Athens)
   Coauthors: No coauthors were included.
   Title: CO observations of radio galaxies: exploiting the ALMA archive
   Abstract:
   Galactic winds can have a big impact on the evolution of galaxies as they deposit energy in the interstellar medium affecting the molecular gas and thus plausibly altering the star formation. These winds can be generated by intense star formation or by an Active Galactic Nucleus (AGN) due to the radiation pressure or the jet. Jets, the role of which has been theoretically emphasized in cosmological simulations, are -in some circumstances- observationally easier to be identified as wind driving mechanisms in terms of their extent or their power, so we focus on deriving the frequency and the characteristics of winds in radio galaxies. We have compiled a flux-limited radio-QSO survey, representative of the Parkes 2.7 GHz catalog, by searching for CO lines in calibrator and target observations in the ALMA science archive. Our preliminary results show that the fraction of sources in our sample containing molecular gas reservoirs alongside with jet power greater than the binding energy of the host galaxy is in order of 10%. Results for individual sources of interest will be presented.

5. **Name**: Mr. Evangelos-Dimitrios Paspaliaris (National Observatory of Athens)
   Coauthors: Nersesian Angelos (National Observatory of Athens)
   Masoura Vasileia-Aspasia (National Observatory of Athens)
   Xilouris Manolis (National Observatory of Athens)
   Title: Evolution of the physical parameters of galaxies through cosmic time
   Abstract:
   Using the results presented in Nersesian et al. 2019 (A&A, 624, 80) as a reference for the physical properties of local galaxies, we extend the analysis in high redshifts (up to z~5) aiming at linking the properties of local and distant galaxies and examine their evolution through cosmic time. We do this by taking advantage of multi-wavelength photometric data (from the UV to the submillimeter) already culled in two databases, DustPedia (875 local galaxies) and HELP (262.578 distant galaxies). Our sample of local galaxies is enriched with 97 (U)LIRGs that occupy the high end of SFR in the local Universe. The physical properties of the galaxies are derived by using CIGALE, a code that fits their Spectral Energy Distribution (SED). This allows us to determine the dust and the stellar mass, the star-formation rate, the bolometric and dust luminosity, as well as the unattenuated and the absorbed, by dust, stellar light, emitted by the old and the young stellar populations. Evolution of these parameters with redshift and various scaling relations are presented.

6. **Name**: Dr. Liana Tsigaridi (ACS Athens)
   Coauthors: Patsis Panos (RCAAM, Academy of Athens)
   Title: Slow rotating models of barred-spiral galaxies
   Abstract:
   We use response models to study the stellar and gaseous flows of slow rotating barred-spiral potentials. We vary the pattern speed so that the corotation-to bar radius ratios (Rc/Rb) are in the range 2 < Rc/Rb < 3. We find in general two sets of spirals, one inside and one outside corotation, which are reinforced by two different dynamical mechanisms. The bar and the spirals inside corotation are supported by regular orbits, while the spirals beyond corotation are associated with the "chaotic spirals", both in the stellar as well as in the gaseous case. In the characteristic of the central family of periodic orbits, we find a `bistable region'. In the response model, we observe a ring surrounding the bar and spiral arms starting tangential to the ring. This is a morphology resembling barred-spiral systems with inner rings. However, the dynamics associated with this structure in the case we study is different from that of a typical bar ending close to corotation. The ring of our model is round, or rather elongated perpendicular to the bar. It is associated with a folding (an `S'-shaped feature) of the characteristic of the central family, which is typical in bistable bifurcations. Along the `S' part of the characteristic, we have a change in the orientation of the periodic orbits from an x1-type to an x2-type morphology. The orbits populated in the response model change rather abruptly their orientation when reaching the lowest energy of the `S'. The spirals of the model follow a standard `precessing ellipses flow' and the orbits building them have energies beyond the `S' region. The bar is structured mainly by sticky orbits from regions around the stability islands of the central family. This leads to the appearance of X features in the bars **on** the galactic plane. Such a bar morphology appears in the unsharp-masked images of some moderately inclined galaxies.

Session S3: Cosmology and Relativistic Astrophysics

1. **Name**: Prof. Dimitiros Giannios (Purdue University)

   Coauthors: No coauthors were included.

   Title: Neutron Star Mergers: Gravitational Waves and Jet Structure

   Abstract:

   The first-ever neutron star merger observed through its gravitational wave emission, GW170817, was followed by a short duration gamma-ray burst (GRB). At longer time scales the source exhibited thermal and non-thermal optical, radio and X-ray emission related to matter ejected during and after the merger and its subsequent interaction with ambient gas. This ground-breaking discovery, not only proves that short-duration GRBs originate from the merger of neutron stars but allows us, for the first time, to directly probe the structure of the relativistic jet produced in these events. I will present the work of my group in predicting the detection of GRBs in a significant number of gravitational wave neutron star mergers as well as our work in calculating the jet structure and the jet interactions with the ambient gas. I finish with a discussion on a possible surprise that GW170817 may have in store for us in the near future.

2. **Name**: Mr. Petros Stefanou (University of Athens)

   Coauthors: Contopoulos Ioannis (RCAAM, Academy of Athens)

   Title: Particle Acceleration in the Current Sheet of Pulsar Magnetospheres

   Abstract:

   We investigate the mechanism and the origin of high-energy emission from the pulsar magnetosphere. We consider a simple semi-analytic model, the so-called "ring of fire", that satisfies global electric current closure. According to this model, a dissipation zone develops in the magnetosphere at the edge of the closed-line region beyond the light cylinder. Electrons and positrons are accelerated inwards and outwards respectively along relativistic Speiser orbits that are deflected in the azimuthial direction by the pulsar’s rotation. After they exit the reconnection layer, the outward moving positrons form the equatorial return current sheet, and the inward moving electrons form the separatrix return current sheet. The particles lose their energy via curvature radiation mostly outside of the dissipation zone, along the current sheets. We present the first results of extensive numerical simulations that routinely integrate the particle’s equations of motion in a given electromagnetic field with radiation losses, and calculate particle orbits and the resulting high-energy spectra.

3. **Name**: Prof. Demetrios Papadopoulos (University of Thessaloniki)

   Coauthors: No coauthors were included.

   Title: The magnetic Rayleigh-Taylor instability around astrophysical black holes

   Abstract:

   We investigate the development of the magnetic Rayleigh-Taylor instability at the inner edge of an astrophysical disk around a spinning central black hole. We solve the equations of general relativity that govern small amplitude oscillations of a discontinuous interface in a Keplerian disk threaded by an ordered magnetic field, and we derive a stability criterion that depends on the central black hole spin and the accumulated magnetic field. We also compare our results with the results of GR MHD simulations of black hole accretion flows that reach a magnetically arrested state (MAD). We found that the instability growth timescales that correspond to the simulation parameters are comparable to the corresponding timescales for free-fall accretion from the ISCO onto the black hole. We thus propose that the Rayleigh-Taylor instability disrupts the accumulation of magnetic flux onto the black hole horizon as the disk reaches a MAD state.

4. **Name**: Mr. Dimitrios Kantzas (University of Amsterdam)

   Coauthors: No coauthors were included.

   Title: Emission from secondary electrons in the jets of Cygnus X-1

   Abstract:

   Cygnus X-1 is the first Galactic source confirmed to host a black hole. It has been observed across the whole electromagnetic spectrum and recently, it was also detected in the GeV band by Fermi/LAT and possibly in the TeV band at low significance by MAGIC during a flare. The source's non-thermal radiation is thought to originate from the relativistic jets because of the flat radio spectrum and of the orbital-period dependence found in the high energy light curve. The processes that lead to this non-thermal emission are still debated, with both leptonic and hadronic deemed to be viable. The latter scenario requires protons to be accelerated up to hundreds of TeV by some natural mechanism. These particles can collide with other protons or photons emitted by the companion star in the form of stellar wind and stellar radiation, respectively. These interactions lead to particle cascades and produce secondary electrons and gamma-rays that can potentially contribute to the observed spectrum. In this work, we use a multi-zone jet model parameterizing the dynamical properties, such as the jet velocity profile, the magnetic field, and the energy density, combined with a self-consistent secondary cascade and radiation calculations. We compare our model to the first ever high-quality simultaneous multi-wavelength data-set obtained from the CHOCBOX campaign. We compare our new models to prior work and discuss the contribution of secondary electrons as well as the physical conditions of the source. Dimitrios Kantzas, Sera Markoff, A. Chhotray, M. Lucchini & CHOCBOX collaboration

5. **Name**: Ms. Maria Chira (University of Thessaloniki)

   Coauthors: No coauthors were included.

   Title: Environmental Dependence of the Dynamical Properties of Light-cone Simulation Dark Matter Haloes

   Abstract:

   We study the dependence of a variety of halo properties (shape, spin, virialisation status) on different environments in a whole-sky ΛCDM light-cone halo catalogue extending to $z < 0.65$, using a simple and well-defined halo isolation criterion. Using this definition of the environment we study if and how the DM halo-properties and their interrelations depend on their environment. We also study the relative orientations of the spin- and shape- vectors of DM halos with their isolation, as well as the alignment of the shape- and the spin- vectors of neighboring DM halos for a vast range of separations. Lastly, we focus on halo pairs, which are encountered in a variety of isolation states in our catalogue and, specifically, we study how the shape- and spin- alignments of halo-pairs is dependent on the isolation of the pair. The latter can give insight in the formation and evolution of halos formed under the dynamical interaction of their nearest neighbor in a region devoid of other massive halos, i.e., not affected by the ambient tidal field.

Poster

1. **Name**: Mr. Nikolaos Chatzarakis (University of Thessaloniki)

   Coauthors: No coauthors were included.

   Title: Exponentially Increasing Early-time and Decreasing Late-time with F(R) Gravity

   Abstract:

   This paper focuses on an exponential inflationary model, followed by a rapidly decreasing Hubble rate, in the context of vacuum F(R) gravity. Using well-known reconstruction techniques, our purpose is to investigate whether the F(R) gravity realizing each scenario in terms of the scalar curvature can be written in closed form; for the case of a slow-roll inflation, so that only the leading order of the F(R) gravity survives, we calculate the slow-roll indices and the corresponding observational indices. In this context, the general formulas of the slow-roll and observational indices in respect to the e-foldings number are presented. In these calculations, the formulas considered are general and no assumption that all slow-roll indices are much smaller than unity is made, so that generality is preserved. Finally, the phenomenological viability of the inflationary model is considered, comparing our results with the latest Planck and BICEP2/Keck-Array data, as well as of its follow-up, comparing the resulting F(R) gravity with the expected forms for the radiation-dominated, matter-dominated and late-time acceleration eras. It is clearly demonstrated that certain cases where the model is compatible with the current observational data do exist, with only one parameter in actual need of adjustment.

Session S4: Stars, Planets and the Interstellar Medium

1. **Name**: Dr. Nicolas Prantzos (Institut d'Astrophysique de Paris)
   Coauthors: No coauthors were included.
   Title: Recent views on the chemical evolution of the Milky Way
   Abstract:
   I will present results of recent studies of the chemical evolution of our Galaxy, with state-of-the-art semi-analytical models including, for the first time, yields from a distribution of rotating massive stars with mass loss. I will discuss, in particular, the evolution of the local thin and thick disks and the role of radial migration.

2. **Name**: Dr. Frank Tramper (NOA-IAASARS)
   Coauthors: No coauthors were included.
   Title: Southern Massive Stars at High Angular Resolution
   Abstract:
   One of the most striking features of massive stars is their high degree of multiplicity, and their evolution is dominated by binary interactions. As such, it is important to characterise the properties of the companions to these stars. Typically, companions are found either through spectroscopy (close companions) or direct imaging (distant companions), leaving a large range of medium separations mostly unexplored. The 'Southern Massive Stars at High Angular Resolution' project observed all nearby Southern massive stars with two interferometric instruments on ESO's VLT, closing the gap between spectroscopy and direct imaging. In this talk I will give a short overview of the project and present the most important results in terms of number of companions, and the distributions of separations and mass ratios.

3. **Name**: Dr. Grigoris Maravelias (IAASARS/NOA)
   Coauthors: Bonanos Alceste Z. (IAASARS/NOA), Yang Ming (IAASARS/NOA), Tramper Frank (IAASARS/NOA), deWit Stephan A. S. (IAASARS/NOA), Bonfini Paolo (IAASARS/NOA; UoC)
   Title: Automated classification of massive stars in nearby galaxies
   Abstract:
   Current photometric surveys can provide us with multiwavelength measurements for a vast numbers of stars in many nearby galaxies. Although the majority of these stars are evolved luminous stars (e.g. Wolf-Rayet, Blue/Yellow/Red Supergiants), we lack an accurate spectral classification, due to the demands that spectroscopy faces at these distances and for this number of stars. What we can do instead is to take advantage of machine learning algorithms (such as Support Vector Machines, Random Forests, Convolutional Neural Networks) to build an automated classifier based on a large multi-wavelength photometric catalog. We have compiled such a catalog based on optical (e.g. Pan-STARRS, OGLE) and IR (e.g. 2MASS, Spitzer) surveys, combined with astrometric information from the GAIA mission. We have also gathered spectroscopic samples of massive stars for a number of nearby galaxies (e.g. the Magellanic Clouds, M31, M33) and by using our algorithm we have achieved a success ratio of more than 80% for the training and test samples. By applying the fully trained algorithm to the available photometric datasets, we can uncover previously unclassified sources, which will become our prime candidates for spectroscopic follow-up aiming to confirm their nature and our approach.

4. **Name**: Prof. Despina Hatzidimitriou (University of Athens)
Coauthors: A. Z. Bonanos (1), M. Yang (1), K. Sokolovsky (2,1), P. Gavras (3,1), D. Hatzidimitriou (4,1), I. Bellas-Velidis (1), G. Kakaletris (5), D. J. Lennon (6,7), A. Nota (8), R. L. White (8), B. C. Whitmore (8) (1) IAASARS, National Observatory of Athens, Penteli 15236, Greece (2) Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA (3) RHEA Group for ESA-ESAC, Villanueva de la Canada, 28692 Madrid, Spain (4) Department of Physics, National and Kapodistrian University of Athens, Panepistimiopolis, Zografos 15784, Greece (5) Athena Research and Innovation Center, Marousi 15125, Greece (6) Instituto de Astrofísica de Canarias, E-38205 La Laguna, Tenerife, Spain (7) ESA, European Space Astronomy Centre, Villanueva de la Canada, 28692 Madrid, Spain (8) Space Telescope Science Institute, Baltimore, MD 21218, USA.
Title: The Hubble Catalog of Variables
Abstract:
The "Hubble Catalog of Variables" (HCV) is the first homogeneous catalog of variable sources from the Hubble Space Telescope (HST) and currently is the deepest catalog of variables available. It is based on homogeneous photometry from the Hubble Source Catalog version 3 (Whitmore et al. 2016), which includes all available images obtained with WFPC2, ACS and WFC3 onboard the HST that were public as of October 2017. It contains 84,428 variable candidates with V<=27 mag, which were identified among sources having at least 5 measurements in the same instrument/filter combination, in “groups” with at least 300 sources. The catalog includes variable stars in our Galaxy and nearby galaxies, as well as transients and variable active galactic nuclei. We expect that the catalog will be a valuable resource for the community. Possible uses include searches for new variable objects of a particular type for population analysis, detection of unique objects worthy of follow-up studies, identification of sources observed at other wavelengths and photometric characterization of candidate progenitors of supernovae and other transients in nearby galaxies. The catalog will be released in September 2019 and will be available to the community from the Mikulski Archive for Space Telescopes (MAST) at STScI and the ESA Hubble Science Archive (eHST) at ESAC. This work was supported by the European Space Agency (ESA) under the "Hubble Catalog of Variables'' program, contract No. 4000112940.

5. **Name**: Dr. Andreas Zezas (University of Crete & FORTH)
Coauthors: No coauthors were included.
Title: X-ray binary populations in nearby galaxies
Abstract:
Characterization of X-ray binaries on the basis of their donor stars allow us to identify their parent stellar populations and measure directly their formation efficiency as function of their age. Combining this information with constraints on the nature of their compact objects allow us to measure the formation rate of compact objects and their demographics in different types of X-ray binaries. These are key parameters for constraining models of massive stellar evolution and understanding the populations of gravitational wave progenitors and short gamma-ray bursts. We present results from a Chandra-based study of the formation efficiency of X-ray binaries in the Magellanic Clouds and M81, and a systematic study of the compact object populations in nearby galaxies observed with NuSTAR. We find that High-mass X-ray binaries show enhanced formation rates at ages of ~30-60Myr, with another possible peak around 10Myr. Our analysis of the compact-object populations indicates that more actively star-forming galaxies host a larger fraction of black-hole systems. Furthermore, we see a clear preference for accreting pulsars to be associated with star-forming regions, in good agreement with similar studies in our Galaxy. Finally, we compare these results with predictions from population synthesis models for different star-formation scenarios.

6. **Name**: Dr. Ioannis Contopoulos (RCAAM, Academy of Athens)
   Coauthors: No coauthors were included.
   Title: Dynamics of Accretion–Ejection Flows
   Abstract:
   We will present a general overview of the accretion, outflow, and radiation processes during an X-ray binary (XRB) outburst. The dynamics of the system are controlled by a large-scale magnetic field that is held in place by a delicate balance between inward advection and outward diffusion through the accreting matter. We propose that the source of the field is the so-called Cosmic Battery. When the Cosmic Battery operates, the disk is filled with magnetic field, and its associated accretion rate gradually increases, thus leading the system to an outburst. The Cosmic Battery ceases to operate when the central accretion flow reaches equipartition with radiation. Magnetic flux then reconnects with the black hole flux and escapes in the form of intermittent plasmoids. The disk is gradually emptied of its magnetic field, and the associated accretion rate slowly decreases, thus driving the system back to quiescence. We conclude that the action or inaction of the Cosmic Battery is the missing key that allows us to understand the long-term evolution of astrophysical accretion–ejection flows.

7. **Name**: Mr. Alexandros Filothodoros (University of Zielona Gora)
   Coauthors: No coauthors were included.
   Title: Meterwavelength Single-pulse Polarimetric Emission Survey: A Study of Pulsars' Component Widths.
   Abstract:
   Using data from the Meterwavelength Single-pulse Polarimetric Emission Survey at 333 and 618 MHz we study the profile component widths of 123 pulsars, whose period (P) > 0.1 s. The profile components were classified either into core and conal classes, which exhibit distinct frequency evolutions as well as different polarization characteristics, with the core components always being centrally located within the profile. After the components were classified, their respective widths at each frequency were measured at the 50% level of the peak intensity (W_{core} and W_{cone}). Also the separation between adjacent components (Wsep) was measured. Using quantile regression we found that at both frequencies, the relations between the core and the conal component widths versus period, have a minimum limit called Low Boundary Line (LBL) that follows an, already known, P^{?0.5} relation. Our analysis suggests a deviation from the traditional view that the period dependence of widths is a consequence of the dipolar geometry in pulsars. We have shown that the P^{?0.5} dependence is indeed seen individually in the core and conal components. These results firmly establish the core and the conal components to be equivalent within the pulsar profile and eliminate any requirement for two different emission mechanisms for the core and conal emission at different heights. We suggest that in normal pulsars, where the radio emission is supposed to originate at heights of around 500 km from the stellar surface throughout the pulsar profile, the P^{?0.5} dependence of the LBL is a result of a physical mechanism and not an outcome of the dipolar nature of the magnetic field in the emission region. In the absence of further constraints from observations, more detailed modeling of the emission processes are required to explain the period dependence of components.

8. **Name**: Prof. Paul Kalas (UC Berkeley)
   Coauthors: No coauthors were included.
   Title: A near co-planar stellar flyby of the HD 106906 planetary system
   Abstract:
   Close stellar encounters have the potential to significantly alter the architecture of planetary systems. Stars passing close to our solar system have been invoked to explain the formation of the Oort cloud, comet showers, the disruption of the Kuiper Belt, and the distant detached orbits of dwarf planets such as 90377 Sedna, as well as the hypothetical Planet Nine. Such stellar flybys have also been invoked to explain the orbital properties of extrasolar planets. However, direct empirical evidence for these hypothetical encounters is lacking. Here we show that the 15 Myr-old planet-hosting binary star HD 106906 underwent a close stellar encounter that can explain the system’s current architecture. Using the exquisite precision of ESA’s Gaia satellite for measuring stellar motions, we have discovered a pair of external stellar perturbers that approached within 1 pc of the HD 106906 system in a flyby geometry that is coplanar with the observed, highly asymmetric circumbinary disk. This flyby is consistent with the scenario that the massive planet HD 106906 b formed in a disk near the binary star, was ejected from the inner system through interactions with the eccentric binary, and was subsequently stabilized onto its current wide orbit (~740 au) by the perturbations of the passing stars.

9. **Name**: Dr. Angelos Tsiaras (UCL)
   Coauthors: No coauthors were included.
   Title: The legacy of HST/WFC3: First insights into the nature of super-Earths
   Abstract:
   Today, more than 3900 exoplanets have been detected, with super-Earths being the most common in our galaxy. We still know very little about these planets, with their basic parameters such as radius and mass – when available – suggesting a great variety among them. However, the density alone does not reveal the chemical composition and climate of these planets, nor casts light into their formation history. To answer those questions, we need to observe their atmospheres. Currently, the WFC3 camera on-board the Hubble Space Telescope is the most powerful instrument to perform infrared transit spectroscopy of exoplanets. In particular, the use of the spatial scanning technique has given the opportunity for even more efficient observations of the brightest targets, achieving the necessary precision of 10 to 100 ppm to the flux of the star. Atmospheric characterisation of super-Earths is within reach of the WFC3 but such observations have been very limited so far, with no confirmed detection of molecules. Three targets with radii above 1.5 Earth radii – GJ-1214 b, HD 97658 b and 55 Cnc e – have been studied so far. The first two show only flat spectra, suggesting an atmosphere covered by thick clouds or made of heavy molecular species, while only the spectrum of 55 Cnc e has revealed a light-weighted atmosphere, suggesting H/He still being present. In addition, the transit observations of six planets around TRAPPIST-1 – planets b, c, d, e, f, and g – have not shown any molecular signatures and have excluded the presence of cloud-free, H/He atmospheres around them. In this presentation, I will discuss the main characteristics of the WFC3/IR instrument, the process followed to develop an automatic analysis pipeline, and the lessons learnt from this process, focusing on the parallel development of both data analysis and simulation software. I will also present the result of reanalysis of previously published spectra of super-Earths as well as new results from recent observing campaigns with HST.

10. **Name**: Ms. Sofia Savvidou (MPIA, Heidelberg)
    Coauthors: No coauthors were included.
    Title: Thermal structures of protoplanetary discs
    Abstract:
    The thermal structure of protoplanetary discs is regulated by their dust content and the opacity that dust grains provide. Therefore it is important to investigate the effect grain growth has on the disc structure. We use 2D hydrodynamical simulations coupled to a new opacity model that calculates the opacity as a function of temperature for a dust population taking into account the particle size, composition and abundance. We compare simulations utilizing single grain sizes to two different multi-grain size distributions at different levels of turbulence strengths, parameterized through the ?-viscosity. In the first grain size distribution, the number density follows an MRN power-law. The second one begins with the same mass distribution, but takes into consideration the relative velocities for particles of different sizes and gives different slopes for the mass distribution depending on the particle sizes and their aerodynamical properties. I will present the first results from this work and discuss how we then use the aforementioned simulations to study the thermal structure of protoplanetary discs and how it affects the evolution of the iceline. Additionally, I will discuss the implications of the iceline location to planetesimal formation and planet migration.

11. **Name**: Ms. Anastasia Kokori (Royal Observatory Greenwich)
 Coauthors: No coauthors were included.
 Title: Ground-based exoplanet observations in support of the ARIEL space mission
 Abstract:
 Currently the number of exoplanets is rapidly growing, with over 3900 planets discovered. This number is expected to grow even more in the future with dedicated missions like TESS and PLATO. While discovering new exoplanets is still important, we have now entered the era of exoplanets characterisation. More specifically, ESA's next medium scale mission, ARIEL, will observe 1000 known exoplanets to obtain their spectra and characterise their chemical consistency. For this large-scale survey to be as efficient as possible we need to have a good knowledge of the orbital parameters of the planets observed, especially of the expected transit time, and this is where small and medium-scale telescopes can contribute significantly. ExoWorlds Spies (www.exoworldsspies.com) is a project that started in early 2018, aiming to monitor transiting exoplanets through long-term regular observations using small and medium scale telescopes. We are actively collaborating with the ARIEL consortium on obtaining follow-up observations of exoplanet-hosting systems in order to define their ephemerides as precisely as possible. In this effort, we are supported by amateur astronomers, the Holomon Astronomical Station and the private telescope network of Konika Minolta. In addition, we strongly believe that research is an effort that everyone can contribute and, thus, our project is open to collaboration with the public, including students of schools and universities. To facilitate this, we have developed user-friendly data analysis tools and a dedicated website, in order to disseminate the material to as many people as possible. The website includes audiovisual material, information on the project, data analysis tools, instructions, observational data and graphics. All sources are online, free, and available for everyone both in English and Greek. So far, we have collected approximately 60 transit observations of more than 25 different exoplanets, from both the North and the South hemisphere, including recently discovered planets with limited data available. These observations prove that multiple small observatories can collaborate in order to cross-calibrate their data and provide complementary, high-precision results. In this presentation, we will present the network of our observing partners, the importance of the synergy with ARIEL, the future observing plans, and the most exceptional cases of exoplanets observed until today as part of our project.

12. **Name**: Dr. Nikolaos Georgakarakos (New York University Abu Dhabi)
 Coauthors: No coauthors were included.
 Title: Is the system real? The case of the HD 34445 multi-planet system.
 Abstract:
 The star HD34445 was known to host a planet. Recently, it was announced to have another five planets. It is a rather dense planetary system with some of its planets having separations of fractions of an au. In this work we investigate the dynamical stability of the HD 34445 planetary system in order to check the validity of the orbital solution acquired. By means of numerical simulations, the dynamical stability of the system is tested on different timescales. We vary the orbital elements and masses of the system within the error ranges provided and we find that for a large area of the parameter space we can produce stable configurations and therefore conclude it is very likely that the HD 34445 planetary system is real. Some discussion about the potential habitability of the system is also done.

13. **Name**: Prof. Konstantinos Tassis (University of Crete & FORTH)
 Coauthors: No coauthors were included.
 Title: "Hearing" the 3D shape of Musca molecular cloud
 Abstract:
 Dust continuum and molecular observations of the low column density parts of molecular clouds have revealed the presence of elongated structures which appear to be well aligned with the magnetic field. These so-called striations are remarkably ordered structures in otherwise chaotic-looking clouds. They encode information revealing the properties of their parent clouds. We have demonstrated that magnetosonic waves, ubiquitous in molecular clouds, are the most probable cause of striations, since they are the only mechanism that can reproduce quantitatively their observed properties. If indeed striations are the interstellar ripples caused by the passage of magnetosonic waves, then profound consequences are implied for their ability to reveal hidden, important information about molecular clouds. I will present a specific example: striations in the Musca molecular cloud are found to encode normal modes of the cloud's global magnetosonic vibrations, allowing the reconstruction of it's 3D shape.

14. **Name**: Dr. Alexandros Chiotellis (National Observatory of Athens)
Coauthors: Panos Boumis (National Observatory of Athens)
Title: On the interaction of Type Ia Supernovae with Planetary Nebulae
Abstract:
Type Ia supernovae (SNe Ia) are believed to result from the thermonuclear combustion of carbon oxygen white dwarfs that get destabilized by mass accretion from a companion star. However, despite decades of research, the nature of SNe Ia remains largely unknown. One promising method that attempts to put insights on the unknown nature of SNe Ia is the search of traces from the interaction of the SN ejecta with circumstellar structures formed by the progenitor system. These traces can be found either at the early SN phase or at the subsequent phase of the supernova remnant (SNR). However, from the current observations of SNe Ia and their SNRs are extracted ambiguous conclusions about the existence and the properties of the surrounding circumstellar medium (CSM) and up to date there is no any model able to explain all the observables at the same time. In this work we present an alternative progenitor model according to which SNe Ia occur in the center of, and substantially interact with, Planetary Nebulae (PNe) formed by one or both the progenitor stars. We show that the diverse observables of the CSM around SNe Ia and SNRs reveal intriguing similarities with the overall properties of PNe. We preform 2D hydrodynamic simulations and we study the results of a SN Ia-PN interaction on the properties of the resulting SNR. We show that such a model can explain self-consistently the overall properties of well-studied Type Ia SNRs e.g. Kepler's and Tycho's SNR. In this work we present an alternative progenitor model according to which SNe Ia occur in the center of, and substantially interact with, Planetary Nebulae (PNe) formed by one or both the progenitor stars. We show that the diverse observables of the CSM around SNe Ia and SNRs reveal intriguing similarities with the overall properties of PNe. We preform 2D hydrodynamic simulations and we study the results of a SN Ia-PN interaction on the properties of the resulting SNR. We show that such a model can explain self-consistently the overall properties of well-studied SNRs e.g. Kepler's and Tycho's SNR.

15. **Name**: Mr. John A. Kypriotakis (University of Crete & FORTH)
Coauthors: Andreas Zezas (University of Crete, Department of Physics), Ioanna Leonidaki (University of Crete, Department of Physics)
Title: Mapping the Physical Properties of Supernova Remnants in our Galaxy
Abstract:
The study of supernova remnants is crucial, not only for uncovering the physics behind the evolution of the remnants themselves, but also the physics of the explosions, the shock waves and the interaction with the interstellar medium. The commonly used method for studying the supernova remnants is to measure their physical parameters from their spectra. In this contribution, we present a method to recover maps of the shock wave velocity, and the corresponding uncertainties. This is achieved by means of narrow-band imaging in diagnostically useful spectral lines. We apply this method on the Galactic supernova remnants G65.8-0.5 and G67.8+0.5. In this context we also redefine the standard $frac{left[S_{II}right]}{H_alpha}$ shock-excitation diagnostic in order to account for the contamination of the H_alpha line by the $left[N_{II}right]$ emission. Finally, we compare those results with measurements from long-slit spectra in selected regions of the SNRs.

16. **Name**: Ms. Sophia Derlopa (IAASARS, NOA & University of Athens)
Coauthors: Panos Boumis (IAASARS, National Observatory of Athens), Alexandros Chiotellis (IAASARS, National Observatory of Athens), Steffen Wolfgang (Instituto de Astronomía, Universidad Nacional Autónoma de México, Ensenada 22800, Baja California, Mexico), Stavros Akras (Instituto de Matemática, Estatística e Física, Universidade Federal do Rio Grande, Rio Grande 96203-900, Brazil)
Title: A holistic study of the supernova remnant VRO 42.05.01 (G 166.0 +4.3)
Abstract:
We present an holistic study of the Galactic Supernova Remnant (SNR) VRO 42.05.01, which includes new observational data, 2-D hydrodynamical modeling of VRO and the first 3-D morpho-kinematical modeling ever created for a SNR. VRO consists of two major components: a 30' diameter semicircle shell at NE (a.k.a. 'the shell') and a much larger bow shaped (almost triangular) shell at the SW (a.k.a. 'the wing'). We present optical imaging of the VRO in Hα+[N II], [O III] 5007 and [S II] at a moderate angular resolution, along with low and high-dispersion spectroscopy and high-resolution imaging at selected areas around this extended remnant. Our results provide new significant information on (a) the morphological and kinematical properties of the remnant and (b) the interaction between the SNR and the surrounding ambient medium. Our 2-D hydrodynamical simulations of VRO are based on the scenario of a supersonically moving Wolf-Rayet progenitor star with strong, asymmetric stellar winds at its equatorial plane, which excavates an extended wind-bubble. The interaction of the subsequent supernova ejecta with the surrounding wind-bubble resulted to the current morphology of VRO, as it is sufficiently reproduced in our hydrodynamical modeling. Finally, we conducted a 3-D morpho-kinematical modeling of VRO aiming to provide vital information on its morphology and kinematics in the third dimension, something that is absent in the 2-D observational data. Applying our observational data in the astronomical code "SHAPE", we managed to reproduce an overall 3-D structure of VRO. We found that a) the "shell" and the "wing" components of the remnant reveal different kinematic behaviour which stems from different circumstellar medium properties, and b) the systemic velocity of VRO is within the range of -15 km s $^{-1}$ to -25 km s $^{-1}$.

17. **Name**: Ms. Maria Kopsacheili (University of Crete & FORTH)
Coauthors: No coauthors were included.
Title: Study of Extragalactic Supernova Remnants
Abstract:
Studies of populations of supernova remnants (SNRs) in different galaxies provide a more representative picture of their importance for feedback and metal enrichment in a wide variety of galactic environments. We present our results on the SNRs populations in a sample of nearby spiral galaxies (NGC 7793, NGC 55, NGC 45, NGC 1313), based on deep narrow-band Hα and [S II] images. We find a total of 224 candidate SNRs. We derive the Ha and excitation distributions of the SNRs, both of which are proxies of the energy deposition on the galactic interstellar medium (ISM). In our analysis we develop methods to account for selection effects that allow us to directly compare results between different galaxies. We also present a new, efficient, diagnostic tool for identifying SNRs and measuring their shock velocities based on narrow-band imaging. Through the effective differentiation from H II regions this diagnostic provides more complete samples of SNRs including those in later evolutionary phases with slower shocks.

18. **Name**: Dr. George Voyatzis (University of Thessaloniki)
Coauthors: No coauthors were included.
Title: Limits of stable periodic motion of triple star systems
Abstract:
The stability of gravitational triple systems (GTS) is a well-known problem in celestial mechanics. In triple systems we include systems of i) three stars ii) two stars and a heavy planet or iii) two heavy planets around a single star. The basic model used for the study of their orbital evolution is the general three body problem. Many criteria for the long term stability of GTS have been proposed. Most of them they are based on restrictions provided by the integrals of motion or on purely numerical simulations. In our study we propose a different approach for the study of the long term stability of GTS, which is based on the numerical computation of manifolds of periodic orbits. Generally, the linear stability of such periodic orbits is associated with the existence of invariant tori in phase space which support quasiperiodic evolution and, therefore, long-term stability. Such an approach has been used for the study of the orbital evolution of two-planet exosolar systems. By applying the method of analytic continuation of periodic orbits with respect to the masses, we can compute periodic orbits for GTS where all bodies can have similar mass values. In the present work we apply the mass-continuation to the circular family of periodic orbits. Such family exists for the planetary type problem, namely the case of two planets around a single star. By increasing the planetary masses we obtain a manifold of periodic orbits. The linear stability of these periodic orbits is studied through the computation of appropriate stability indices derived from the monodromy matrix. By considering that the GTS has a hierarchical structure, the constructed manifold of periodic solutions can be projected on a plane defined by the relative distance and the relative mass of the system. On such a plane a stability map can be constructed showing the stability limits on the manifold of periodic orbits. We performed computations considering an initial planar configuration consisting of a single star, of mass m0=1, and two small bodies (m1=m2=0). Then we increase the masses m1 and m2 such that m1=m2 and m0+m1+m2=1 and compute the corresponding monoparametric families of periodic orbits. Finally we obtain a planar system of three bodies with equal masses, m1=m2=m3=1/3. In the assumed hierarchical structure, if a1 is the semimajor axis of the inner binary and a2 the semimajor axis of the outer body with respect to the barycenter of the inner binary, we define the relative orbital distance as a=a2/a1. For the system of m0=m1=m2 we have determined periodic motion for a>1.16 and stable periodic motion for a>2.33.

19. **Name**: Ms. Georgia Loukaidou (University of Athens)
Coauthors: Kosmas Gazeas (National Kapodistrian University of Athens)
Title: Investigating coalescence scenarios on Low Mass Contact Binaries
Abstract:
Research on dwarf Main Sequence stars with low mass and low temperature, is particularly interesting and highly important in understanding stellar evolution in stellar systems in our solar neighborhood. Low Mass Contact Binaries (LMCBs) host stars, which are one step before their final coalescence, having a substantial part of their mass and angular momentum already exhausted due to their long evolution. The purpose of this study is to investigate these binaries by correlating their physical parameters with other known similar systems. In this work, we present the photometric investigation of low temperature and low mass stars, that simultaneously have orbital period very close to the period cut-off of 0.22 days. The scientific approach was obtained by utilizing photometric observations of contact binary stars, in order to determinate their physical and geometrical parameters (i.e. mass, radius, temperature and luminosity). The sample was selected from the SWASP survey, on which follow-up photometric observations were carried out with larger telescopes and a proper optical filter set, such as the 2.3m telescope at Helmos Observatory and the 1.2m telescope at Kryoneri Astronomical Station (both at the National Observatory of Athens) and the 0.40m telescope at the University of Athens Observatory (UOAO).

Posters:

1. **Name**: Ms. Seda Acar (Erciyes University)
   Coauthors: Inci Akkaya Oralhan (Erciyes University, Turkey)
   Title: Multi-passband Photometric Analysis of Open Cluster Teutsch144
   Abstract:
   We present fundamental parameters of poorly studied galactic open cluster Teutsch144 using CCD UBVRI photometric data observed at the San Pedro Martir Observatory (SPMO). We also used SDSS and GAIA DR2 passbands to obtain different colour magnitude diagrams (CMDs). Cluster memberships have been determined from Gaussian Mixture Method by utilising the proper motion and parallax measures from the GaiaDR2 astrometric data release. The cluster diameter is estimated as 1.5 arcmin by using King Profile. The reddening has been obtained as E(B-V)=0.80±0.11 mag and E(g-r)=0.77±0.11 mag from two-color magnitude diagram. These reddening values have used for fitting the PARSEC isochrones with the CMDs. The mean distance module, distance, and the age of this cluster derived from nine different CMDs obtained as (V-Mv)0=12.0±0.15 mag, 2.51±0.18 kpc and 0.56±0.07 Gyr with respectively. The new results show that this cluster is an intermediate age and a distant cluster.

2. **Name**: Dr. Inci Akkaya Oralhan (Erciyes University)
   Coauthors: Yüksel Karatas (Observatorio Astronomico Nacional, Universidad Nacional Autonoma de México), Raul Michel & Hikmet Çakmak (Istanbul University, Turkey)
   Title: CCD UBVRI and GAIA Photometry of NGC 6791, NGC 6811, NGC 6819, NGC 6866 Open Star Clusters
   Abstract:
   Cluster memberships have been determined from Gaussian Mixture Method by utilising the proper motion and parallax measures from the GaiaDR2 astrometric data release. The reddenings of four OCs have been obtained as E(B-V) = 0.12 +/- 0.07 (NGC 6791), E(B-V) = 0.06 +/- 0.05 (NGC 6811), E(B-V) = 0.15 +/- 0.07 (NGC 6819), and E(B-V) = 0.07 +/- 0.06 (NGC 6866). The distance moduli, distances, and ages of these OCs, with their corresponding uncertainties, are almost in good harmony with the recent literature values. Fitting the PARSEC isochrones to the colour magnitude diagrams (CMDs) gives an old age, 5.01 Gyr, for NGC 6791 and 2.24 Gyr for NGC 6819, respectively. Whereas the other two OCs have intermediate-ages, 0.79 and 0.71 Gyr. Gaia DR2 provides distances roughly consistent with the photometric values of these OCs within the uncertanties. The likely members of NGC 6811, NGC 6819 and NGC 6866 reach to zmax < 0.8 kpc heights with the circle orbits (ecc < 0.15). The members of NGC 6811 and NGC 6866 seem to reside in the region, Rm >= 8.5 kpc. Whereas thoes of NGC 6819 lie in solar suburb, 7.5 < Rm <= 8.5 kpc. Their dynamical values of NGC 6811, NGC 6819 and NGC 6866 and their distributions on (U, V) velocity plane indicate the characteristics of Galactic thin disk, which are in good concordance with their metal abundances. Four likely members of NGC 6791 reach to zmax > 1.28 - 2.59 kpc heights with the eccentric values (ecc > 0.30 - 0.40). These four stars locate in the inner ring, Rm <= 7.5 kpc. One member of this OC has a elongated orbit (ecc = 0.403), and reaches to zmax = 2.593 kpc height. This star resides out Rm > 8.5 kpc. This is probably caused by its low proper motion = 0.104+/-0.026 mas. NGC 6791 with the metal rich ([Fe/H] = +0.38) and old age value (5 Gyr) may be formed in the inner thin disc or in the bulge, and also it is possible that this OC migrated from there to its current orbit by the dynamical processes such as, Galactic bar and spiral arms (Carraro et al. 2006, 2013; Jilkova et al. 2012, Martinize-Medina 2014).

3. **Name**: Dr. Panos Boumis (IAASARS, National Observatory of Athens)
   Coauthors: Chiotellis Alexandros (IAASARS, National Observatory of Athens), Derlopa Sophia (IAASARS, National Observatory of Athens), Akras Stavros (IMEF, Universidade Federal do Rio Grande, Brazil) Leonidaki Ioanna (IESL, FORTH), Alikakos John (IAASARS, National Observatory of Athens) Kopsacheili Maria (University of Crete, FORTH), Harvey Eamonn (LJMU, UK) Sabin Laurence (IAA, UNAM, Mexico), Nanouris Nikos (IAASARS, National Observatory of Athens), Mavromatakis Fotis (TEI Crete)
   Title: Optical study of the peculiar supernova remnant G 166+4.3 (VRO)
   Abstract:
   We present optical images of the VRO 42.05.01 (G 166.0+4.3) supernova remnant in H?+[N II], [O III] 5007 and [S II] at a moderate angular resolution. Low and high-dispersion spectroscopy and high-resolution imaging were also performed at selected areas around this extended remnant. Diagnostic diagrams of the line intensities from the present spectra and the new kinematical observations both confirm the supernova origin. Taking into account our results (i.e. shock velocities, morphological characteristics etc.) together with observations of other wavelengths (i.e. radio) and modeling, we provide new significant information on (a) it's formation and evolutionary history, (b) the interaction between the SNR and the surrounding medium.

4. **Name**: Dr. Alexandros Chiotellis (National Observatory of Athens)
   Coauthors: Panos Boumis (National Observatory of Athens), Sofia Derlopa (National Observatory of Athens), Wolfgang Steffen (I.A., Auton. National University of Mexico)
   Title: VRO 42.05.01: A supernova remnant resulting by a supersonically moving Wolf Rayet progenitors star
   Abstract:
   VRO 42.05.01 is a Galactic supernova remnant (SNR), which reveals an intriguing morphology consisted of two major components: a ~ 30' diameter semicircle shell at NE (a.k.a. 'the shell') and a much larger bow shaped (almost triangular) shell at the SW (a.k.a. 'the wing'). The SN ejecta and ambient medium properties that formed VRO's morphological properties is a subject of speculation for several decades and up to date remain unknown. In this work we present a model of VRO 42.05.01 according to it the SNR resulted by a supersonically moving Wolf Rayet progenitor star. The strong stellar wind of the Wolf Rayet progenitor was asymmetric enhanced at the equatorial plane of star. The systemic motion of the Wolf Rayet star in combination with its asymmetric outflows excavated an extended wind bubble that revealed similar morphological characteristics with these of VRO. Subsequently, the interaction of the SN ejecta with the surrounding wind bubble resulted to the current morphology of VRO 42.05.01. We present two-dimensional hydrodynamical simulations of both the wind bubble formation and the SNR evolution. We show that the extracted results of our simulations reproduce the structure of VRO 42.05.01 in great detail.

5. **Name**: Ms. Eleni Christopoulou (University of Athens)
   Coauthors: Kosmas Gazeas (National and Kapodistrian University of Athens, Greece)
   Title: General Theory of Relativity verification with observations of total solar eclipses
   Abstract:
   In 1919, astrophysicist Arthur Stanley Eddington performed the first attempt to prove that light is bent due to gravity, following Albert Einstein's General Theory of Relativity (GTR). Although he confirmed GTR and made Einstein famous, his effort was doubted by many scientists. Since then many expeditions were carried out in order to repeat the experiment, some of which confirmed Einstein but other did not. In this work we present the results of stellar displacement due to the curvature of space from the solar gravitational field, using high resolution digital eclipse images. Our results for the stellar displacemen t in the limb of the Sun, confirm Einstein's GTR within the error margins, indicating the constraints in the methodology of modern eclipse photography and modern scientific methods. This is the first time that high resolution digital imaging is used for testing GTR, right on the first centenary of Eddington's eclipse expedition in 1919.

6. **Name**: Prof. Michael Contadakis (University of Thessaloniki)
   Coauthors: M.E.Contadakis (1), S.J. Avgoloupis (2), J. H. Seiradakis (2), Ch.Papantoniou (1) (1)Department of Surveying and Geodesy, Aristotle University of Thessaloniki, GR-54124, Thessaloniki Greece (2)Session of Astronomy, Astrophysics and Mechanics, Department of Physics, School of Sciences, Aristotle University of Thessaloniki, GR-54124, Thessaloniki Greece.
   Title: Detection of starquakes on the red dwarf YZ CMin.
   Abstract:
   The results of the analysis of the one colour (B) observations of the Stefanion Observatory for the red dwarfs YZ CMin at any stage of their activity (quiescence, weak flares, strong flares),indicate that: (1) Transient high frequency oscillations occur during the flare event and during the quiet-star phase as well; (2) The Observed frequencies range between 0.0005Hz (period 33min) and 0.3 Hz (period 3s) not rigorously bounded; However, the quiescence parts of the light-curved which were analyzed belong to the pre- or after- flare state i.e. are connected with a major magnetic even (the observed flare). It is interesting that we find that transient oscillations appear far apart from the observed flares, during the quiet state of the stars, as a result of the general magnetic activity of the star. The power spectrum of these oscillations resamples that of the solar like oscillation spectra i.e the sunquake spectra. In particular the starquake spectra of YZ CMin resamples that of a red subgiant. Keywords: Flare stars -Discrete Fourier Transform analysis -Brownian Walk noise.

7. **Name**: Ms. Fatemeh Danesh Manesh (Ferdowsi University of Mashhad)
   Coauthors: No coauthors were included.
   Title: Gravitational fragmentation of a filamentary molecular cloud using SPH
   Abstract:
   Gravitational instability of filamentary molecular clouds leads to formation of high-density regions which are sites of star formation. The presence of magnetic field can hinder or facilitate this process. We investigate the fragmentation of a filamentary molecular cloud with uniform density and different mass per unit length. We also study the effect of magnetic field orientation by taking into account parallel and perpendicular magnetic field in respect to the filament axis. To this end, we use three-dimensional smoothed particle magnetohydrodynamic simulation with the Phantom code. We study the filament evolution and fragment formation including the filament width, number of fragments and their mass distribution and also compare their separation with the linear theory.

8. **Name**: Ms. Sophia Derlopa (IAASARS, NOA & University of Athens)
   Coauthors: Boumis Panos (IAASARS, National Observatory of Athens)
   Chiotellis Alexandros (IAASARS, National Observatory of Athens)
   Steffen Wolfgang (Instituto de Astronomía, Universidad Nacional Autónoma de México, Ensenada 22800, Baja California, Mexico)
   Akras Stavros (Instituto de Matemática, Estatística e Física, Universidade Federal do Rio Grande, Rio Grande 96203-900, Brazil)
   Title: SNR VRO 42.05.01 (G 166.0 +4.3) 3-D morpho-kinematical model
   Abstract:
   We present the first 3-dimensional (3-D) morpho-kinematical model of a supernova remnant (SNR), using as a study case the Galactic SNR VRO 42.05.01 (G 166.0 +4.3). Its 3-D representation provides us with the information in the third dimension, which is completely absent in the 2-D imaging data. This will significantly contribute to our understanding of its evolutionary history, which still remains unknown. For the purpose of our model, the astronomical code “SHAPE” was employed in which low and high-resolution imaging and spectroscopic data were utilized. We assume that the VRO’s current morphology was shaped by the interaction of the remnant with a bow-shaped wind bubble. In the framework of this model, the SNR comprises by three basic components: a hemisphere in the NE region (“shell”), an elongated structure from SE to NW (“wing”) and a smaller hemisphere in the SW area (“hat”). We found that in our model: a) The synthetic Position Velocity (PV) diagrams created with “SHAPE” and correspond to the produced 3-D structure of the remnant, are in very good agreement with the observational PVs deduced from the spectroscopic analysis. b) The systemic velocity of the remnant is within the range of -15 km s^-1 to -25 km s^-1 . c) The “wing” component of the SNR has lower expansion velocities than the “shell” and “hat” counterparts.

9. **Name**: Mr. Alexandros Filothodoros (University of Zielona Gora)
   Coauthors: No coauthors were included.
   Title: A long term and broad X-ray band analysis of GRS 1758-258 using INTEGRAL Data
   Abstract:
   We present our initial results on out study of GRS 1758-258, using all the publicly available INTEGRAl/ ISGRI and JEMX data, spanning a period of 15 years covering. For our ISGRI spectral analysis we used a power law model in order to estimate the 22 -- 100 keV flux and photon index. The results are later used for the creation of a phenomenological spectral state classification system of this target, based only on hard X-rays. We move on, by splitting the hard special state into 4 hard substates and perform a separate spectral analysis using JEMX, ISGRI and PICsIT spectra, binned per revolution, and Comptonization spectral models such as COMPPS and EQPAIR. Finally, we present the evolution of the models' most important parameters as the source's behavior varies between the softest and hardest spectral state.

10. **Name**: Mr. Alexandros Filothodoros (University of Zielona Gora)
    Coauthors: No coauthors were included.
    Title: A Clustering Behavior of the Cyg X-1 hard X-ray photon index.
    Abstract:
    Our work focuses on the analysis of the black hole binary Cyg X-1. We use X-ray INTEGRAL data, that span a period of 15 years. SWIFT/BAT hard X-ray and Ryle/AMI radio data were also used. Parameters such as the hard X-ray flux, photon index and fractional variability were calculated. Our main finding is that the hard X-ray photon index exhibits a clustering behavior. We found that the distribution of the photon index determined for the 22–100 keV band can be decomposed into four Gaussian peaks. Assuming that Comptonization is the dominant process for the hard X-ray emission, our results suggest that the hot plasma region in Cyg X-1 can take four separate geometries (spectral states) associated with a different jet behavior and X-ray/radio variability patterns.

11. **Name**: Dr. Nikolaos Georgakarakos (New York University Abu Dhabi)
    Coauthors: No coauthors were included.
    Title: Giant planets and habitable worlds: friends or enemies?
    Abstract:
    The presence of giant planets influences potentially habitable worlds in various ways. Big celestial neighbours can facilitate the formation of planetary cores and modify the influx of minor bodies towards Earth-analogs later on. Furthermore, giant planets can indirectly change the climate of terrestrial worlds by gravitationally altering their orbits. In this work we investigate how the gravitational perturbations of a giant planet can affect the capacity of a potentially habitable world to have liquid water on its surface. Using a number of well characterized exoplanetary systems known to date to host a main sequence star and a giant planet, we show that the presence of 'giant neighbours' can reduce a terrestrial planet's chances to remain habitable, even if both planets have stable orbits. In providing constraints on where giant planets cease to affect the habitable zone size in a detrimental fashion, we identify prime targets in the search for habitable worlds.

12. **Name**: Ms. Efsevia Karampotsiou (University of Athens)
    Coauthors: Kosmas Gazeas (National and Kapodistrian University of Athens)
    Title: Diffraction phenomena during stellar occultations from small bodies of our Solar System
    Abstract:
    According to wave theory, diffraction phenomena are observed when a boundary is placed along the propagation of a wavefront. Diffraction is studied in the frame of the present project, as well as its application in astrophysics, specifically stellar occultations from small bodies. The problem is approached using the theory of diffraction and running experiments in the Laboratory of Astronomy and Applied Optics in Physics Department of NKUA. From the observations of stellar occultations from asteroids we derive information about the shape and the exact orbit of the asteroid. The extracted results contribute to the characterization of the observed objects and the determination of their physical and orbital parameters. Another factor that can be studied in detail using this method is the surface roughness of these objects. In this project theoretical light curves of stellar occultations from Near Earth Asteroids (NEA) and Kuiper Belt Objects (KBO) are presented, which can be fitted to observations in order to determine the orbits of these objects more accurately.

13. **Name**: Ms. Yonca Karsli (Erciyes University)
    Coauthors: No coauthors were included.
    Title: CCD UBV(RI)KC Photometry of Open Clusters, Juc 09 and Be 97
    Abstract:
    In this study, we have analyzed two open star clusters with the name of Juc 09 and Be 97. These star clusters are known to have F-G spectral type stars. CCD UBV(RI)KC photometric observations of these clusters have been taken from 0,84 m f/13 Ritchey-Chretien telescope in San Pedro Martir National Observatory which is connected to Universidad Nacional Autonoma de Mexico. Cluster memberships have been determined from Gaussian Mixture Method by utilising the proper motion and parallax measures from the GaiaDR2 astrometric data release. We have used PARSEC isochrones to determine cluster parameters. The reddenings have been obtained as E(B-V)=0.79±0.03 mag and E(G-R)=1.06±0.08 mag from two-color magnitude diagram for Juc09 and E(B-V)=0.87±0.05 mag and E(G-R)=1.12±0.08 for Be 97. The mean distance module, distance, and the age of this clusters derived from different CMDs obtained as (V-Mv)0=13.50±0.08 mag, 5.01±0.18 kpc and 30±10 Myr for Juc 09 and (V-Mv)0=12.40±0.10 mag, 3.02±0.13 pc and 11.22±1.37 Myr for Be 97.

14. **Name**: Mr. John A. Kypriotakis (University of Crete & FORTH)
    Coauthors: No coauthors were included.
    Title: The Wide Area Linear Optical Polarimeter - North. Challenges and Triumphs so Far
    Abstract:
    A large victory of cosmological astrophysics was the discovery of E-modes in the polarization of the cosmic microwave background (CMB), back in 2002. Unfortunately, to prove the inflationary model for the early expansion of the universe, one needs to also observe B-modes in the polarization of the CMB. Those 'elusive' modes have fled scientists for years, partly because the magnetized interstellar medium (ISM) polarizes the microwave radiation. For this reason, we started the PASIPHAE project, in order to measure the 3D structure of dust and magnetic field in the polar regions of the Galaxy. In order for this to succeed, 2 'wide area linear optical polarimeters' (WALOP) (one in the North and one in the South) will be installed, that will measure the polarization of millions of stars during the span of the survey. In this contribution, various challenges in the design of such an instrument will be presented, as well as few of the solutions.

15. **Name**: Dr. Alexios Liakos (IAASARS, NOA)
    Coauthors: Stavros Akras (FURG, Brasil), Panayotis Boumis (IAASARS, NOA), Alexandros Chiotellis (IAASARS, NOA)
    Title: Hunt for eclipsing binaries in the centers of Planetary Nebulae
    Abstract:
    This work presents the long term and ongoing observational campaign for detection of eclipsing binary systems as central stars of planetary nebulae (PNe). From 2014 to date using the 2.3 m Aristarchos and the 1.2 m Kryoneri telescopes, systematic monitoring of more than 25 selected PNe has been conducted. Three of them have been revealed as very good candidates for hosting an eclipsing binary system as central star. The aim of this campaign concerns the discovery of as many as possible binary central stars in PNe, the identification of their stellar parameters, and finally the comparison of our results with the theoretical models of PNe regarding the connection of their central stars with the morphology of the surrounding PN. Through the complementation of this research, we anticipate to contribute substantially in clarifying the physical processes that determine the final stages of stellar evolution of low mass stars and the formation of PNe.

16. **Name**: Ms. Maria Petropoulou (University of Athens)
   Coauthors: Kosmas Gazeas (National and Kapodistrian University of Athens)
   Title: Investigating the Physical Properties of Globular Clusters NGC 6218, NGC 6205 and NGC 6809
   Abstract:
   Globular Clusters (GCs) are among the oldest objects in the Universe, setting a lower limit to its age. Recent studies have revealed that they may host distinct populations as far as their age, chemical abundances, dynamical state and spatial distribution, concerns. In this study we present a multi-band photometric study, of the galactic GCs NGC 6218, NGC 6205 and NGC 6809, conducted at the University of Athens Observatory. We estimate their distances, inspecting the existing RR Lyrae population on their Color Magnitude Diagrams (CMDs), as well as their evolutionary ages, utilizing theoretical isochrones of PARSEC evolutionary code. Constructing their radial density profiles, we examine the spatial (2D) distribution of characteristic, distinct stellar populations, and we search for gradients that may be explained by mass segregation, second-parameter phenomenon (Horizontal Branch-HB stars) or multiple generations of stars in the same cluster. NGC 6218 exhibits a gradient on the distribution of its Blue and Red HB Populations, which can be connected to second and first generation stars.

17. **Name**: Ms. Sofia Palafouta (University of Athens)
   Coauthors: Kosmas Gazeas (National and Kapodistrian University of Athens)
   Title: Temporal evolution of the eclipsing binary system DV Psc
   Abstract:
   The existence of a magnetic activity for the eclipsing binary system DV Psc is known for almost two decades. However, no evidence of periodic behavior relevant to this activity has been found until recently. In this study, long-term photometric observations of DV Psc between 2005-2017 are used to analyze its magnetic activity, seek a possible magnetic cycle and determine the orbital and physical parameters of the system. The combination of photometric and spectroscopic observations resulted in a unified model that describes the system throughout the years, as a result of the variable spot activity. A total of 71 new times of minimum light are calculated through the entire time span of observations and combined with the 123 bibliographic ones since 1997, increasing significantly the existing sample. As a result an accurate astronomical ephemeris and an updated O-C diagram were constructed for a total span of 19 years (1997-2017) of the system. An intense magnetic activity, which is shown through the strong asymmetries on the light curves (O' Connell effect) and the periodic variation of the O-C diagram are combined to explain the system's behavior. The existence of a third body, orbiting the eclipsing binary in an eccentric orbit, as well as a magnetic cycle is the most likely scenario. The absolute physical parameters of DV Psc are calculated for the unified model, while the evolution state of the system is studied through the mass-radius and temperature-luminosity (H-R) diagrams.

18. **Name**: Dr. Frank Tramper (NOA-IAASARS)
   Coauthors: No coauthors were included.
   Title: Slowly-rotating nitrogen rich O stars in 30 Doradus
   Abstract:
   Surface nitrogen enrichment in O-type stars is predicted from evolutionary models for high rotational velocities, as a result of the rotational mixing of CNO-processed material from the core. The VLT/FLAMES Tarantula Survey discovered a group of slowly-rotating nitrogen-rich O-type stars that challenge these predictions. In this poster I will present the preliminary results of a detailed atmosphere analysis of a representative subset of these stars. The derived stellar parameters and surface abundances of carbon, nitrogen, and oxygen can help to provide clues to the nature of these stars, and help improve evolutionary models.

19. **Name**: Georgios Vasilopoulos (Yale Department of Astronomy)

Coauthors: No coauthors were included.

Title: Study super-Eddington accretion through the spin evolution of NGC300 ULX1

Abstract:

Ultra luminous X-ray Pulsars (ULXPs) are bright binary systems that host a Neutron Star (NS) and emit radiation in excess of the Eddington Limit expected for isotropic accretion. We have studies the spectral and spin properties of the ULXP NGC300 ULX1 through archival data, and have shown that its spin evolution from ~126 s down to 16 s is consistent with almost constant accretion between 2014 and 2018. Moreover, based on the 2018 Swift/XRT and NICER monitoring campaigns of the system we have concluded that even during an 100 d period where the observed flux drops by a factor of 20, the spin-up rate and thus the mass accretion rate remained almost constant. This can be explained only by invoking extreme X-ray absorption or obscuration due to extreme outflows from the accretion disk, or disk precession. Finally, an intriguing consequence is that assuming constant spin-up rate a NS spin reversal should have occurred around 2012.

Special Session: Radioastronomy

1. **Name**: Prof. Nectaria Gizani (Hellenic Open University)
   Coauthors: Veldes Giorgios (University of Thessaly)
   Title: The Hellenic Radiotelescope
   Abstract:
   We report on the progress of the conversion of the 32m telecom antenna to the Hellenic Radiotelescope. The professional instrument upon completion will function both as a single dish and within the European and Global Very Large Baseline Interferometry Network (spectral line and continuum mode).

Index of Contributors