Abstract book of XLI PTA Meeting

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Scientific sessions

Session I: Historical session

Session II: The Sun and heliosphere

Session III: Planetary systems and small bodies

Session IV: Compact objects and multi-messenger astronomy

Session V: High Energy astrophysics

Session VI: Stars, star systems and interstellar matter

Session VII: Cosmology and evolution of galaxies

Session VIII: Instrumental programs

Session IX: Session for popular science and education

Session X: Poster session

Monday 11th September 2023 11:15 – 12:00
Opening Lecture

Kazimierz Stępień
Astronomical Observatory, University of Warsaw

100 lat Polskiego Towarzystwa Astronomicznego

abstract:
Omówię powstanie i działalność PTA w okresie stu lat

Monday 11th September 2023 16:00 – 16:30

Session I: Historical session (invited lecture)

Jerzy M. Kreiner

Mt. Suhora Astronomical Observatory, Pedagogical University in Kraków

Astronomia w niepodległej Polsce: lata 1923-1973

abstract:

W okresie międzywojennym astronomiczne badania naukowe prowadziły wyższe uczelnie w Krakowie, Lwowie, Poznaniu, Warszawie i Wilnie. Za pomocą niewielkich instrumentów podjęto ambitne programy badawcze, obejmujące również zagadnienia astrofizyczne. Rozpoczęto wydawanie kilku czasopism astronomicznych (w tym: Acta Astronomica), a także podjęto program obserwacyjny w nowych stacjach i obserwatoriach astronomicznych zbudowanych na Lubomirze i na Popie Iwanie. Po drugiej wojnie światowej tradycje Obserwatorium Wileńskiego przejął Toruń, natomiast kilka lwowskich programów obserwacyjnych kontynuowano we Wrocławiu. Po roku 1956 nastąpił rozwój współpracy polskich placówek astronomicznych z ośrodkami zagranicznymi, dzięki której duża liczba młodych naukowców odbyła tam wielomiesięczne staże. Podjęto badania w nowych dziedzinach astronomii, m. in. w radioastronomii i heliofizyce, a także prace teoretyczne w zakresie astrofizyki. Astronomia polska uzyskała wysoką pozycję międzynarodową, czego wyrazem było zorganizowanie w Warszawie w 1973 r. nadzwyczajnego kongresu Międzynarodowej Unii Astronomicznej dla uczczenia 500. rocznicy urodzin Mikołaja Kopernika.

Monday 11th September 2023 16:30 – 17:00
Session I: Historical session (invited lecture)

Marek J. Sarna
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Astronomia w Polsce: drugie 50 lat: 1973-2023

abstract:

Drugie 50 lat:1973-2023

Monday 11th September 2023 17:00 – 17:20
Session I: Historical session (invited lecture)

Andrzej Pigulski
University of Wrocław

Polskie Obserwatoria w ostatnim stuleciu

abstract:

Polskie Obserwatoria w ostatnim stuleciu

Monday 11th September 2023 17:20 – 17:40

Session I: Historical session (invited lecture)

Michał Tomczak

Institute of Astronomy, University of Wrocław

Edukacja astronomiczna

abstract:

Zaprezentowane zostaną podstawowe informacje na temat zmieniających się formuł nauczania astronomii w Polsce na różnych szczeblach edukacji począwszy od lat międzywojennych, poprzez PRL, aż do współczesności. Wystąpienie zostanie zilustrowane danymi o charakterze statystycznym.

Monday 11th September 2023 17:40 – 18:00
Session I: Historical session (invited lecture)

Marek Zawilski
Polish Society of Amateur Astronomers, Łódź

Wkład polskich miłośników astronomii w poznawanie Wszechświata

abstract:

Poznawanie wszechświata jest głównie domeną astronomów zawodowych. Jednocześnie jednak jego tajemnice starali się zgłębiać miłośnicy astronomii. Początkowo niezrzeszeni, ale od ponad 100 lat działający w dużej mierze w Polskim Towarzystwie Miłośników Astronomii (PTMA), mogą się poszczycić dokonaniami zarówno naukowymi, jak i popularyzatorskimi.
Ta pasja skłaniała ich do, najczęściej samodzielnego, studiowania astronomii, budowy własnych teleskopów, a nawet obserwatoriów oraz prowadzenia obserwacji nieba, które przyniosły wiele wyników, liczących się naukowo. Obserwacje te zazwyczaj były i są uzupełniające w stosunku do profesjonalnych, jednak często dotyczą zjawisk, które nawet z przyczyn organizacyjnych nie mogą być podejmowane przez astronomów zawodowych. Obserwacje miłośnicze są poza tym dość liczne. Wymienić tu można obserwacje gwiazd zmiennych, komet (w tym ich odkrywanie), meteorów, aktywności Słońca, a także obserwacje zaćmień i zakryć (w tym zakryć brzegowych przez Księżyc oraz zakryć gwiazd przez asteroidy, zwykle wykonywanych tylko w terenie, z dala od dużych obserwatoriów).
Oprócz tych dokonań, które mają znaczenie naukowe, nie sposób nie wskazać na inną działalność, a mianowicie szeroko pojętą popularyzację astronomii w społeczeństwie. Dyskusje, prelekcje, pokazy nieba, wyprawy obserwacyjne, publikacje drukowane i internetowe są nieocenionym uzupełnieniem edukacji oficjalnej i popularyzacji wiedzy o wszechświecie realizowanej w środkach masowego przekazu. Niebagatelną rolę spełnia także ostatnio astrofotografia amatorska.
W referacie zostaną przedstawione przykłady osiągnięć miłośników astronomii w Polsce.

Tuesday 12th September 2023 9:00 – 9:30
Session II: The Sun and heliosphere (invited lecture)

Janusz Sylwester
Space Research Centre

Badania plazmy koronalnej w Zakładzie Fizyki Słońca CBK: Od kamery pin-hole na Verical-1 (1970) do teleskopu STIX na Solar Orbiter (2020)

abstract:

Tuesday 12th September 2023 9:30 – 10:00

Session II: The Sun and heliosphere

Paweł Swaczyna

Space Research Centre

Interstellar Medium Surrounding the Heliosphere

abstract:

The solar wind emitted from the Sun carves out a cavity in the interstellar plasma called the heliosphere, which extends more than 100 au from the Sun. While the heliosphere shields the solar system from most interstellar charged particles, interstellar neutral atoms flow through the heliosphere. Since late 2008, Interstellar Boundary Explorer (IBEX) directly samples these atoms from an Earth orbit, allowing for the study of the physical conditions in the interstellar medium. Interpreting these observations requires a careful analysis of ionization and filtration processes operating in the heliospheric boundaries. The bulk velocity of the interstellar medium derived from these observations is intermediate between the velocities of the two nearest warm, partially ionized interstellar clouds identified using high-resolution spectroscopic observations of absorption lines in the UV spectra of nearby stars measured by the Hubble Space Telescope. This indicates that the Sun is inside a mixed interstellar cloud medium (MICM) formed in the collision of these two clouds. The MICM also explains the higher interstellar neutral hydrogen density near the Sun and higher absorption from ISN hydrogen found along the lines of sight to two nearby stars (AD Leo and HD 82558). Further observations of interstellar atoms and absorption lines should allow us to study processes occurring in the interaction zones between two interstellar clouds.

Tuesday 12th September 2023 10:00 – 10:15
Session II: The Sun and heliosphere

Dorota Przepiórka
Space Research Centre

The Low-Frequency Array (LOFAR) interferometer: a unique tool for Solar-Earth interaction studies. Possibilities and perspectives

abstract:

Tuesday 12th September 2023 10:15 – 10:30

Session II: The Sun and heliosphere

Kamil Bicz

Institute of Astronomy, University of Wrocław

Starspot and flare activity – differences and similarities between stars with different inner structure

abstract:

Low-mass main-sequence stars exhibit intense flaring and spot activity, likely due to convective layers and magnetic dynamos. TESS has revolutionized the study of stellar activity. In our analysis, we investigated the connection between flares and star spots on various stars with different internal structures. We selected highly active M and K main sequence stars, with up to 4.5 flares/day, from the TESS data. Using BASSMAN software, we modeled starspots and analyzed light curves with WARPFINDER to identify and estimate the parameters of flares. We examined the temporal evolution of starspot modulation, its influence on light curves of flares, and the impact of flares on planetary habitability. Our starspots models were tested to unveil insights into the overall stellar magnetic field and its correlation with flares. Notably, we discovered large, long-duration flares in white light, whose brightness is modulated by rapid stellar rotation. We observed that the occurrence frequency of flares didn't always align in rotation phases, except in some cases. Our findings showed starspots at latitudes exceeding 60 degrees, surpassing typical solar spot latitudes due to rotations. Most of the analyzed stars exhibited activity levels insufficient to deplete ozone or support abiogenesis on hypothetical orbiting planets.

Tuesday 12th September 2023 10:30 – 10:45

Session II: The Sun and heliosphere

Krzysztof Radziszewski

Institute of Astronomy, University of Wrocław

The first comparison of the MSDP spectroscopic observations of a solar flare recorded in the hydrogen H-alpha line with the results of RHD modeling obtained from the FLARIX code

abstract:

Wybrane aspekty analizy wyników modelowania emisji rozbłyskowej w zakresie linii widmowej H-alpha wodoru (6563 A) uzyskanych kodem FLARIX, zostaną przedstawione podczas wystąpienia. Jako cel modelowania numerycznego wybrany został kompaktowy rozbłysk słoneczny klasy C1.6, zaobserwowany w Obserwatorium w Białkowie, należącym do Instytutu Astronomicznego Uniwersytetu Wrocławskiego. Dane obserwacje uzyskane przy użyciu spektrografu obrazującego MSDP znajdującego się w Białkowie, umożliwiły unikatową analizę 2D emisji rozbłyskowej w linii H-alpha wodoru z rozdzielczością czasową wynoszącą 50 ms. Dzięki możliwości uzyskania 2D obrazów oraz profilu linii widmowej w każdym pikselu pola widzenia (dla każdej pojedynczej ekspozycji), została przeprowadzona diagnostyka zarówno całkowitej emisji rozbłysku z wysoką rozdzielczością czasową, jak i analiza kształtu profilu linii z poszczególnych fragmentów obszaru rozbłysku. Syntetyczna emisja rozbłysku została policzona kodem hydrodynamicznym FLARIX (z uwzględnieniem strat promienistych), rozwijanym przez grupę heliofizyczną pod kierownictwem prof. Petra Heinzel'a z Instytutu Astronomicznego Czeskiej Akademii Nauk w Ondrejovie (obecnie zatrudnionego również w UWr, w ramach działania Inkubatora Doskonałości Naukowej - Aktywność Słońca i Gwiazd).

Tuesday 12th September 2023 10:45 – 11:00
Session II: The Sun and heliosphere (invited lecture)

Petr Heinzel
University of Wrocław

Large eruptive prominences observed by Metis onboard Solar Orbiter

abstract:

Tuesday 12th September 2023 11:00 – 11:30

Session III: Planetary systems and small bodies (invited lecture)

Piotr Guzik

Astronomical Observatory of Jagiellonion University

Interstellar minor bodies in the Solar System

abstract:

Comets and asteroids, collectively known as minor bodies, brought water and organic compounds to the Earth shortly after it had formed, significantly contributing to the emergence of life on our planet. We have been investigating them for centuries, and now more than a million asteroids and a few thousand comets are cataloged. All of them, except two, are believed to be the leftovers of the solar system formation. The two remaining are recently identified interstellar minor bodies that were thrown away from other planetary systems and incidentally flashed through the solar system. Though only two are known to date, more are expected to be discovered soon thanks to the advancements of automatic sky surveys. As the samples of the matter from alien planetary systems, they give us a unique opportunity to study the remote worlds from close with the methods that we use to study our native minor bodies. Thus they are natural bridges between our solar system and other planetary systems. In this talk, I will give a background about what we know (and don't know) about the two interstellar visitors 1I/'Oumuamua and 2I/Borisov.

Tuesday 12th September 2023 11:30 – 11:45

Session III: Planetary systems and small bodies

Mikołaj Sabat

Astronomical Observatory of Jagiellonion University

New Constraints on Cometary Activity of 'Oumuamua from Lyman-Alpha Images Obtained by SOHO/SWAN

abstract:

'Oumuamua is the first confirmed interstellar minor body observed in the Solar System. The object was discovered by the Pan-STARRS survey on 19 October 2017, when it was located 1.2 au from the Sun and 0.2 au from the Earth. Ultra-deep imaging of 'Oumuamua by the largest telescopes showed no signs of comet-like coma or tail, providing strong evidence that the object is an asteroid [1, 2]. Also spectroscopic investigations did not reveal any traces of gas emissions [3, 4]. Despite no signs of mass loss, 'Oumuamua displayed unexpected orbital anomalies, consistent with an anti-Sunward non-gravitational force [5] as strong as the strongest non-gravitational forces ever measured in Solar System comets. This suggested comet-like water-ice outgassing as the possible cause [5]. However, the proposed explanation is difficult to reconcile with the absent signs of mass loss, and it could not be properly tested given the poor observational limits on the water-ice outgassing. To date, the most meaningful upper limit on the water production rate of 'Oumuamua was obtained from the non-detection of the 18-cm radio lines of OH using the Green Bank Telescope [6]. Unfortunately, this observation was too brief (4 hours) and made too late (more than 3 weeks after the discovery of 'Oumuamua, when the object was already 1.8 au from the Sun and 1.1 au from the Earth), resulting in an insufficient sensitivity to address the problem of the object's non-gravitational acceleration. Other limits, estimated indirectly from empirical relations (e.g. [7]) are inherently irrelevant, as they assume a typical cometary composition. Potentially, the most promising instrument for the detection of water on 'Oumuamua is Solar Wind ANisotropies (SWAN) on the SOlar and Heliospheric Observatory (SOHO). SWAN is an all-sky mapper of hydrogen in the ultra-luminous Lyman alpha line, which is also an excellent tracer of cometary water (e.g. [8]). The

instrument provides unique access to daily measurements of the hydrogen emission, including pre- and post-discovery data for the positions of ‘Oumuamua, when the object was relatively close to the Sun and the spacecraft (minimum distances of 0.46 au and 0.17 au, respectively). Based on the SOHO/SWAN observations, we will present the new most rigorous upper limit on the water production rate of ‘Oumuamua, which is an order of magnitude lower than the best previous estimates actually sensitive to water. Most significantly, our limit enables us to discuss the hypothesized water-driven cause of the non-gravitational acceleration [5], the most recent concept of H2O and H2 emission [9], as well as the more exotic scenario of a hydrogen iceberg [10]. Our result supports the view that ‘Oumuamua is unlike any object ever seen before.

References: [1] Meech et al. 2017, Nature 552, 378. [2] Drahus et al. 2018, Nat. Astron. 2, 407. [3] Ye et al. 2017, ApJL 851, L5. [4] Fitzsimmons et al. 2018, Nat. Astron. 2, 133. [5] Micheli et al. 2018, Nature 559, 223. [6] Park et al. 2018, AJ 155, 185. [7] Hui & Knight 2019, AJ 158, 256. [8] Combi et al. 2021, Icarus 365, 114509. [9] Bergner & Seligman 2023, Nature 615, 610. [10] Seligman et al. 2020, ApJL 896, L8.

Tuesday 12th September 2023 12:15 – 12:45

Session III: Planetary systems and small bodies (invited lecture)

Przemysław Mróz

Astronomical Observatory, University of Warsaw

Free-floating planets and other beasts

abstract:

Thousands of extrasolar planets have been discovered up to date. Although many of the known exoplanets do not resemble those in our Solar System, they have one thing in common - they all orbit a star. However, theories of planet formation and evolution predict the existence of free-floating planets, gravitationally unattached to any star. They may form as a result of dynamical processes in young planetary systems or during the late stages of host star evolution.

Gravitational microlensing is uniquely suited for finding free-floating planets. Recent independent studies carried out by three microlensing surveys - OGLE, KMTNet, and MOA - indicate that free-floating or wide-orbit planets are indeed very common in the Milky Way.

I will present the current constraints on the frequency and properties of rogue planets in the Milky Way. I will also discuss observational techniques that allow us to distinguish free-floating planets from planets in Uranus- and Neptune-like orbits. Finally, I will briefly discuss the future prospects for determining the frequency and mass function of rogue planets by the planned microlensing experiments.

Tuesday 12th September 2023 12:45 – 13:15

Session III: Planetary systems and small bodies (invited lecture)

Krzysztof Goździewski

Institute of Astronomy, Nicolaus Copernicus University

Analiza orbitalna obserwacji gwiazd z układami planet jowiszowych

abstract:

Wśród odkrytych podczas ubiegłych trzech dekad systemów planetarnych można wyróżnić klasę układów zawierających masywne planety jowiszowe. Oddziaływania grawitacyjne pomiędzy składnikami takich systemów wprowadzają mierzalną kontrybucję do syntetycznych krzywych opisujących szeregi czasowe obserwacji, szczególnie metodą prędkości radialnych, astrometryczną i chronometrażową. Celem referatu jest przedstawienie kilku pozornie już dobrze znanych układów z planetami jowiszowymi, dla których szczególnie istotne jest oparcie modelu orbitalnego o zasady fizyczne i matematyczne, ogólnie opisywane jako problem N-ciał. Wnioski i wyniki (architektura orbitalna i rozkład parametrów orbit, masy planet) uzyskane na podstawie iteracyjnych badań takich systemów mogą zyskiwać na znaczeniu razem z wydłużaniem się interwałów obserwacji.

Tuesday 12th September 2023 13:15 – 13:30

Session III: Planetary systems and small bodies

Gracjan Maciejewski

Institute of Astronomy, Nicolaus Copernicus University

Search for small planets in hot Jupiter systems

abstract:

Hot Jupiters, giant planets on tight orbits, have been perceived as loners that are devoid of planetary companions in close orbital proximity. This observation is interpreted as an output of a violent formation path through the high eccentricity tidal migration, which is destructive for primordial multi-planetary architecture. However, recent discoveries based on space-borne photometry have revealed that some of these giant planets do have low-mass planet companions in close orbits. This finding speaks in favour of a quiescent formation scenario through disk migration. Understanding the occurrence rate of these systems could offer new insights into the origins of hot Jupiters, a question that has puzzled planetary formation and evolution theory for a long time. Our project uses the transit detection method to search for nearby transiting planetary companions to hot Jupiters using data from the Transiting Exoplanet Survey Satellite. In this brief discussion, we share the first results of our search.

Tuesday 12th September 2023 13:30 – 13:45

Session III: Planetary systems and small bodies

Jan Golonka

Institute of Astronomy, Nicolaus Copernicus University

Probing planet-star tidal interactions with precise transit timing of hot Jupiters

abstract:

Tidal interactions in stellar systems have been the subject of studies for decades. These interactions are predicted to be strong in systems with hot Jupiters, which are gas giants orbiting their host stars in extremely tight orbits. One of the outcomes of tidal interactions is transfer of orbital momentum from the planet to its host star, which could be observable by detecting the tightening of the planets orbit. Recent publications present testable predictions on this effect. In this talk I will present my work, that focuses on putting observational constraints on theoretical predictions of tidal interactions in promising systems. This is done by performing Transit Timing Variation analysis of observational data gathered from TESS, literature and ground observations, including new observations from Piwnice observatory.

Tuesday 12th September 2023 13:45 – 14:00
Session III: Planetary systems and small bodies (invited lecture)

Hanna Rothkeahl
Space Research Centre

Juice-ESA mission, challenge for Jupiter system exploration

abstract:

Tuesday 12th September 2023 15:00 – 15:15

Session III: Planetary systems and small bodies

Agnieszka Kryszczyńska

Institute Astronomical Observatory, Adam Mickiewicz University

Application of machine learning algorithms in asteroid taxonomic classification

abstract:

Multifilter photometry based on different sky surveys is commonly used in estimating taxonomy of individual asteroids. Colour indices are often used to study the distribution of asteroids across the Solar System as well as in determination of size distribution of asteroid families, their age relation and in providing implications to the Solar System evolution.

The widely used Bus-DeMeo taxonomy and its extensions are based on VIS-NIR asteroid spectra which are available for a limited number of objects (thousands out of over a million of asteroids known in our Solar System). These measurements require a high demand of observing time by ground-based telescopes.

In our work we study what are the most efficient machine learning (ML) algorithms to link the spectro-photometric measurements arriving from various large sky surveys to the Bus-DeMeo taxonomy.

We carried out several experiments to investigate which ML methods are the best for predicting asteroid types and complexes. Using simulated fluxes from 11 different space and ground- based surveys we found that best performing surveys are Euclid and VISTA reaching 85 and 93% of balanced accuracy. Those surveys cover the pyroxene and olivine IR absorption bands. Moreover we found that selecting the right machine learning algorithm can improve the accuracy by a factor of two in the most extreme cases. Among the studied methods multi-layer perceptron and gradient boosting resulted in the highest balanced accuracy. Modern wide-field surveys can record thousands of asteroids, using the right ML algorithms can improve the accuracy of taxonomic classification, the algorithm should be optimized for each sky survey individually.

Using ML algorithms we find also a set of photometric passbands which will give optimal results for spectrophotometric classification of asteroids' into taxonomic types and classes. We find that to determine the taxonomic complexes with a balanced accuracy of 85%, a set of five spectrophotometric bands is required. For taxonomy type determination with the balanced accuracy of 80% a set of eight bands is necessary. Furthermore, only a 3 band system is enough for distinguishing the C complex asteroids with the 92% balanced accuracy. These results can be used for designing future asteroid multifilter sky surveys.

Tuesday 12th September 2023 15:15 – 15:30

Session III: Planetary systems and small bodies

Andrzej Maciejewski

Janusz Gil Institute of Astronomy, University of Zielona Góra

Niecałkowalność zagadnienia n ciał

abstract:

Przedstawiam rozwiązanie jednego z najstarszych problemów mechaniki nieba dotyczącego dodatkowych praw zachowanie klasycznego grawitacyjnego zagadnienia n ciał. Znane prawa zachowania to prawo zachowania energii, całkowitego pędu i prawo zachowania całkowitego momentu pędu. Dla dowolnego $n>2$ i dla dowolnych dodatnich mas ciał zagadnienia n ciał nie ma innych praw zachowania.
Nie ma również „ograniczonych praw zachowania", które dotyczą rozwiązań o ustalonej energii całkowitej i ustalonym całkowitym momencie pędu.

Wednesday 13th September 2023 9:00 – 9:30

Session IV: Compact objects and multi-messenger astronomy (invited lecture)

Brynmor Haskell

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Multi-messenger astrophysics in the age of gravitational wave discoveries

abstract:

In this talk I will review how the recent discoveries of gravitational wave signals from compact binaries, have revolutionised the study of compact objects and their environments, and how their combination with traditional EM observations can be particularly powerful. Finally I will discuss future prospects and what we may learn from future discoveries.

Wednesday 13th September 2023 9:30 – 9:45

Session IV: Compact objects and multi-messenger astronomy

Paweł Szewczyk

Astronomical Observatory, University of Warsaw

Dynamical stability of hypermassive neutron stars

abstract:

Hypermassive neutron stars are known to be produced in binary neutron star mergers and core-collapse supernovae. Because of strongly differential rotation in the remnants of those events, they can support significantly larger masses than the mass limit for non-rotating NS.
In our work, we explore the limits of dynamical stability of those objects. By means of relativistic hydrodynamical simulations we test the stability against both quasi-radial instaiblities and non-axisymmetrical instabilities. We find solutions stable against a prompt collapse to black hole, which can be interesting sources of gravitational wave emission.

Wednesday 13th September 2023 9:45 – 10:00

Session IV: Compact objects and multi-messenger astronomy

Marcin Gawroński

Institute of Astronomy, Nicolaus Copernicus University

Digging in noise and interferences – FRB observations in Piwnice

abstract:

Szybkie błyski radiowe (Fast Radio Burst) są jednym z najgorętszych tematów współczesnej astrofizyki. Mimo dużych inwestycji sprzętowych i szybko rosnącej bazie obserwacyjnej cały czas nie ma odpowiedzi na najważniejsze pytania: jakie źródła generują FRB oraz jakie procesy fizyczne za te zjawiska odpowiedzialne. Radioteleskop RT4 w Piwnicach od 3 lat bierze intensywny udział w różnego typu obserwacjach związanych z badaniami fenomenu FRB, a dedykowany czas sięga ponad 1/3 całości czasu obserwacyjnego tego instrumentu. Oprócz międzynarodowej współpracy w ramach projektu PRECISE, którego zadaniem jest lokalizacja źródeł FRB z dokładnością milisekund łuku w galaktykach macierzystych, RT4 także monitoruje najbardziej aktywne obiekty FRB badając własności statystyczne zarejestrowanych błysków. Podczas wystąpienia zostanie omówiony aktualny stan programu badawczego FRB realizowanego przez IA UMK oraz przedstawione najważniejsze wyniki uzyskane z pomocą danych dostarczonych przez RT4.

Wednesday 13th September 2023 10:00 – 10:15

Session IV: Compact objects and multi-messenger astronomy

Agnieszka Janiuk

Center for Theoretical Physics, Polish Academy of Sciences

What we can learn about compact binary mergers from their kilonova signals

abstract:

Compact binary mergers are sources of gravitational waves, and can be accompanied with electromagnetic signals. I will discuss the possible features in the kilonova emissions which may help distinguish the black hole - neutron star mergers from the binary neutron stars. Furthermore, the amount of ejected material may depend on whether the system undergoes the creation of a transient hyper-massive, differentially rotating neutron star. In this context, the numerical simulatiosn of post-merger systems and their outflows are important to understand the nature of progenitor systems.
In this talk, I will present a suite of GR MHD simulations performed by our group, to model the neutrino driven disk winds and their contribution to the kilonova emissions.

Wednesday 13th September 2023 10:15 – 10:30

Session IV: Compact objects and multi-messenger astronomy

Mariusz Tarnopolski

Institute of Astronomy, Nicolaus Copernicus University

Quasi-periodic oscillations in gamma-ray bursts" prompt light curves

abstract:

I report on the discovery of 34 new quasi-periodic oscillations (QPOs) in the prompt light curves of long GRBs from the Swift/BAT catalog: with one or more constant leading periods, as well as several chirping signals. This is the largest homogenously identified sample or GRB QPOs to date. The presence of QPOs suggests the existence of characteristic time scales that at least in some GRBs might be related to the dynamical properties of plasma trajectories in the accretion disks powering the relativistic jets. Several scenarios for their origin were examined. We identify non-planar orbits around Kerr BHs, the Lense-Thirring effect, and shock oscillations as plausible mechanisms for the QPO generation.

Wednesday 13th September 2023 10:30 – 10:45

Session IV: Compact objects and multi-messenger astronomy

Łukasz Wyrzykowski

Astronomical Observatory, University of Warsaw

Hunting for black holes with Gaia space mission and a network of small telescopes

abstract:

Gaia skanuje całe niebo dostarczając przełomowej jakości dane o jasności, położeniu oraz widmie prawie dwóch miliardów gwiazd. Wieloletnie dane publikowane są w porcjach rewolucjonizując każdą dziedzinę astronomii. Dane misji Gaia pozwalając wykrywać kandydatki na obiekty zwarte, w szczególności układy podwójne z czarną dziurą oraz soczewkujące czarne dziury. Przedstawię pierwsze odkrycia z misji Gaia oraz perspektywy na nowe odkrycia z wykorzystaniem kompletnych danych misji, której będą opublikowane już w 2025 roku.

Wednesday 13th September 2023 10:45 – 11:00

Session IV: Compact objects and multi-messenger astronomy

Andrzej Szary

University of Zielona Góra

Inner Acceleration Region in pulsars and direction of plasma drift

abstract:

For many pulsars the single pulse components, the so-called subpulses, exhibit systematic variation in position and/or intensity. The phenomenon was discovered in the early years of pulsar research, and still there is no consensus regarding the main feature of drift, namely the plasma drift direction in the pulsar magnetosphere. The models of the inner acceleration region assume the pair cascade localised in the form of discharges (called sparks) over the polar cap. Ruderman & Sutherland (1975) proposed the carousel model which assumes drift of sparks around the magnetic axis. In Szary & van Leeuwen (2017) we have shown that sparks rotate not around the magnetic axis per se, but around the location of the electric potential extremum of the polar cap. This Modified Carousel model can be used to interpret the most extraordinary drifting behaviours. However, in recent years an alternative model, where drift is produced as plasma lags behind the corotation of the neutron star, gained momentum (see, e.g. Basu et al. 2020). The Lagging Behind Corotation model connects the drift with the rotation axis and stands with clear opposition to the carousel models. In this talk we will propose a project to perform a comprehensive study of the nature of drifting subpulses to solve this conundrum. The research program will be an important step in solving the mystery of the origin of radio emission observed from pulsars.

Wednesday 13th September 2023 11:00 – 11:30

Session V: High Energy astrophysics (invited lecture)

Bożena Czerny

Center for Theoretical Physics, Polish Academy of Sciences

Accretion processes onto black holes – theoretical problems, constraints from the optical data

abstract:

Accretion onto black hole powers a hundred of well studied binary black holes and hundreds of thousands of active galactic nuclei. The overall picture is well established but a number of aspects are still under discussion. Those are: stability of the radiation-pressure dominated disks, the transition to an inner ADAF flow and jet formation, the possibility of the vertical stratification of the inner disk into warm (accreting ?) corona and inner (passive ?) disk. All these aspects are likely related to the role of the magnetic field. New observational developments, including transient behaviour seen now in many active galaxies (Changing-Look AGN, Tidal Disruption Events) due to massive surveys path the way do better understanding of the aspects, which are too difficult to address at the basis of pure theory.

Wednesday 13th September 2023 11:30 – 11:45

Session V: High Energy astrophysics

Krzysztof Nalewajko

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Initialization of magnetic flux eruptions at accreting black holes

abstract:

Black holes acquire relativistic magnetospheres by accreting magnetized gas. Once they collect significant magnetic flux across the horizon, aided by spin, they can drive powerful relativistic jets by the Blandford-Znajek mechanism. Large enough black hole magnetic fluxes may arrest or choke the accretion flow. Recently, magnetic flux eruptions have been identified as a mechanism of black hole magnetic flux saturation. These eruptions can potentially dissipate a large fraction of magnetic energy in the black hole magnetosphere by means of magnetic reconnection, accelerating particles and producing flares of non-thermal radiation. We analyze the results of 3D GRMHD numerical simulations of magnetically choked accretion flows at Kerr black holes, focusing on the episodes of major magnetic flux eruptions. We focus on describing the sequence of events that lead to trigerring the magnetic flux eruptions.

Wednesday 13th September 2023 12:15 – 12:45
Session V: High Energy astrophysics (invited lecture)

Bronisław Rudak
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

The Universe in Very High Energy Gamma Rays

abstract:

Wednesday 13th September 2023 12:45 – 13:00

Session V: High Energy astrophysics

Aditya Narendra

Astronomical Observatory of Jagiellonion University

Gamma ray burst Light Curve Reconstruction

abstract:

Gamma ray bursts (GRB) are the most extreme electromagnetic events in the universe. They have been observed up to redshift of 9.4. Thus, they provide an excellent opportunity to study the early universe. However, for this to happen, we require a good coverage of a GRB's light curve. Such constraints can help us obtain strong constraints on their intrinsic properties. One of the features of GRB light curve is called the plateau emission, when the GRB flux remains constant over a period of time. This plateau emission has been linked to the spin down emissions of a newly born neutron star. Thus, plateau emission properties are linked to fundamental astrophysics and obtaining tight constraints on their values can help us realise the cosmological prospects of GRBs. However, many GRB light curves lack full coverage of this plateau region due to lack of follow-up observations, orbital periods of satellites, etc. We address this issue by proposing a light curve reconstruction technique using two methods. We show that with our techniques we can obtain a 30% reduction in the error of the parameters which describe the plateau emission. Thus, with this technique we can help better constrain the plateau emission parameters and help with the cosmological application of GRBs.

Wednesday 13th September 2023 13:00 – 13:15

Session V: High Energy astrophysics

Gerardo Urrutia

Center for Theoretical Physics, Polish Academy of Sciences

Following the Jet Interaction with a post-merger outflow

abstract:

We perform Special Relativistic Hydrodynamical (SRHD) simulations, in two dimensions, to investigate the large-scale propagation of short GRB jet. Our results reveal that the interaction between the jet and a realistic post-merger (NS-NS) outflow significantly modifies the jet dynamics, in respect to typical oversimplified models.

Wednesday 13th September 2023 13:15 – 13:30
Session V: High Energy astrophysics

Benito Marcote
Joint Institute for VLBI ERIC

Unveiling the Transient Universe at the highest resolution with Very Long Baseline Interferometry

abstract:

The Universe is dynamic, and a large variety of transient phenomena, such as gamma-ray bursts, fast radio bursts, gravitational wave counterparts or Galactic binary systems offer insights into the nature of this dynammicity. Thanks to very long baseline interferometry (VLBI) techniques, we can capture the precise details of these events, enabling a deeper understanding of their origins, emission mechanisms, and implications in a large number of fields.

I will present a summary on how radio observations with the European VLBI Network (EVN), involving the Torun radio telescope, have enabled the precise localizations of Fast Radio Bursts for the first time, or the strongest constraints on the expansion of gamma-ray burst and gravitational wave afterglows. The very high resolution achieved with these observations, on the order of milliarcseconds, are key to understand the local environments where Fast Radio Bursts are produced, and how the afterglows can propagate through the surrounding and ejected material, and interstellar medium.

The EVN's extensive network of telescopes across Europe and beyond has thus facilitated numerous groundbreaking discoveries and contributed to major scientific achievements in the last years. The on-going efforts to enhance its capabilities and integration with the future SKA-VLBI is set to boost the sensitivity, resolution, and observation speed of VLBI by orders of magnitude in the near future.

Wednesday 13th September 2023 13:30 – 14:00

Session VI: Stars, star systems and interstellar matter (invited lecture)

Sławomir Ruciński
University of Toronto

Astrophysics of stars and interstellar medium. The first half century: 1923 – 1973

abstract:

Rozwój astrofizyki gwiazd i materii międzygwiazdowej w polskich ośrodkach naukowych dokumentuje bezstronnie - choć z nieco odległej, być może korzystnej tu perspektywy - ADS (Astrophysics Data System) sponsorowany przez NASA i Smithsonian jako spis publikacji i cytowań opublikowanych prac. Przedstawione będą liczby indywidualnych, światowych cytowań dla lat 1923-1973 ukazujące bardzo szybki rozwój polskiej astrofizyki od połowy lat 1950-tych.

Wednesday 13th September 2023 15:30 – 15:45

Session VI: Stars, star systems and interstellar matter

Marek Górski

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Distance measurements in the Araucaria Project

abstract:

Przedstawię najważniejsze metody wyznaczania odległości, wykorzystywane w projekcie Araucaria. W tym kontekście przedstawię zagadnienie pomiaru odległości do galaktyk przy pomocy pomiaru jasności wierzchołka gałęzi czerwonych olbrzymów (TRGB) w kontekście rozbieżności wyznaczeń stałej Hubble'a. Zaprezentuję najważniejsze wyzwania i możliwości rozwinięcia tej metody pomiaru odległości.

Wednesday 13th September 2023 15:45 – 16:00

Session VI: Stars, star systems and interstellar matter

Krzysztof Hełminiak

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Toruń

12 years of "CREME de la creme" of eclipsing binaries

abstract:

CREME is a large spectroscopic programme aimed at detached eclipsing binaries, that brought many interesting findings to the field of stellar astrophysics. In this short review I will present the current status, most recent results, and plans for the future.

Thursday 14th September 2023 9:00 – 9:30
Session VI: Stars, star systems and interstellar matter (invited lecture)

Jadwiga Daszyńska-Daszkiewicz
Institute of Astronomy, University of Wrocław

Seismic probing of stellar interiors: past achievements and future goals

abstract:

Thursday 14th September 2023 9:30 – 9:45
Session VI: Stars, star systems and interstellar matter

Ambra Nanni
National Centre for Nuclear Research

Dust formation around carbon-rich stars: the role of metallicity and implications for dust-driven winds

abstract:

Most of the stars in the Universe will end their evolution by losing their envelope during the thermally pulsing asymptotic giant branch (TP-AGB) phase, enriching the interstellar medium of galaxies with heavy elements, partially condensed into dust grains formed in their extended envelopes. Among these stars, carbon-rich TP-AGB stars (C-stars) are particularly relevant for the chemical enrichment of the local and high-redshift galaxies. We have investigated the dust formation process from a theoretical viewpoint by coupling an up to date description of dust growth and dust-driven wind, including the time-averaged effect of shocks propagating into the circumstellar envelope, with the stellar evolutionary tracks computed with the FUNS code. We compare our predictions with observations of C-stars in our Galaxy, in the Magellanic Clouds and in the Galactic Halo, characterised by metallicity between solar and 1/10 of solar. Our calculations explain the variation of acetylene molecules in the gas phase and dust content around C-stars derived from the IRS Spitzer spectra as a function of the metallicity. The wind speed of the C-stars observed at varying metallicity is fairly well reproduced by our description. We predict the properties of the circumstellar envelope, including the wind speed, down to metallicities of 1/10 solar for different stellar masses, representative of diverse environments, including metal-poor star-forming dwarf galaxies. The model predictions can be tested with future observations performed by the Atacama Large Millimeter Array (ALMA) and the James Webb Space Telescope (JWST).

Thursday 14th September 2023 9:45 – 9:58
Session VI: Stars, star systems and interstellar matter

Miguel Figueira
National Centre for Nuclear Research

Induced star-formation towards the HII region RCW120

abstract:

High-mass stars emit ultraviolet radiation which ionized the surrounding medium and create ionized (HII) regions. These structures further expand, sweep-up the surrounding dust and gas, and form a circular layer of neutral material which fragments to form a new generation of stars. It was proposed that this mechanism, called the Collect and Collapse (C&C), could favor the formation of high-mass stars. This hypothesis was later strengthened by the fact that 30% of high-mass Galactic sources are found at the edges of HII regions. However, the true impact of such expansion on the next generation of stars in the layer might not be as clear as initially proposed, as found in simulations.
I will focus on a particular and widely-studied HII region known as RCW120. This region is relatively close to us (1.34kpc), slightly above the Galactic plane (b=0.5ş) and shows a nice ovoid shape due to the HII region expansion powered by a single O9.5V star. Towards the ring of neutral material enclosing the HII region, we observed stars in their earliest stages of formation, which may have been induced thanks to the expansion of the region.

I will present the results obtained from APEX observations of CO and its isotopologues towards two clumps located in the photo-dissociation region at a different distance from the ionizing star. Both regions display different properties (Mach number, velocity dispersion, excitation temperature) in agreement with the star-formation activity occurring within them and their stellar content. One of the clump displays a slightly curved morphology as expected from a radiation-driven implosion process. We found that the electron density at its surface is far above the critical electron density needed to form an ionized boundary layer during the formation of a bright rimmed cloud.

We estimated the age of RCW120 to range from 0.75 to 0.96Myr while the fragmentation time of the surrounding layer ranges from 0.5 to 0.8Myr. Therefore, the radiation of the ionizing star being responsible for the fragmentation of the layer is a plausible model but should be taken with caution.

Thursday 14th September 2023 9:58 – 10:11

Session VI: Stars, star systems and interstellar matter

Tomasz Kamiński

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Toruń

Observing stellar mergers

abstract:

I am going to review observations of red novae and their remnants in the context of the hypothesis that red novae are stellar mergers. I am going to discuss the nature of the progenitor systems, including one with a giant planet, and present the complex outcome of a merger in red nova remnants.

Thursday 14th September 2023 10:11 – 10:24
Session VI: Stars, star systems and interstellar matter

Ayush Moharana
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Evolution of Compact Hierarchical Triples

abstract:

Compact Hierarchical Triple (CHT) is a triple system where a third star orbits around an inner binary in an orbit of fewer than 1000 days. This allows us to observe their dynamic evolution in the timescale of a few years. These systems were thought to be rare but thanks to space-based photometric missions we are discovering more of these systems. If we combine photometry with spectroscopy we are also able to obtain accurate stellar, orbital, and atmospheric parameters of all three stars in the system. In our work, we use time-series spectroscopic observations from different high-resolution spectrographs. We use spectral disentangling to obtain individual spectroscopic parameters and use them to constrain the evolution of the systems. Using radial velocities we constrain the current dynamics and use numerical integrations to predict their future dynamical evolution. We present our analysis of a few stars in our sample and talk about the different evolution scenarios visible in the systems and the effect of the third star on these scenarios.

Thursday 14th September 2023 10:24 – 10:37
Session VI: Stars, star systems and interstellar matter

Piotr Kołaczek-Szymański
Institute of Astronomy, University of Wrocław

Why is the loudest stellar heartbeat so loud?

abstract:

Eccentric ellipsoidal variables (EEVs, also dubbed as heartbeat stars) provide an excellent laboratory for studying the strong tidal interactions between components in binary systems. The record holder in terms of the range of brightness variations (~0.4 mag in V passband) is the `extreme' and massive EEV, MACHO80.7443.1718, whose primary component is a B0.5 Iae blue supergiant orbited by a late-O type dwarf in a highly eccentric orbit. However, the problem is that even combined proximity effects fail to explain such significant changes in brightness. The time-series spectra of this object and the light curves obtained by us in the U and B passbands come to the rescue, showing that MACHO80.7443.1718 is probably a very rare example of a massive star that entered the Hertzsprung gap quite recently and undergoes envelope stripping due to the extreme stellar wind, enhanced by the close stellar companion.

Thursday 14th September 2023 10:37 – 10:50
Session VI: Stars, star systems and interstellar matter

Rajeev Singh Rathour
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Insights from O-C study of 7000+ Magellanic Cepheids from OGLE survey: Census of irregular period changes and binary Cepheids candidates

abstract:

Classical Cepheids (3-13 Msun) have been long known to be one of the benchmark stars for stellar evolution and pulsation studies. As these stars evolve across the instability strip, their internal structure change, altering their pulsation period. Period change studies via the virtue of Observed-Calculated (O–C) diagrams give a window to probe into the evolutionary and non-evolutionary aspects of these pulsating stars. While evolutionary period changes have been extensively studied, the non-evolutionary or irregular period changes on shorter time scales (a few hundred-thousand days) have received less attention. Moreover, cyclic period changes may indicate the presence of Cepheid in a binary system. There is no comprehensive search for classical Cepheids in binary systems using existing photometric surveys. By analyzing O-C diagrams of ~7200 Magellanic Cloud single mode Cepheids (fundamental and first overtone) from the Optical Gravitational Lensing Experiment (OGLE), we present a systematic search for Cepheids in binary systems and a detailed analysis of irregular period changes.

We apply the modified Hertzsprung technique to calculate O-C diagrams on more than 15 years of photometry data from OGLE-III and OGLE-IV. The O-C diagrams are categorized based on shapes into linear, parabolic, periodic and irregular classes. The periodic nature of the O-C diagrams is largely attributed to the light-travel time effect which is a signature of the binarity nature of Cepheid. These candidates are analyzed with Bayesian binary models, whereas the irregular candidates are quantified with non-parametric fits using Gaussian process models. We also present a comparative analysis of the binary parameter distribution across the metallicity field. Secondly, we present

a comprehensive analysis to quantify and characterize, for the first time, the irregular period changes and provide their incidence rates, and association with amplitude changes, across pulsation modes.

The novelty of the work lies in the homogeneous dataset for the analysis, as well as in the optimum temporal baseline to capture such phenomena. The study is very important in terms of the binary sample which is valuable for precision astrophysics. Moreover, a quantitative understanding of irregular period change effects paves the way for disentangling irregular period changes from evolutionary ones and helps investigate the physical mechanism for the origin of these non-evolutionary period changes.

Thursday 14th September 2023 11:15 – 11:28

Session VI: Stars, star systems and interstellar matter

Felipe Espinoza Arancibia

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Empirical constraints for the instability strip from the analysis of LMC Cepheids

abstract:

The instability strip (IS) of classical Cepheids has been extensively studied theoretically. Comparison of the theoretical IS edges with those obtained empirically, using the most recent Cepheids catalogs available, can provide us with insights into the physical processes that determine the position of the IS boundaries. We investigate the empirical positions of the IS of the classical Cepheids in the Large Magellanic Cloud (LMC) using data of classical fundamental-mode and first-overtone LMC Cepheids from the OGLE-IV variable star catalog, together with a recent high-resolution reddening map from the literature. We studied their position on the Hertzsprung-Russell diagram and determined the IS borders by tracing the edges of the color distribution along the strip. The results obtained show a break located at the Cepheids' period of about 3 days, which was not reported before. This phenomenon adds complexity to the typically assumed shape of the IS. Furthermore, our empirical borders show good agreement with theoretical ones published in the literature. This proves that our empirical IS is a useful tool to put constraints on theoretical models.

Thursday 14th September 2023 11:28 – 11:41

Session VI: Stars, star systems and interstellar matter

Gergely Hajdu

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Circumstellar matter around RR Lyrae stars

abstract:

We present the first detection of circumstellar matter around a sample of RR Lyrae stars, identified through their variable mean magnitudes in the OGLE survey, and confirmed by other data sets (MACHO, EROS-2, KMTNet). While other phenomena, such as blending with other sources, may lead to a similar change of the mean magnitudes of RR Lyrae stars, the unchanging light-curve shapes and amplitudes lead to an unambiguous separation between them and variable extinction from circumstellar matter. The extinction ratios calculated from multi-wavelength light curves possess a wide range, hinting at a similarly wide variety of dust properties. We discuss the prevalence, implications and possible formation mechanisms of circumstellar matter around RR Lyrae variables, with special attention to its connection to binarity.

Thursday 14th September 2023 11:41 – 11:54
Session VI: Stars, star systems and interstellar matter

Anna Bartkiewicz
Institute of Astronomy, Nicolaus Copernicus University

Bursting methanol masers in high-mass star-forming regions – a need for high quality counterpart data

abstract:

Extensive observing campaigns of the 6.7 GHz methanol maser line have been carried out using single dishes in only a few observatories around the world. Among them, the 32-m Torun radio telescope uniquely has been monitoring the high-mass star-forming regions in the Galactic plane for over a decade. It has been shown recently, that outbursts and flares of the methanol maser transition give a unique opportunity to investigate the accretion process in high-mass protostars. Under the international collaboration M2O, we are jointly analyzing observations performed with diverse instruments using radio wavelengths and very long baseline interferometers as well as infra-red data.

Thursday 14th September 2023 14:00 – 14:30

Session VII: Cosmology and evolution of galaxies (invited lecture)

Agnieszka Pollo

National Centre for Nuclear Research / Jagiellonian University

Evolution of galaxies in the cosmic web

abstract:

Galaxies evolve in the cosmic web woven from the underlying dark matter field. Their evolution is, however, a result of the complex interplay between the effects related to their host halo mass, interactions with the environment and internal feedback. I will present some new results casting new light on the complexity of these processes. I will also try to highlight the discovery potential in this field, which is right now only opening with the advent of a new generation of ground- and space-based observatories.

Thursday 14th September 2023 14:30 – 14:45

Session VII: Cosmology and evolution of galaxies

Dariusz Graczyk

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Toruń

The Hubble tension

abstract:

Some insights about the present Hubble tension are given from a perspective of the observational astronomy. The difference between the local (based on supernova) and the global (based on the LCDM model) values of the Hubble parameter may indicate a need for a revision of the LCDM model - a "new" physics. However, another likely cause is simply an underestimation of systematic uncertanties.

Thursday 14th September 2023 14:45 – 15:00
Session VII: Cosmology and evolution of galaxies

Marius Peper
Institute of Astronomy, Nicolaus Copernicus University

Detecting cosmic voids via maps of geometric-optics parameters

abstract:

Light bundles propagating through the Universe will experience distortion due to the three-dimensional matter distribution. The measured distortion of the light bundles thus will contain information about the matter distribution and more specificly about the cosmic voids.
In this talk I will present an analysis to what degree sky-plane geometric-optics maps can reveal the presence of intrinsic three-dimensional voids. We study the effect in cosmological N-body simulations in which we have full information about the matter distribution and no detector errors.
We infer three-dimensional void structures using a watershed void finder. Independently, we calculate a surface overdensity map and maps of the weak gravitational lensing scalars (which are widely used in observations) and the Sachs optical scalars. We propose and implement a heuristic algorithm for detecting (projected) radial void profiles from these maps.
We find in our simulation that given the sky-plane centres of the three-dimensional watershed-detected voids, there is significant evidence of finding corresponding void centres in the surface overdensity, the averaged weak-lensing tangential shear, the Sachs expansion, and the Sachs shear modulus. Recovering the centres of the three-dimensional voids from the sky-plane information alone is highly significant given the Sachs optical scalars in our analysis.
This investigation shows preliminary evidence encouraging observational studies of gravitational lensing through individual voids, either blind or with spectroscopic/photometric redshifts.

Thursday 14th September 2023 15:00 – 15:15
Session VII: Cosmology and evolution of galaxies

Jakub Nadolny
Institute Astronomical Observatory, Adam Mickiewicz University

Main Sequence to Starburst Transitioning Galaxies: Gamma-ray Burst Hosts at z~2

abstract:

Star-forming galaxies populate a main sequence (MS), a well-defined relation between stellar mass (M*) and star-formation rate (SFR). Starburst (SB) galaxies lie significantly above the relation whereas quenched galaxies lie below the sequence. In order to study the evolution of galaxies on the SFR-M* plane and its connection to the gas content, we use the fact that recent episodes of star formation can be pinpointed by the existence of gamma-ray bursts (GRBs). Here we present sensitive [CI]-nondetections of z~2 ultra luminous infrared (ULIRG) GRB host galaxies. We find that our GRB hosts have similar molecular masses to those of other ULIRGs. However, unlike other ULIRGs, the GRB hosts are located at the MS or only a factor of a few above it. Hence, our GRB hosts are caught in the transition toward the SB phase. This is further supported by the estimated depletion times, which are similar to those of other transitioning galaxies. The GRB hosts are [CI]-dark galaxies, defined as having a [CI]/CO temperature brightness ratio of 10^4 cm^-3) where CO is shielded from photodissociation, leading to under-abundances of [CI]. This is consistent with the merger process that is indeed suggested for our GRB hosts by their morphologies.

Thursday 14th September 2023 15:15 – 15:30
Session VII: Cosmology and evolution of galaxies

Junais
National Centre for Nuclear Research

Exploring the dust content of low surface brightness galaxies: Implications for the LSST survey

abstract:

Although it is recognized that low surface brightness galaxies (LSBs) contribute a large fraction to the number density of galaxies, their properties are still poorly known. For instance, LSBs are often considered to be “dust poor”. However, this assumption is based only on a few studies.
To verify this, we use a large sample of LSBs and high surface brightness galaxies with deep observational data. We study their dust properties as a function of surface brightness. Our sample, which is the largest in the literature, consists of 1631 galaxies (1003 LSBs) at z < 0.1 from the North Ecliptic Pole (NEP) wide field, with a large multi-wavelength set of ancillary data ranging from UV to FIR. We analyzed the spectral energy distributions of the sample using the CIGALE code.
Our results show that the majority of LSBs have a negligible dust attenuation (Av < 0.1 mag), except for about 4% of them that show significant attenuation with a mean Av of 0.8 mag. We found that the LSBs with a significant attenuation also have a higher r-band mass-to-light ratio than the others. These outlier LSBs also show similarity to the giant LSBs from the literature, like Malin 1, indicating a possibly high dust attenuation in them as well. Our recent deep spectroscopic measurements of Malin 1 suggest a dust attenuation of Av ~ 0.3 mag. Moreover, we also identified several LSBs with mid-infrared detections using JWST, which further confirms our estimates on the presence of dust in LSBs.
This work emphasises that the dust content of LSBs is more varied than previously thought. We found that some of the LSBs have significant attenuation making them fainter than their intrinsic value. This will have serious implications for the observation and analysis of LSBs with upcoming large sky surveys like LSST.

Thursday 14th September 2023 15:30 – 15:45
Session VII: Cosmology and evolution of galaxies

Oliver Newton
Center for Theoretical Physics, Polish Academy of Sciences

The undiscovered ultra-diffuse galaxies of the Local Group

abstract:

Ultra-diffuse galaxies (UDGs) are attractive candidates to probe cosmological models and test theories of galaxy formation at low masses; however, they are difficult to detect because of their low surface brightness. In the Local Group a handful of UDGs have been found to date, most of which are satellites of the Milky Way and M31, and only two are isolated galaxies. It is unclear whether so few UDGs are expected. We address this by studying the population of UDGs formed in hydrodynamic constrained simulations of the Local Group from the HESTIA suite. For a Local Group with a total enclosed mass M_LG(< 2.5 Mpc) = 8 × 10^12 M_⊙ , we predict that there are 12±3 isolated UDGs (68% confidence) with stellar masses 10^6 ≤ $M*$ / M_⊙ < 10^9, and effective radii Re ≥ 1.5 kpc, within 2.5 Mpc of the Local Group, of which 2^+2_−1 (68% confidence) are detectable in the footprint of the Sloan Digital Sky Survey (SDSS). Accounting for survey incompleteness, we find that almost the entire population of UDGs in the Local Group field would be observable in a future all-sky survey with a depth similar to the SDSS, the Dark Energy Survey, or the Legacy Survey of Space and Time. Our results suggest that there is a population of UDGs in the Local Group awaiting discovery.

Thursday 14th September 2023 16:00 – 16:12
Session VII: Cosmology and evolution of galaxies

Magdalena Kunert-Bajraszewska
Institute of Astronomy, Nicolaus Copernicus University

Radio transient phenomenon – the moment of birth of the radio source?

abstract:

The evolution of extragalactic sources has been an important issue in the study of active galactic nuclei for many years. Numerous observations led to creation of a standard evolutionary model for radio sources, according to which the younger and smaller Gigahertz-Peaked Spectrum (GPS) and Compact Steep Spectrum (CSS) sources expand and become large-scale FRI and FRII objects. However, the excess of compact sources in comparison to fully developed radio-galaxies indicates that a part of GPS and CSS sources never evolve into extended structures.
Among several explanations for this early cessation of radio activity, there are indications that some sources may be transient objects on timescales of 10^4 - 10^5 years, representing the new population of active galaxies that needs to be explored. This phenomenon is naturally associated with a discussion about the conditions/factors needed to initiate the radio emission in AGNs. My talk will be a subjective look at these issues.

Thursday 14th September 2023 16:12 – 16:24
Session VII: Cosmology and evolution of galaxies

Mahmoud Hamed
National Centre for Nuclear Research

Decoding the IRX- β dust attenuation relation in star-forming galaxies at intermediate redshift

abstract:

We aim to understand what drives the IRX-β dust attenuation relation at intermediate redshift (0.5 < z < 0.8) in star-forming galaxies. We investigate the role of various galaxy properties in shaping this observed relation. We use robust [O ii] λ3727, [O iii] λλ4959, 5007, and Hβ line detections of our statistical sample of 1049 galaxies to estimate the gas-phase metallicities. We derive key physical properties that are necessary to study galaxy evolution such as the stellar masses and the star formation rates using the spectral energy distribution fitting tool CIGALE. Equivalently, we study the effect of galaxy morphology (mainly the Sérsic index n and galaxy inclination) on the observed IRX-β scatter. We also investigate the role of the environment in shaping dust attenuation in our sample. We find a strong dependence of the IRX-β relation on gas-phase metallicity in our sample, and also strong correlation with galaxy compactness characterized by the Sérsic indexes. A less strong correlation is seen with stellar masses, specific star formation rates and the stellar ages of our sources. Metallicity is one of the drivers of the dust attenuation scatter, this also results from the older stars and higher masses at higher β values. The correlation with specific dust mass is strong in shifting the galaxies away from the IRX-β relation towards lower β values. We find that more compact galaxies witness a larger amount of attenuation than less compact galaxies. There is a subtle variation in the dust attenuation scatter between edge-on and face-on galaxies, but the difference is not statistically significant. Galaxy environments do not significantly affect dust attenuation in our sample of star-forming galaxies at intermediate redshift.

Thursday 14th September 2023 16:24 – 16:36
Session VII: Cosmology and evolution of galaxies

Michael Romano
National Centre for Nuclear Research

The impact of galactic outflows on the baryon cycle of local dwarf galaxies

abstract:

Galactic feedback plays a fundamental role in the framework of galaxy formation and evolution. Dwarf galaxies are particularly affected by such feedback that can produce strong winds able to transport significant amount of gas, metals and dust into the circumgalactic (or even intergalactic) medium, drastically affecting their growth. We investigate the physical properties of galactic outflows in a sample of 29 local low-metallicity dwarf galaxies drawn from the Dwarf Galaxy Survey. We make use of Herschel/PACS archival data to detect atomic outflows in the broad wings of observed [CII] 158 um line profiles. We find evidence of outflowing gas in 1/3 of the sample, and in the average galaxy population through line stacking. The outflow rates of our sources are comparable to their star-formation rates, implying mass-loading factors (i.e., outflow efficiencies) of the order of unity. Outflow velocities are larger than the velocities required from gas to escape away from the galaxies with, on average, ~40% of gas carried out into their intergalactic medium. Moreover, their energetics suggest that our outflows are consistent with momentum-driven winds powered by the radiation pressure of young stellar populations on dust grains, in agreement with observations of local starbursts.
These results highlight the importance of feedback in the baryon cycle of low-mass sources. Indeed, galactic outflows powered by star formation are able to bring a significant amount of gas and dust out of the dark matter halos of dwarf galaxies, enriching their surroundings and shaping their star-formation histories. Our constraints on the mass-loading factors will be used as input for chemical evolution models attempting to reproduce the physical processes ruling the evolution of these galaxies across cosmic time.

Thursday 14th September 2023 16:36 – 16:48
Session VII: Cosmology and evolution of galaxies

Prasad Sawant
National Centre for Nuclear Research

Investigating the Early Universe: A Study of Dusty Star-Forming Galaxies at high redshift to understand the baryonic evolution

abstract:

Probing the galaxies located in the high redshift Universe provides us with a unique chance to understand the evolution of baryonic matter at early epochs. The Dusty Star-Forming Galaxies (DSFGs) are proven to be objects of intense star formation activity with Star Formation Rate (SFR) ranging up to thousands of solar masses per year. Due to their compact sizes, the star formation activity occurring in such small-scale environments gives rise to various physical phenomena in extreme conditions, unlike the local Universe. Recent observations in the far-infrared and submillimeter domains led to the discovery of a large number of DSFGs in the distant Universe which was not anticipated in previous studies, challenging our present comprehension of dust formation mechanisms at early times.

In this work, we characterize a sample of strongly lensed DSFGs drawn from the South Pole Telescope-Sunyaev Zel'dovich (SPT-SZ) survey. These galaxies have robust spectroscopic measurements through ALMA CO observations, with redshifts spanning from 1.9 to 6.9. We estimate their stellar masses by adopting scaling relations between SFR and stellar mass for different redshifts. The work presented here not only allows us to investigate the stellar mass build-up in the early Universe but also it is essential to derive a detailed picture of the baryonic evolution of these galaxies. This work allows putting constraints on dust production in the early universe through the comparison of observations with chemical evolution models.

Thursday 14th September 2023 16:48 – 17:00
Session VII: Cosmology and evolution of galaxies

Hareesh Thuruthipilly
National Centre for Nuclear Research

Enlightening the Low Surface Brightness Universe with Transformers

abstract:

Low surface brightness galaxies (LSBGs), which are defined as galaxies that are fainter than the night sky, play a crucial role in understanding galaxy evolution and cosmological models. Upcoming large-scale surveys like Rubin Observatory Legacy Survey of Space and Time (LSST) and Euclid are expected to observe approximately 10^9 astronomical objects. In this context, using semi-automatic methods to identify LSBGs while rejecting artefacts would be a highly challenging and time-consuming process. To address this issue, we propose a new machine learning architecture known as 'transformers' for the detection of LSBGs. We study the use of transformers in separating LSBGs from artefacts from the Dark Energy Survey (DES) and report the identification of 4,083 new LSBGs with transformers from DES. We also analyse the unusual clustering nature of LSBGs and their properties to give more insights into the nature of LSBGs. In addition, our results also increase the number density of LSBGs to 5.5 per deg^2, forecasting more than 100,000 LSBGs from LSST highlighting the necessity of fast automated methods for the analysis.

Thursday 14th September 2023 17:00 – 17:12
Session VII: Cosmology and evolution of galaxies

Anjitha John William Mini Latha
Center for Theoretical Physics, Polish Academy of Sciences

Deep learning based photometric redshifts of galaxies in Kilo-Degree Survey

abstract:

Redshift is the key quantity to constrain the models of galaxy evolution and for cosmological analyses, the basic proxy for galaxy distances, it allows us to map the 3D large-scale structure. In modern wide-angle deep surveys, most of the redshifts are derived indirectly from photometry rather than spectroscopy. In this talk, I will discuss the use of Convolutional Neural Networks (CNN) for photometric redshift (photo-z) estimation of galaxies from imaging data of the Kilo-Degree Survey (KiDS) broadband.
CNNs have recently shown promise in accurately estimating photometric redshifts, leveraging the ability of deep learning algorithms to capture complex patterns in large datasets. I propose a new architecture based on Inception to estimate the photometric redshift of galaxies by training the network with a spectroscopic redshift of galaxies.
In this talk, I will describe the architecture of CNN and the training process, the effect of hyperparameters and loss function on photo-z estimation, and, highlight the advantages of using a CNN over traditional machine learning algorithms. I will present the results of experiments, comparing the performance of CNN to other state-of-the-art photometric redshift estimation methods. Finally, I will discuss the potential implications of this work for future astronomical surveys and cosmological studies.

Thursday 14th September 2023 17:12 – 17:24
Session VII: Cosmology and evolution of galaxies

Luis Suelves
National Centre for Nuclear Research

Merger identification through photometric bands, colours, and their errors

abstract:

Galaxy merger identification is a key step in the contemporary studies of galactic evolution. Their abundance and physical properties can answer many questions about their interaction processes and life cycle. In this talk, we will explain the methodology for merger identification that we developed through a Neural Network (NN) for galaxy mergers classification, using as input only photometric information from SDSS DR6. For training, we built a class-balanced set, with merging and non-merging galaxies from Galaxy Zoo DR1 visual classification in redshifts between 0.01 and 0.1. The mergers are visually confirmed galaxy pairs from Darg et al (2010). We discovered that the error in the 5-band sky background estimation allowed the NN to achieve a 92.64 ± 0.15 % of training accuracy, and a 92.36 ± 0.21 % in test. Moreover, we found out that this sky error is enough for the classification: simply drawing a decision boundary in the g - r bands plane, one can get a 91.59 % using all our data. We consider that this sky background error is sensitive to the stripped material surrounding the merging sources. Currently, we are extending this decision boundary to all SDSS DR6 within Galaxy Zoo DR1, addressing the stars and galaxies forming visual pairs that contaminate the results. Our plan is to build a pipeline to discard sources whose sky background is affected by the contamination, rather than by merging related low surface brightness material. The proper understanding and extension to deeper images of this methodology could support LSST's science very effectively.

Thursday 14th September 2023 17:24 – 17:36
Session VII: Cosmology and evolution of galaxies

Mateusz Bronikowski
University of Nova Gorica Center for Astrophysics and Cosmology

Strongly-lensed supernovae in upcoming surveys

abstract:

Przedstawiam naszą pracę mającą na celu umożliwienie wykorzystania silnie soczewkowanych grawitacyjnie supernowych za gromadami galaktyk jako potężnych narzędzi do rozwiązania niektórych otwartych problemów w astrofizyce i kosmologii. Soczewkowanie grawitacyjne może pomóc badać supernowe o wysokim przesunięciu ku czerwieni, co umożliwi sprawdzenie, czy populacja progenitorów supernowych typu Ia ewoluuje wraz z przesunięciem ku czerwieni. Szczególnie interesujące jest wykrywanie supernowych o wielu obrazach oraz pomiar opóźnień czasowych między nimi, ponieważ umożliwiają one niezależny pomiar stałej Hubble'a.
W naszej pracy gromadzimy bazę danych gromad galaktyk i szacujemy właściwości soczewkowanych przez nie galaktyk, a następnie szacujemy liczbebność supernowych wykrywanych przez nadchodzące Roman Space Telescope czy Vera C. Rubin Observatory (LSST).

Friday 15th September 2023 9:00 – 9:30

Session VIII: Instrumental programs (invited lecture)

Piotr Orleański

Space Research Centre

Aktualnie przygotowywane w Polsce naukowe misje kosmiczne

abstract:

Referat zaproszony - przegląd przygotowywanych obecnie w Polsce satelitarnych misji naukowych, krótkie omówienie instrumentów w wybranych misjach.

Friday 15th September 2023 9:30 – 10:00
Session VIII: Instrumental programs (invited lecture)

Grzegorz Pietrzyński
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Polskie Obserwatorium Astronomiczne w Chile

abstract:

Friday 15th September 2023 10:00 – 10:30
Session VIII: Instrumental programs (invited lecture)

Krzysztof Katarzyński
Institute of Astronomy, Nicolaus Copernicus University

Polish contribution to the research of the Universe at radio wave

abstract:

Friday 15th September 2023 10:30 – 10:45
Session VIII: Instrumental programs

Michał Drahus
Astronomical Observatory of Jagiellonion University

HYADES mission: In search of the cosmic origins of Earth's oceans and new reservoirs of water in our and other planetary systems

abstract:

The advent of standardized small satellites called CubeSats has made astronomical research from space more accessible than ever before. Our ERC-funded project HYADES (HYdrogen And DEuterium Survey) directly derives from the vast research possibilities offered by this platform, and aims at the construction of a miniature UV space telescope designed specifically to detect hydrogen and deuterium around comets and asteroids through the ultra-luminous Lyman alpha transition. Thanks to the unparalleled sensitivity to these atoms, the envisioned satellite will provide definite answers to some of the most profound problems of the near Universe. First, it will enable ultra-sensitive investigation of future interstellar objects passing through the Solar System in search of their hydrogen clouds, with direct implications to our understanding of orbital anomalies in the absence of detectable dust, such as seen in 'Oumuamua, as well as their physical nature in general. Second, the satellite will allow for deep investigation of hydrogen content around main-belt comets, probing water-ice outgassing from these bodies with a better sensitivity than the best present-day limits. The high level of sensitivity will be routinely achieved for all known objects of this class, including new main-belt comets discovered by LSST, transforming our knowledge of the ice reservoir in the outer Main Belt. Finally, the satellite will provide homogeneous, model-independent and self-consistent measurements of the D/H ratio for dozens of comets from different dynamical classes down to 12 mag of total brightness, which is a factor-of-hundred improvement in sensitivity over the state-of-the-art methods and a major leap in measurement reliability. The D/H measurements will ultimately resolve the puzzle of cometary origin of water on Earth, and unveil the link between present-day cometary reservoirs and their original place of formation in the solar nebula.

Friday 15th September 2023 11:15 – 11:30
Session VIII: Instrumental programs

Adam Dobrzycki
European Southern Observatory

ESO Archive

abstract:

Friday 15th September 2023 11:30 – 11:45
Session VIII: Instrumental programs

Danuta Dobrzycka
European Southern Observatory

ESO Science Data Products

abstract:

Friday 15th September 2023 11:45 – 12:00

Session VIII: Instrumental programs

Rodolfo Smiljanic

Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

The Cassegrain U-Band Efficient Spectrograph (CUBES) – Status and Opportunities

abstract:

CUBES is a new spectrograph that will be installed at the Very Large Telescope of ESO and that is currently in the final design phase. CUBES will be able to cover with high efficiency the ground-based near-UV spectral region (300-400 nm) in two resolution modes (R = 6000 and 20 000). The instrument is being built by a consortium of institutes from Brazil, Germany, Italy, Poland, and the UK. In this talk, I will present the current instrument design and its capabilities. I will also summarise the main science cases driving the instrument development in the fields of Galactic, extra-galactic, and solar system astrophysics.

Friday 15th September 2023 12:00 – 12:15

Session VIII: Instrumental programs

Andrzej Niedzielski

Institute of Astronomy, Nicolaus Copernicus University

Spektrograf ANDES

abstract:

Jednym z instrumentów budowanego obecnie przez ESO teleskopu ELT będzie spektrograf wysokiej rozdzielczości ANDES, funkcjonujący w zakresie widma od ziemskiego nadfioletu do podczerwieni. W ramach wystąpienia przedstawię założenia techniczne, główne cele naukowe, stan zaawansowania, a także planowany polski wkład w to urządzenie.

Friday 15th September 2023 12:15 – 12:30
Session VIII: Instrumental programs

Jacek Niemiec
Institute of Nuclear Physics, Polish Academy of Sciences

Development of new technologies for composite mirror production for ground-based very-high-energy gamma-ray astronomy

abstract:

Teleskopy Czerenkowa są stosowane w naziemnych obserwatoriach astronomii gamma do detekcji wysokoenergetycznego promieniowania gamma. Reflektory takich teleskopów zbudowane są z mozaiki sferycznych zwierciadeł, które są metalizowane na ich przednich powierzchniach warstwą aluminium oraz cienką warstwą ochronną z kwarcu. Wskutek bezpośredniego działania czynników atmosferycznych wydajność optyczna takich zwierciadeł ulega stosunkowo szybkiej degradacji, co stwarza potrzebę ich ponownego napylania lub wymiany, pociągając za sobą w obu przypadkach wysokie koszty. Rewolucyjnym rozwiązaniem tego problemu jest opracowanie technologii produkcji zwierciadeł kompozytowych z przednim panelem szklanym metalizowanym na tylnej powierzchni, co zabezpiecza delikatną powłokę refleksyjną przed uszkodzeniami oraz wpływem czynników środowiskowych. W tym wystąpieniu przedstawione zostaną wyniki międzynarodowych prac badawczych kierowanych przez zespół z Instytutu Fizyki Jądrowej PAN, w ramach których opracowano nowatorskie technologie budowy szklano-aluminiowych zwierciadeł kompozytowych napylanych od tyłu. Pokazane zostanie, że spadek wydajności optycznej spowodowany transmisją światła Czerenkowa odbitego przez warstwę szkła można znacznie zrekompensować poprzez wybór specjalnego rodzaju szkła o odpowiedniej grubości. Zaprezentowane zostaną także pełnowymiarowe prototypy zwierciadeł, które spełniają wymagania dla zwierciadeł średnich teleskopów obserwatorium Cherenkov Telescope Array.

Friday 15th September 2023 12:30 – 12:45
Session VIII: Instrumental programs

Maciej Bilicki
Center for Theoretical Physics, Polish Academy of Sciences

Vera Rubin Observatory – LSST – present status

abstract:

Friday 15th September 2023 12:45 – 13:00
Session VIII: Instrumental programs

Andrzej Krankowski
University of Warmia and Mazury in Olsztyn

POlish Low Frequency Array – POLFAR. Rozwój systemu: LOFAR2.0 oraz praca w ramach LOFAR-ERIC

abstract:

Friday 15th September 2023 13:00 – 13:15
Session VIII: Instrumental programs

Mateusz Olech
University of Warmia and Mazury in Olsztyn

LOFAR-VLBI obrazowanie wysokiej rozdzielczości na niskich częstotliwościach

abstract:

LOFAR (Low Frequency Array) to obecnie największy radioteleskop pracujący na bardzo niskich częstotliwościach. Obecnie składa się on z 52 stacji rozmieszczonych w Europie. Trzydzieści osiem jest usytuowany w Holandii z maksymalną długością baz wynoszącą 120km i razem z 14 międzynarodowymi stacjami tworzą interferometr wielkobazowy (VLBI, Very Long Base-line Interferometr). Dzięki rozwojowi metod kalibracji typu "direction-dependent" rutyną stała się kalibracja obserwacji stacji Holenderskich w wyniku których uzyskuje się mapę w rozdzielczości 6 sekund łuku i polu widzenia 20 stopni kwadratowych. Ten tryb obserwacji jest używany między innymi w przeglądzie nieba północnego LOFAR Two-metre Sky Survey (LoTSS) w przedziale częstotliwości 120-168MHz. Niedawno opracowano strategię kalibracji, która pozwala nam tworzyć obrazy w rozdzielczości poniżej sekundy łukowej przy użyciu LOFAR-VLBI. Międzynarodowe stacje dają nam długości bazy do około 2000km, co pozwala na uzyskanie rozdzielczości do 0.27 sekundy łuku przy częstotliwości 150MHz. W tym wystąpieniu zaprezentujemy proces przetwarzania danych jak i pierwsze wyniki w rozdzielczości poniżej sekundy łuku uzyskane za pomocą oprogramowania zainstalowanego w Olsztynie.

Wednesday 13th September 2023 11:00 – 11:30
Session IX: Session for popular science and education (invited lecture)

Stefan Janta
Planetarium Śląskie, Chorzów

Odnowione Planetarium Śląskie

abstract:

Wednesday 13th September 2023 11:30 – 11:45

Session IX: Session for popular science and education

Grzegorz Stachowski

Astronomical Observatory of Jagiellonion University

XVI Międzynarodowa Olimpiada z Astronomii i Astrofizyki

abstract:

W dniach 10-20 sierpnia 2023 odbędzie się XVI Międzynarodowa Olimpiada z Astronomii i Astrofizyki, po raz drugi w Polsce. Uczestniczyć będą młodzi ludzie stanowiący czołówkę uczniów i studentów astronomii z rekordowej liczby (53) krajów z całego świata. W wystąpieniu przedstawione zostanie podsumowanie wydarzenia oraz uwagi na temat tego, jak tego typu wydarzenia wpływają pozytywnie na rozwój i postrzeganie astronomii i astrofizyki na świecie.

Wednesday 13th September 2023 12:15 – 12:30

Session IX: Session for popular science and education

Krzysztof Czart

Urania - Postępy Astronomii

Przewodnik astronomiczny po Polsce w wersji online

abstract:

Około 40 lat temu ukazała się książka pt. "Przewodnik astronomiczny po Polsce". Od tamtej pory astroturystyczny krajobraz naszego kraju znacząco się zmienił. Z okazji swojego 100-lecia, w 2023 roku, Polskie Towarzystwo Astronomiczne wydało współczesny "Przewodnik astronomiczny po Polsce" w formie książkowej, portalu internetowego i aplikacji mobilnej. W przewodniku przedstawione są setki miejsc w Polsce związanych z astronomią i badaniami kosmosu. Są to zarówno obserwatoria, teleskopy, planetaria, jak i zegary słoneczne, miejsca pamięci, pomniki, a nawet ulice czy szkoły.

Wednesday 13th September 2023 12:30 – 12:45
Session IX: Session for popular science and education

Sylwester Kołomański
Institute of Astronomy, University of Wrocław

Ochrona obserwatoriów astronomicznych przed zanieczyszczeniem światłem w dobie rewolucji oświetleniowej LED

abstract:

Nocne niebo jest zasobem niezbędnym astronomii. Jego jasność to jeden z głównych czynników określających możliwość prowadzenia naziemnych obserwacji obiektów astronomicznych. Niestety, coraz liczniejsze instalacje oświetleniowe powodują sztuczne zwiększenie jasności nieba do poziomu mającego istotny negatywny wpływ na obserwacje astronomiczne. Problem ten jest szczególnie duży w przypadku obserwatoriów zlokalizowanych w obszarach o stosunkowo gęstej sieci osadniczej, jak np. Europa. Obecnie w oświetleniu zewnętrznym trwa przejście od lamp wyładowczych do źródeł LED. Zmiana ta może jeszcze bardziej pogorszyć warunki obserwacyjne.
W naszej pracy przebadaliśmy możliwy wpływ na obserwacje astronomiczne dużej liczby źródeł LED w zależności od ich widma emisji, warunków zewnętrznych i charakteru otoczenia. Uzyskane wyniki wskazują jakie działania mogą zostać wdrożone w celu ochrony warunków obserwacyjnych dla astronomii. Działania te mogą stać się podstawą do tworzenia stref ochronnych wokół obserwatoriów.

Wednesday 13th September 2023 12:45 – 13:00
Session IX: Session for popular science and education

Joanna Molenda-Żakowicz
Institute of Astronomy, University of Wrocław

O strukturze wiedzy studentów pierwszego roku astronomii

abstract:

Kontekst: Rekrutacja na studia astronomiczne, polegająca na przeliczaniu wyników matur na punkty rekrutacyjne, nie zawsze pozwala oszacować, czy kandydaci posiadają wystarczającą wstępną wiedzę i umiejętności konieczne do udanego studiowania na tym kierunku. Ta niepewność utrudnia stwierdzenie czy programy studiów są dobrze dopasowane do poziomu przyjętych osób.

Cel: Naszym celem było zbadanie poziomu podstawowej wiedzy astronomicznej osób rozpoczynających studia na kierunku astronomia i określenie czynników go różnicujących, a następnie sformułowanie zaleceń dotyczących ewentualnych modyfikacji treści programowych przekazywanych na studiach.

Metody: Dla ustalenia odpowiedzi na pytanie o poziom wiedzy studentów przeprowadzono badanie empiryczne, które miało formułę testu składającego się z szeregu twierdzeń, których prawdziwość należało zweryfikować. Badanie objęło okres czasu od roku 2008 do roku 2022 i dotyczyło studentów pierwszego roku astronomii w czterech ośrodkach akademickich.

Wyniki: Uzyskane wyniki pokazują, że chociaż średni poziom wiedzy osób rozpoczynających studia astronomiczne można uznać za zadowalający, to jednak wśród studentów rozpoczynających studia na kierunku astronomia można znaleźć osoby o zaskakująco niskim poziomie wiedzy ogólnej z tej dziedziny. Ponadto, analiza czasowa badanego szeregu pokazuje zauważalny, niepokojący trend spadkowy średniego poziomu wiedzy studentów.

Wnioski: W celu właściwego zaadresowania wymienionych problemów rekomendujemy stałe monitorowanie stanu wiedzy nowoprzyjętych studentów astronomii np. poprzez wykonywanie tego samego lub podobnego badania empirycznego i odpowiednie modyfikowanie nauczanych treści, tak by uzupełnić wykryte braki wiedzy.

Wednesday 13th September 2023 13:15 – 13:30
Session IX: Session for popular science and education

Monika Maślaniec
Młodzieżowe Obserwatorium Astronomiczne im. Kazimierza Kordylewskiego w Niepołomicach

Astronomia dla najmłodszych

abstract:

Rozwijając zainteresowania otaczającym nas Wszechświatem wśród dzieci i młodzieży realizujemy najważniejszy cel dydaktyczny. W Młodzieżowym Obserwatorium Astronomicznym w Niepołomicach zajęcia z młodymi pasjonatami, będącymi w wieku od 5 – 10 roku życia, utwierdzają nas w przekonaniu, iż warto realizować ich marzenia o poznawaniu świata. Realizacja ta jest oparta na jak największej aktywności dzieci. Chcemy, aby jak najdłużej pozostali wspaniałymi małymi odkrywcami szczególnie, że zamiłowanie do nauki i pasja, jaką przejawiają niejednokrotnie zaskakuje. Pamiętać trzeba, że to od nas, nauczycieli, zależy rozwijanie ich "małych" zainteresowań. Sposób przekazu, jaki zastosujemy, ma dawać im jak najwięcej radości i wiedzy z wybranej przez nich dziedziny. To oni będą przyszłością naszego naukowego społeczeństwa.

Wednesday 13th September 2023 13:30 – 13:45
Session IX: Session for popular science and education

Justyna Średzińska
Copernicus Science Centre

Europejskie Biuro Edukacji Kosmicznej (ESERO Polska) – międzynarodowa współpraca na rzecz edukacji kosmicznej

abstract:

Europejskie Biura Edukacji Kosmicznej ESERO działają w całej Europie w ponad 20 krajach. Celem ich działalności jest usprawnienie wprowadzania tematyki kosmicznej do szkół podstawowych i średnich oraz inspirowania nią młodzieży do wyboru w przyszłości zawodów inżynierskich lub związanych z naukami ścisłymi, w szczególności astronomią, astrofizyką i astronautyką. W Polsce koordynatorem programu ESERO jest Centrum Nauki Kopernik.
W trakcie prezentacji opowiem jakie działania prowadzimy, by zwiększyć w przyszłości liczbę studentek i studentów na kierunkach przyrodniczych i ścisłych. Przedstawię plany edukacji kosmicznej rozwijane w ramach sieci ESERO oraz strategii edukacyjnej ESA na lata 2025 – 2030. W jaki sposób chcielibyśmy zaprosić środowiska naukowe, technologiczne oraz biznesowe do współpracy na rzecz lepszego przygotowania oferty dla młodych ludzi, by w przyszłości związali swoją karierę z sektorem kosmicznym w każdym jego wymiarze. Przeprowadzę wstępne zebranie potrzeb i pomysłów środowiska PTA w kierunku zaproszenia młodych ludzi na studia wszystkich stopni oraz do współpracy.

Wednesday 13th September 2023 13:45 – 14:00
Session IX: Session for popular science and education

Krzysztof Kowalczyk
Copernicus Science Centre

Śladami Kopernika

abstract:

550 rocznica urodzin Mikołaja Kopernika to doskonała okazja do szerszego upowszechniania dokonań wielkiego astronoma i ich znaczenia dla rozwoju nauki. O Koperniku w Roku Kopernika powiedziano już wiele, dlatego w swoim wystąpieniu skupię się na mniej znanych historiach związanych z Mikołajem Kopernikiem oraz miejscach, które miałem okazję odwiedzić. Przedstawię też działalność Centrum Nauki Kopernik na polu upowszechniania dokonań naszego patrona.

Centrum Nauki Kopernik włączając się w obchody związane z Rokiem Kopernika oferuje swoim zwiedzającym multimedialny pokaz „Rewolucja Kopernika" prowadzony na żywo przez prezenterów Planetarium oraz możliwość porozmawiania z humanoidalnym robotem imitującym Mikołaja Kopernika w przestrzeniach wystaw. Zorganizowaliśmy też wykłady przybliżające postać naszego wielkiego rodaka.

Na pokazie „Rewolucja Kopernika" opowiadamy o historycznych dokonaniach Kopernika na kanwie obrazu Jana Matejki „Astronom Kopernik, czyli rozmowa z Bogiem", którego różnym elementom (m.in. przyrządom astronomicznym) przyglądamy się na kopule Planetarium. Do obrazu Matejki, którego cyfrową reprodukcję wyświetlamy na kopule Planetarium dodaliśmy jednak kilka elementów, jak np. konwalię, która symbolizuje działalność Kopernika na polu medycyny. I choć mówimy, że Kopernik studiował medycynę i prawo kanoniczne, a także miał zasługi na polu administracyjno - ekonomicznym, to jednak astronomia była dla niego królową nauk. W tym kontekście porównujemy naszą współczesną wiedzę o Układzie Słonecznym z tym co wiedział Kopernik, a wychodząc daleko poza Układ Słoneczny przedstawiamy

kilka nierozwiązanych zagadek, którymi dziś mógłby się zająć Kopernik, gdyby żył wśród nas.

Session X: Poster session

Izabela Kowalska-Leszczyńska
Space Research Centre

Radiation pressure acting on ISN He in the Heliosphere

abstract:

The Sun, along with the heliosphere, moves through a partially ionized interstellar medium. While charged particles flow around the heliosphere along the lines of the magnetic field, neutrals freely enter its interior. Thanks to this, we can directly capture particles from outside the heliosphere and use them to study the conditions prevailing in the interstellar medium. Neutral particles traveling toward the Sun are attracted to it by gravitational force but also repelled by the force associated with radiation pressure. Hydrogen atoms are the most vulnerable to this effect because they are the lightest. During periods of high solar activity, these atoms can even be pushed away from the Sun. In the case of helium, the influence of radiation pressure has been neglected until now. Is it justified? The answer, as in many other cases, is: it depends...
I will show when radiation pressure acting on the helium can be neglected and when it has to be taken into account and why.

Session X: Poster session

Paweł Swaczyna
Space Research Centre

Interstellar Medium Surrounding the Heliosphere

abstract:

The solar wind emitted from the Sun carves out a cavity in the interstellar plasma called the heliosphere, which extends more than 100 au from the Sun. While the heliosphere shields the solar system from most interstellar charged particles, interstellar neutral atoms flow through the heliosphere. Since late 2008, Interstellar Boundary Explorer (IBEX) directly samples these atoms from an Earth orbit, allowing for the study of the physical conditions in the interstellar medium. Interpreting these observations requires a careful analysis of ionization and filtration processes operating in the heliospheric boundaries. The bulk velocity of the interstellar medium derived from these observations is intermediate between the velocities of the two nearest warm, partially ionized interstellar clouds identified using high-resolution spectroscopic observations of absorption lines in the UV spectra of nearby stars measured by the Hubble Space Telescope. This indicates that the Sun is inside a mixed interstellar cloud medium (MICM) formed in the collision of these two clouds. The MICM also explains the higher interstellar neutral hydrogen density near the Sun and higher absorption from ISN hydrogen found along the lines of sight to two nearby stars (AD Leo and HD 82558). Further observations of interstellar atoms and absorption lines should allow us to study processes occurring in the interaction zones between two interstellar clouds.

Session X: Poster session

Barbara Sylwester
Space Research Centre

Time Changes of Calcium Abundance during Flare Decays

abstract:

Using new calibration data from the Bent Crystal Spectrometer (BCS) aboard NASA's Solar Maximum Mission, the absolute abundance of calcium (Ca) was determined with high accuracy from observed high-resolution soft X-ray spectra.
The calcium abundances were determined based on the analysis of emission in its helium-like ion lines relative to the level of the adjacent continuum. Both the lines and the continuum are formed at plasma temperatures T > 5 MK.
It turned out that for the majority of decay phases of the 194 flares studied, the derived Ca abundance is constant within unprecedently high determination accuracy (1 - 3%). However, for some flares, changes in abundance over time are evident. We show examples of the obtained results and suggest a possible physical scenario explaining the observed changes in Ca abundance.

Session X: Poster session

Milagros Colazo
Institute Astronomical Observatory, Adam Mickiewicz University

Phase curves using large databases

abstract:

Nowadays, we are living in a revolution of astronomical surveys. Thanks to these ground-based and orbiting telescopes, millions of observations of hundreds of thousands of asteroids in various photometric filters are available. The scientific community must be prepared to analyze and benefit as much as possible from this amount of data. Furthermore, there is an exciting possibility to combine specific observations carried out by the astronomer with the data from surveys (usually sporadic).

The main objective of this work is to develop tools for readout, processing, and analyzing large volumes of data. In addition, we will determine phase curves for hundreds of thousands of asteroids in various bands.

In this work, we illustrate the usefulness of processing and analyzing large databases that we find nowadays. Moreover, we developed tools and tested them using observations from different surveys. Hence, we anticipate the release of data from the large observational projects coming up in the coming decades, with the methodology already prepared, verified, and refined.

Session X: Poster session

Karolina Dziadura
Institute Astronomical Observatory, Adam Mickiewicz University

Asteroid orbit determination: The Role of the Photocenter-Barycenter Offset

abstract:

In our study, we explore the influence of the photocenter-barycenter offset on the precision of asteroidal astrometric observations. The discrepancy between the observable photocenter and the actual mass centre of an asteroid, the photocenter-barycenter offset, can significantly affect asteroidal astrometry. By adjusting this offset in Gaia's observations, we enhance the precision and accuracy of orbital parameters. Our method generates synthetic images through asteroid shape models, identifies the offset, and adjusts these corrections before orbit determination. We used all available observations from the Minor Planet Center, radar data from JPL Horizon, and Gaia's third data release (DR3) on asteroid astrometry, we enhanced the accuracy of asteroid orbit predictions. This investigation reveals the profound influence of the photocenter-barycenter offset on asteroidal astrometry and underscores its importance in future astronomic studies.

Session X: Poster session

Robert Jaros
Nicolaus Copernicus University

Low-mass companions to three enigmatic PTPS stars

abstract:

Nearly 1000 evolved stars at various evolutionary stages were monitored for radial velocity variations within the Pennsylvania-Toruń Planet Search (PTPS). Detailed spectral analysis of Deka-Szymankiewicz et al. (2018) revealed 29 objects with intrinsic parameters either uncertain or indicating anomalies, inconsistency between derived physical parameters and their apparent evolutionary stage. Here we present the analysis results of half (15) of the 29 object sample from obtained precise radial velocity measurements made by the Hobby-Eberly Telescope (HET, Ramsey et al. 1998) and its High Resolution Spectrograph (HRS, Tull et al. 1998). The analysis ended up with three periodic signals of possible orbiting bodies. Keplerian
analysis was done using a radial velocity module of Data Analysis Center for Exoplanets (DACE) web facility based at the University of Geneva.

Session X: Poster session

Paweł Kankiewicz
Institute of Physics, Jan Kochanowski University of Kielce

Chaos maps for retrograde asteroids

abstract:

Retrograde asteroids, found in limited number in the Solar System, are characterised by a great diversity in terms of the stability of their orbits. They are characterised by a large diversity when it comes to the stability of their orbits.
Thanks to new software tools, it is possible to investigate the influence of observational errors on the chaotic behaviour of orbits in a very flexible way. In particular, it is possible to verify how predictable their trajectories are, depending, for example, on potential non-gravitational effects typical of asteroids. A quantitative estimate of the chaos was made using Lyapounov indicators and the Mean Exponential Growth factor of Nearby Orbits (MEGNO), which were visualised as a dependence on various parameters describing the dynamical system and potential perturbations.

Session X: Poster session

Artur Paczuski
Nicolaus Copernicus University

Exoplanet and binary discoveries in PTPS rejected sample

abstract:

As big, evolved stars remain insufficiently researched in terms of spectroscopy, there are several projects focused on them, like The Penn State - Toruń Centre for Astronomy Planet Search (PTPS). Using TNG and HET telescopes, it allowed for discovery of several exoplanets and many new binary systems through radial velocity measurements. After focusing on clusters, dwarfs and giants, there were several objects not fit for any of the previous samples. I investigated those objects from a rejected sample which are located in a thin galactic disc. I will present my results obtained with the use of the DACE RV tool, which utilizes the Markov Chain Monte Carlo (MCMC) algorithm, which allows me to look for periodic changes in greater detail. I discovered one new exoplanet and three variable stars in the sample. I present their orbital parameters and describe a curious case of the newly discovered planet, which appears to be quite close to its smallest stable orbit.

Session X: Poster session

Radosław Poleski
Astronomical Observatory, University of Warsaw

Roman Space Telescope – Hubble's Successor with 100 Times Larger Field of View

abstract:

NASA is building (and plans to launch in late 2026) the Nancy Grace Roman Space Telescope with the same mirror diameter as the Hubble Space Telescope but Roman's near-infrared camera field of view of 0.28 deg^2 will be 100 times larger than Hubble's. This very large field of view will allow Roman to undertake cosmology (weak lensing and SNe) and exoplanets (via microlensing and transits) surveys. In addition, high contrast coronagraph will allow a part-per-billion suppression of stellar light in order to detect and study spectroscopically an exoplanet orbiting that star. I will present goals of the Roman mission focusing on exoplanet and Solar System studies.

Session X: Poster session

Magdalena Polińska
Institute Astronomical Observatory, Adam Mickiewicz University

Eclipsing binary asteroids

abstract:

Since the binary nature of the asteroid 243 Ida was discovered in 1993 by observing its satellite Dactyl, the number of discoveries of binary asteroids in the Solar System has been steadily increasing. Currently, we know of different types of binary asteroids and even multiple systems. Double objects appear both in the main belt of asteroids as well as in other regions of the Solar System. Among the various types of binary asteroids, there are interesting and unique objects that we call synchronously binary asteroids; only a dozen have been discovered so far. These are systems with two bodies of similar size, whose rotation corresponds to the orbital period. From the photometric observations of synchronous binary asteroids, we obtain a characteristic U-V shape lightcurve, resembling those of binary stars. The U-V shape of the lightcurve is due to the rotation of nonspherical bodies and by their mutual eclipses.
Photometric observations from several apparitions evenly distributed along the ecliptic longitude allows to determine the parameters of such systems, for example a non-convex shape solution and the object's spin-axis orientation (Bartczak et al., 2014, Bartczak et al., 2017, Kryszczyńska et al., 2008).
As photometric observations are still the main source of knowledge about the physical properties of synchronous binary asteroids, we would like to present the latest photometric observations and models, obtained for a few selected systems.

Session X: Poster session

Magdalena Szkudlarek
Janusz Gil Institute of Astronomy, University of Zielona Góra

How to see „invisible" exoplanets – small review of Transit Timing Variations (TTV) and Transit Duration Variations (TDV)

abstract:

Session X: Poster session

Ireneusz Włodarczyk
Polish Astronomical Society / Polish Society of Amateur Astronomers, Rozdrażew

The physical parameters of asteroid (29075) 1950 DA after 0.5 Myr forward integration

abstract:

We present the evolution of the physical parameters of asteroid (29075) 1950 DA after 0.5 Myr forward integration.
We studied the period, spin, and non-gravitational parameters da/dt.
Maybe one of the calculated clones will collide with Earth?

Session X: Poster session

Ireneusz Włodarczyk
Polish Astronomical Society / Polish Society of Amateur Astronomers, Rozdrażew

Updated impact solutions of the potentially dangerous asteroid (29075) 1950 DA

abstract:

We computed impact solutions of the potentially dangerous asteroid (29075) 1950 DA based on 1009 optical observations,
from 1950 February 22.23014 to 2023 May 03.161324, from which 1014 were selected, and 12 radar observations from 2001March 03 to 2012 May 01.
According to the NEODyS website\footnote{https://newton.spacedys.com/neodys/index.php?pc=4.1$\&$ots=t} the asteroid (29075) 1950 DA belongs to
the so-called 'special group' of asteroids contains one more asteroid (101955), Bennu now.
They are subject to an individual procedure for calculating possible collisions with Earth.
We also computed the non-gravitational parameter A2.

Session X: Poster session

Eshaan Bhatta
Zespół Szkół Zawodowych Huty im. Tadeusza Sendzimira

Hard X-ray variability of TeV blazar Mrk 421

abstract:

Session X: Poster session

Marek Nikołajuk
University of Bialystok, Faculty of Physics

Cool white dwarf + black hole. A quantum look at a tidal stripping

abstract:

We study the tidal stripping of a white dwarf by a black hole. An accretion disk (AD) is formed. We implement the full quantum hydrodynamic equations and carry out numerical simulations to look at the process of creation of the disk. The model of a white dwarf star is a Bose-Fermi droplet of attractively interacting degenerate atomic bosons and fermions.
During the creation of the AD, the falling matter becomes fragmented due to nonlinear effects. Additionally, quantised vortices present in the bosonic component of the accretion disk
are observed. They could be responsible for the X-ray flickering noise. Gravitational radiation generated during the process of the white dwarf tidal stripping is also investigated.

Session X: Poster session

Dorota Rosinska
Astronomical Observatory, University of Warsaw

Binary black holes from globular clusters as sources of gravitational waves

abstract:

Session X: Poster session

Parikshit Partha Biswas
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Warszawa

Internal heating effects in AGN disk and its influence on the spectral lines

abstract:

The internal heating effects for a back-illuminated disk in AGN play an important role in the determination of the spectral features in AGN. The internal heating effects can decrease or increase the line strength of a given iron ionization depending on the disk temperature. In this poster, we will discuss such heating effects occurring in the disk. The seed photons from behind also affect the disk, which illuminates the disk and contributes to the disk's cooling. Due to such phenomena, different spectral features can be observed in X-Ray,s and a variation in the iron line of different ionization can be studied.

Session X: Poster session

Marta Cholewa
Nicolaus Copernicus University

Aktywność radiowa magnetara XTE 1810-197 w czasie glitch'u w na początku czerwca 2023

abstract:

Magnetar XTE 1810-197 jest najaktywniejszym radiowo obiektem tej klasy. Obrócz klasycznej emisji radiowej, podobnej do tej obserwowanej w przypadku pulsarów, produkuje on także gwałtowne rozbłyski radiowe, przypominające szybkie błyski radiowe (FRB) czy superpulsy pulsara w mgławicy Krab. W czerwcu 2023 doniesiono o zarejstrowaniu zjawiska 'glitch'u' w XTE 1810-197, co związane jest ze zmianą tempa rotacji i/lub możliwej rekonfiguracji globalnego pola magnetycznego. Dzięki prowadzonym od roku regularnym obserwacjom XTE 1810-197 na dwóch częstościach z pomocą toruńskiego radioteleskopu prześledzono zmiany aktywności tego mangetara w czasie poprzedzającym i po zjawisko glitch'u.

Session X: Poster session

Michał Hanasz
Institute of Astronomy, Nicolaus Copernicus University

First spectrally resolved studies of CR electrons propagation, polarised synchrotron emission and spectral index maps of live MHD models of spiral galaxies

abstract:

Recent theoretical and numerical studies incorporating cosmic rays (CRs) into the global modelling of magnetized interstellar medium demonstrate that CRs can play an essential role in generating large-scale galactic magnetic fields while driving galactic winds.

We construct a global model of NGC891 based on the observational characteristics of this galaxy. We assume that on large scales, the dynamics of the magnetized ISM is driven by Cosmic Rays. We apply the algorithm of energy-dependent propagation of CR electrons in the ''Cosmic Ray Energy SPectrum'' (CRESP) module of PIERNIK MHD code to model CR propagation in this galaxy. The overall propagation of cosmic rays is described by an energy-dependent diffusion-advection equation. We assume a piece-wise power-law, isotropic CR distribution function and apply a conservative, finite volume-type propagation of CR gas in momentum space.

The numerical models exhibit CR-driven galactic and magnetic field amplification by CR-driven dynamo. We perform a parameter study of the system by varying the efficiency of conversion of supernova energy to CRs, the magnitude and momentum dependence of the CR electron diffusion coefficients. We consider the advection, diffusion, adiabatic changes, synchrotron, and inverse-Compton losses.
We use the dynamical models of spectral evolution of synchrotron emitting electrons to generate synchrotron emission maps at different radio frequencies together with maps of spectral index and Faraday rotation. We demonstrate that including the spectral evolution of CR electron population, combined with MHD modelling of galaxies, opens new opportunities for

observational diagnostics of ISM dynamics and CR propagation parameters and for verification of galactic magnetic field structures and amplification models.

Session X: Poster session

Junghwan Oh
Joint Institute for VLBI ERIC

A persistent double nuclear structure in 3C 84

abstract:

3C 84 (NGC 1275) is the radio source at the centre of the Perseus cluster and exhibits a bright radio jet. We observed the source with the Global Millimeter VLBI Array (GMVA) between 2008 and 2015, with a typical angular resolution of ~50 micro-arc-sec. The observations revealed a consistent double nuclear structure separated by ~770 gravitational radii assuming a black hole mass of 3.2×10^8 solar masses. The region is likely too broad and bright to be the true jet base anchored in the accretion disc or black hole ergosphere. A cone and parabola were fit to the stacked (time averaged) image of the nuclear region. The data did not strongly prefer either fit, but combined with a jet/counter-jet ratio analysis, an upper limit on the viewing angle to the inner jet region of ≤35° was found. This provides evidence for a variation of the viewing angle along the jet (and therefore a bent jet) within ~0.5 pc of the jet launching region. In the case of a conical jet, the apex is located ~2400 gravitational radii upstream of the bright nuclear region and up to ~600 gravitational radii upstream in the parabolic case. We found a possible correlation between the brightness temperature and relative position angle of the double nuclear components, which may indicate rotation within the jet.

Session X: Poster session

Michał Ostrowski
Jagiellonian University

Fale elektomagnetyczne w zakresie ELF a detekcja fal grawitacyjnych

abstract:

Realizowane przez zespół z UJ i AGH pomiary naturalnych fal elektomagnetycznych w zakresie częstosci ELF (tutaj 0.03-1500 Hz) pozwalają na badania szeregu zjawisk geofizycznych i związanych z pogodą kosmiczną. Dodatkowo fale te mogą być czynnikiem zakłucajacym pracę detektorów fal grawitacyjnych. W prezentacji przedstawię m.in. realizowany przez nas globalny projekt WERA ze stacjami pomiarowymi w Polsce, USA i Argentynie. Omówię także wybrane ciekawe wyniki w ramach współpracy z detektorami fal grawitacyjnych LIGO i VIRGO, oraz
interesujace pomiary geofizyczne (w tym elektromagnetyczną detekcję wybuchu wulkanu Hunga Tonga w 2022).

Session X: Poster session

Biswaraj Palit
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Ray traced spectra of hot neutron stars for various metallicities

abstract:

The observed spectra of compact objects are significantly impacted by general relativity. For different chemical compositions, we present new models of hot, non-rotating neutron star (NS) atmospheres. To determine the observable appearance of the NS's continuum emission, ray tracing computations are carried out for the single space-time configuration. These models combined with ray tracing will be made available as an XSPEC fitting package. We show how strong gravity affects the value of the color-correction factor (the ratio of frequency at which the best-fit spectrum displays the maximum to the peak flux of the black body at the effective temperature of the atmosphere) as determined by the distant observer.
The ATM24 code, which accurately treats the Compton scattering of photons on free electrons in fully relativistic thermal motion, was used to calculate the grid of intensity spectra emanating from the NS surface. Using the GYOTO code and the range of surface gravities from the atmosphere, the emerging specific intensity spectra are then ray-traced over the spacetime of a non-rotating NS to the far-off observer. For a broad grid of models with various chemical compositions, color-correction factors were established for surface gravities ranging from the critical gravity (log g_{crit}) up to 15.00 (cgs) and for effective temperatures in the range 1x 10^7 K to 3 x 10^7 K.
In very bright metal-rich atmospheres, Comptonized spectra at the source rest frame show color-correction factors ranging from 1.4 to 2.0 and even up to 3.0 in pure hydrogen atmospheres. For ray-traced spectra, the color-correction factors ranged from 0.9 to 1.4.
The NS's surface gravity, brightness, and atmospheric metal abundance all play a significant role in determining the structure of the hot atmosphere in the strong gravity regime. The theoretical color-correction factors of the ray-traced spectra are typically roughly 30% lower than the hardening factors of the source spectra.

Session X: Poster session

Karolina Bąkowska
Nicolaus Copernicus University

Inscrutable signals in the polarimetric and photometric observations of Deneb

abstract:

We report the results of the polarimetric and photometric monitoring of the best-known A-type supergiant Deneb. The photometric data include the 9-years of observations (2003-2011) from the SMEI instrument aboard the Coriolis satellite and measurements provided by the TESS satellite (sector 41). To detect periodicities and determine the frequencies of the most prominent peaks, together with their amplitude and phase, Fourier transforms (FT) of the collected light curves were performed. Polarimetric observations were obtained with the POLISH2 polarimeter at the Lick Observatory. We measured linear polarization (Stokes q and u) and detected mysterious signals at 130 and 43 days, respectively.

Session X: Poster session

John Eduard Martínez Fernández
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Testing Gaia Atmospheric Parameters in Open Cluster Stars

abstract:

The study of open clusters plays a pivotal role in advancing our understanding of stellar formation and evolution. These clusters are believed to have originated from single molecular clouds, resulting in stars with similar initial chemical compositions in each cluster. Additionally, open clusters are distributed across a wide range of Galactocentric distances, making them valuable tracers of chemical enrichment throughout the Milky Way's disk. In recent years, the Gaia mission has emerged as a crucial tool for open cluster studies. Gaia provides precise astrometry that aids in the determination of cluster membership and facilitates the discovery of new clusters. Moreover, Gaia Data Release 3 offers an extensive data set of stellar atmospheric parameters and chemical abundances, which greatly benefit investigations involving open clusters. This work presents preliminary findings from our ongoing investigation into the chemical abundances within the Galactic disk, utilizing Gaia results for stars in open clusters and cross-matching with other catalogs. The analysis is part of the development of a spectral analysis pipeline known as CHESS (CHEmical Survey analysis System). CHESS aims to automate the analysis of large stellar spectral datasets. For initial testing, we focus on re-analyzing high-resolution archival UVES spectra of stars in open clusters. By cross-matching the UVES sample with Gaia DR3, we have identified approximately 1000 stars within several open clusters that possess both UVES spectra and Gaia atmospheric parameters. As one of the primary steps in the CHESS pipeline, we employ unsupervised machine learning algorithms on photometric and spectroscopic data to perform a similarity analysis. This analysis aims to identify stars with highly similar effective temperatures, surface gravities, and metallicities, without conducting a radiative transfer analysis. Consequently, the similarity analysis serves as a consistency check for the Gaia atmospheric parameters. In this poster, we present our methodology and the outcomes of a consistency check

conducted on the Gaia DR3 atmospheric parameters and metallicities for stars within the open cluster fields. We then proceed to discuss how our sample can contribute to the investigation of chemical enrichment patterns within the Galactic disk.

Session X: Poster session

Fabian Kaczmarek
Institute Astronomical Observatory, Adam Mickiewicz University

Modelling of the symbiotic recurrent nova RS Ophiuchi based on interferometric observations

abstract:

Symbiotic stars (SySts) represent an example of close binary systems in which a hot, compact object, most often a white dwarf, accretes material from a cool component, usually an evolved red giant. Such systems are characterized by the longest orbital periods among interacting binary stars. In order to spatially resolve the components of SySts, high angular resolution of astronomical observations is required. Optical, long-baseline interferometry provides an ideal method for this task, as it allows to directly and very precisely study such binary stellar systems, e.g. measure the radii of their components with spatial resolution of the order of milli-arcseconds. Here we would like to present the results of our analysis of the interferometric observations that were made for the symbiotic recurrent nova RS Ophiuchi. The data was obtained at two epochs: 5.5 days and 24.5 days after the outburst, using the MATISSE/VLTI instrument. We were able to determine the sizes of the emitting regions, as well as follow the expansion of the ejected matter.

Session X: Poster session

Bartosz Kirpluk
Nicolaus Copernicus University

Superhumps in ER UMa

abstract:

We report CCD photometry of the cataclysmic variable star ER UMa. Based on the observations performed in the Piwnice Observatory, we detected one superoutburst with clear presence of superhumps. We investigated the photometric behaviour of the system to derive its basic outburst properties.

Session X: Poster session

Goutham Krishna Anitha Kumari
Astronomical Observatory of Jagiellonion University

Light curves analysis of newly found subdwarf B-type binary candidates using TESS and ground based observations

abstract:

About 60% of sdBs are observed to be in a binary system and the binary evolution is thought to be the main channel for sdB star creation. Depending on the interactions between the sdB and its companion, we can divide these binaries into two main groups, the systems with long orbital periods (longer than one year) produced in a stable Roche lobe overflow, and the short period systems (order of hours) which evolved via the common envelope channel.
In this poster presentation, we focused on the analysis of short period sdB stars identified as binary candidates in J. Krzesinski et al. (2022) who studied their variability using photometry data obtained from the Transiting Exoplanet Survey Satellite (TESS). Krzesinski et al. (2022) did not perform a complete analysis of all the stars from their sample. Also, some stars' variability could not be assigned to their targets due to the large pixels of the TESS CCDs. Therefore, in our project we aim to perform a detailed analysis of variability of the remaining sdB binary candidates from Krzesinski et al. (2022). For the most northern-hemisphere targets we performed follow up observations using ground-based telescopes to check objects' variability and to obtain their time-series photometry in BVR filters. Furthermore, we are analyzing the O-C diagrams of the targets to get some insights into their orbital period changes in time. In addition, we are in a process of study the properties of the binary systems using the Wilson Devinney code (Wilson & Devinney 1971) to construct models of the sdBs in binaries and to derive physical parameters of the stars such as their mass, radius, and luminosity, as well as the properties of the binary companions.

Session X: Poster session

Agnieszka Mirocha
Antares Foundation / Astronomical Observatory of Jagiellonion University\

Tracing UV radiation around low-mass and high-mass protostars

abstract:

New discoveries of extrasolar planets trigger more questions about planet formation. Detailed studies of the physical and chemical processes at the earliest stages of stellar evolution are necessary in order to understand the initial conditions for planet-formation. For example, molecular outflows are commonly detected in the neighbourhood of protostars, transporting matter and energy outside the protostellar system. Strong outflows observed in massive star-forming regions have a strong impact on protostellar cores and molecular clouds, and even low-mass protostars may have an influence on the efficiency of star formation. In such environment, the emission of ultraviolet radiation affects the gas chemical composition and physical properties. Dedicated studies are necessary to characterise the mechanical and radiative feedback from protostars.
Some molecules can be used to trace UV radiation even in the highest-density clouds which are obscure to optical light. In our projects, we used IRAM 30m and SOFIA spectroscopy of atomic and molecular transitions from 63.2 to 691.5 μm to characterize outflows and UV radiation around protostars. We obtained large-scale maps of far-infrared lines toward the Serpens Main low-mass star-forming region and the DR21 high-mass protostar and its outflow. We modelled HCN and CN emission from the Serpens Main region using the radiative transfer code RADEX to determine the gas physical conditions and molecular abundances. This information provided input parameters to use in an astrochemical model obtained with the Nahoon code in order to characterise the strength of the UV radiation. In the DR21 high-mass star-forming region, we quantified the outflow properties and perform a comparison with shock models. This way, we gained new insights into chemical and physical processes around young stars at the earliest stages of their evolution.

Session X: Poster session

Ayush Moharana
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

The Solaris Photometric Survey: Detection of circumbinary companions using eclipse timing

abstract:

Eclipse timing variations (ETV) have been a successful tool for detecting circumbinary companions to eclipsing binaries (EB).
We present the initial results from the Solaris photometric survey which uses four 0.5m robotic telescopes in the southern hemisphere to look for circumbinary companions. We present the method of light curve extraction, detrending, and EB modeling using the observations from the Solaris network. Using these light curves we extract precise ETV for 8 EB and look for companions using a Lomb-Scargle periodogram search. We report the detection of a few circumbinary companions and try to characterize them.

Session X: Poster session

Dawid Moździerski
University of Wrocław

Variable stars in NGC 637 young open cluster

abstract:

We present the preliminary result of the variability survey in the young open cluster NGC 637. This cluster is known as one of the richest in pulsating β Cephei - type stars in the northern hemisphere. Our results are based on multi-seasonal ground-based photometric observations.

Session X: Poster session

Justyna Olszewska
Institute Astronomical Observatory, Adam Mickiewicz University

High quality follow-up observations of Classical Cepheids

abstract:

In stellar research, spectroscopy and photometry play a key role in obtaining complex insights into stellar properties and processes. Our study focuses on the analysis of spectroscopic data obtained from the Global Astrophysical Telescope System (GATS) for selected Galactic Cepheids. We determined changes in atmospheric parameters and chemical composition in relation to the pulsation phase. To complete our study, we also analyzed photometric data collected by the TESS space observatory. The combination of spectroscopy and photometry provides a more comprehensive understanding of Cepheids and their characteristics.

Session X: Poster session

Sergen Özdemir
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Exploring the Gaia Atmospheric Parameters of Globular Cluster Stars

abstract:

Multiple ongoing or planned large surveys are generating, or will generate, vast amounts of photometric, astrometric, and spectroscopic data of stars in the Milky Way and neighboring galaxies. To ensure that these data produce accurate and precise results, it is crucial to employ modern data processing tools and analysis techniques. To address this need, we are currently developing a novel spectroscopic analysis pipeline named CHESS (CHEmical Survey analysis System). The main characteristic of CHESS is to implement large-scale differential analyses in conjunction with machine learning techniques. The primary goal of CHESS is to automate the necessary steps involved in extracting high-quality stellar parameters and abundances from large sets of spectra. Accurate measurements of chemical abundances for numerous elements play a pivotal role in Galactic archaeology studies. We have focused our initial tests on reanalyzing high-resolution archival UVES spectra of stars in globular clusters. Our sample contains approximately 800 globular cluster stars observed with UVES at the VLT. CHESS employs a similarity analysis directly on the observed spectra to automatically identify similar stars prior to the spectroscopic analysis. This similarity analysis uses unsupervised machine learning algorithms, including clustering and dimensionality reduction methods. To validate our findings, we cross-match the sample with various catalogs, such as Gaia DR3 and others. This similarity analysis also serves as a consistency check for the atmospheric parameters derived from Gaia. In the case of globular clusters, we also investigate and discuss the presence of abundance correlations among the stars and their effect on the similarity analysis. Furthermore, we assess the consistency of the Gaia DR3 atmospheric parameters for our sample, based on the stars that are considered similar by the pipeline.

Session X: Poster session

Oliwia Ziółkowska
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Stellar evolutionary tracks for medium mass stars – effects of microphysics, core and envelope overshooting and mass loss

abstract:

Session X: Poster session

Ganesh N. Pawar
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

Long-term Stability of Solutions in Benchmark Star: UX Mensae

abstract:

Detached Eclipsing Binaries (DEBs) are the key sources of accurate and precise (< 1%) stellar parameters. DEBs, whose analysis leads to stable and robust results can be used as benchmark stars. Benchmark stars are crucial for testing stellar models, calibration and data analysis algorithms used by space-based photometric missions like PLATO.

In our study, we focus on a benchmark candidate UX Men observed in the continuous viewing zone of the Transiting Exoplanet Survey Satellite (TESS), observing the system UX Men for 25 sectors and time-series high-resolution spectroscopic data from the CRÉME project. We are analyzing the stability of lightcurve solutions and investigating factors influencing error rates. The primary goal is to determine the conditions for a DEB to be considered a reliable benchmark in stellar parameter determination. Further, we obtain spectroscopic temperatures using disentangled spectra and compared them with multi-band photometric temperature estimates.

Session X: Poster session

Małgorzata Pietras
University of Wrocław

Analysis of Solar-like X-Class Flare on Wolf 359

abstract:

This poster presents an analysis of a flare on the Wolf 359 star based on simultaneous observations of TESS and XMM-Newton. A stellar flare with energy comparable to an X-class solar flare is analyzed on this star for the first time. The main goal of the study was to determine whether the same physical processes drive and occur in stellar flares as in the solar flares. We estimated the flare class by various direct and indirect methods. Light curves and spectra in different energy ranges were used to determine the parameters and profiles of the flare. From the XMM-Newton EPIC-pn X-ray data, we estimated the temperature and emission measure during the flare. The thermodynamical timescale and the loop semi-length were also determined with two different methods. The RGS spectra enabled us to calculate the differential emission measure (DEM) distributions. The analysis of the line ratio in helium-like triplets allowed us to determine the plasma electron density. Our results for the flare loop on Wolf 359 were compared to typical parameters for solar flares observed with GOES and RHESSI. This supports our conclusion that the processes taking place in stellar flares are like those in solar flares. The determined geometrical parameters of the phenomenon do not differ from the values of analogs occurring on the Sun.

Session X: Poster session

Andrzej Pigulski
University of Wrocław

Blue large amplitude pulsators in ZTF photometry

abstract:

The newly discovered group of compact pulsating stars known as blue large-amplitude pulsators (BLAPs) pose a challenge to the theory of evolution. Several theories were proposed to explain the scenarios of their formation. All they assume that the progenitors of BLAPs were or still are the members of binary systems. To understand the evolution of BLAPs, the most accurate characterisation of this group of pulsating stars is needed. We present the results of our analysis of the Zwicky Transient Facility (ZTF) project photometric data for known and candidate BLAPs, focusing on the detection of their binarity.

Session X: Poster session

Monika Biernacka
Institute of Physics, Jan Kochanowski University of Kielce

Shape evolution in Illustris Simulation

abstract:

Session X: Poster session

Janusz Krywult
Jan Kochanowski University of Kielce

Galaxy star formation quenching knee at z=0.1

abstract:

Based on the photometric and spectroscopic data from the GAMA survey, the star formation quenching of the local Universe galaxies was analyzed. The study of the sSFR surface spread on the D4000 versus the stellar mass plane shows two quenching channels. The horizontal one transfers the majority of blue galaxies into the red sequence. Whereas the bulge-dominated small active galaxies cross the vertical channel.

Session X: Poster session

Krzysztof Lisiecki
National Centre for Nuclear Research

SIMBA – The Universe in a cube

abstract:

SIMBA is a state-of-the-art cosmological simulation aimed at understanding the simultaneous evolution of galaxies, black holes, and intergalactic gas. One of the key advancements of SIMBA over previous simulation attempts is the replacement of "phenomenological" models with large-volume simulations that incorporate dust and gas physics. The flagship run encompasses a 100 Mpc/h box and consists of two billion particles. In this poster, my focus will be on the visualization of this enormous dataset. What does SIMBA look like on different scales? How can we effectively visualize its time evolution? Let's delve into these questions and discover the answers!

Session X: Poster session

Marek Dróżdż
Mt. Suhora Astronomical Observatory, Pedagogical University in Kraków

Nowa stacja ALPS w Obserwatorium Astronomicznym UP na Suhorze

abstract:

Session X: Poster session

Rodolfo Silva Smiljanic
Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences

The Wide-field Spectroscopic Telescope

abstract:

This poster presents a summary of the planned properties of the Wide-field Spectroscopic Telescope (WST). WST is a planned 12-meter class telescope fully dedicated to multiobject spectroscopy. It is currently envisioned to be equipped with three instruments that can be operated simultaneously and observe a field of view of at least 2.5 square degrees. The low-resolution spectrograph is planned to have a multiplex of 20 000 and obtain data with continuous coverage between 370-970 nm with R=2000-7000. The high-resolution spectrograph is planned to have a multiplex of 2000 and observe 3 to 4 selected spectral regions in the optical region with R = 40 000. Moreover, an integral field spectrograph is planned to be mounted at the centre of the field of view covering an area of 3x3 arcmin squared. We are currently working on a detailed science case for such a facility. Registrations to join the science team are open for professional astronomers anywhere in the world.

Session X: Poster session

Roland Wiśniewski
University of Zielona Góra

Automatyzacja teleskopu Meade w obserwatorium na Suhorze

abstract:

Projekt, który miał na celu automatyzację teleskopu Meade w obserwatorium astronomicznym na Suhorze. Meade jest mniejszym teleskopem, którego automatyzacja pozwoliła na synchronizację obserwacji z głównym teleskopem, czego efektem jest np. możliwość pracy na dwóch filtrach jednocześnie.

Session X: Poster session

Michał Żejmo
Janusz Gil Institute of Astronomy, University of Zielona Góra

ROTUZ – Robotic Optical Telescope University of Zielona Gora

abstract:

Session X: Poster session

Krzysztof Czart
Urania - Postępy Astronomii

100 lat Uranii

abstract:

Niedawno czasopismo "Urania - Postępy Astronomii" obchodziło stulecie ukazywania się. Prezentujemy najważniejsze etapy z historii tytułu, a także jego bieżącą działalność.

Session X: Poster session

Agnieszka Mirocha
Antares Foundation / Astronomical Observatory of Jagiellonion University

Działania popularyzujące astronomię w Fundacji Antares

abstract:

Fundacja Antares została założona w 2015 roku przez grupę studentów astronomii oraz astrofizyki i kosmologii Uniwersytetu Jagiellońskiego w Krakowie. Do dnia dzisiejszego realizuje projekty promujące nauki ścisłe ze szczególnym uwzględnieniem astronomii. „Astrotrip – śladami Mikołaja Kopernika" to najnowszy projekt Fundacji Antares wpisujący się w obchody Roku Mikołaja Kopernika. Projekt ma na celu przybliżenie postaci najbardziej znanego polskiego astronoma grupie młodzieży o mniejszych szansach. Poprzez udział w wyjeździe edukacyjnym młodzież będzie miała możliwość poznania miejsc związanych z życiem Mikołaja Kopernika oraz przeżycia przygody w wymiarze międzykulturowym.
Organizacja współpracuje również z Obserwatorium Astronomicznym Uniwersytetu Jagiellońskiego w Krakowie przy organizacji Ogólnopolskiego Konkursu Astronomicznego „Astrolabium". W ramach konkursu uczniowie mierzą się ze współczesnymi problemami świata nauki, posługując się podobnymi metodami i narzędziami, jakie wykorzystują naukowcy. Konkurs kierowany jest do uczniów wszystkich szczebli szkoły podstawowej i średniej. W tegorocznej edycji konkursu wzięło udział 598 uczniów z 98 szkół z całej Polski.

Session X: Poster session

Waldemar Ogłoza
Pedagogical University of Kraków

Międzynarodowa Olimpiada z Astronomii i Astrofizyki

abstract:

Prezentacja 16 edycji IOAA-2023 zorganizowanej w naszym kraju z okazji obchodów Roku Kopernika.

Session X: Poster session

Bartłomiej Zakrzewski
Pedagogical University of Kraków

Międzynarodowa Olimpiada z Astronomii i Astrofizyki ponownie w Polsce. Podsumowanie XVI IOAA 2023

abstract:

W sierpniu 2023 roku odbędzie, po raz drugi w Polsce, Międzynarodowa Olimpiada z Astronomii i Astrofizyki. Wystąpienie ma na celu zaprezentowanie najważniejszych informacji na temat tego wydarzenia.