High Energy Astrophysics and Cosmology in the era of all-sky surveys

Report of Contributions

https://indico.global/e/13758

Contribution ID: **2** Type: **Invited**

The Transient High-Energy Sky and Early Universe Surveyor (THESEUS)

Wednesday 9 October 2024 12:45 (30 minutes)

The Transient High-Energy Sky and Early Universe Surveyor (THESEUS) is a mission conceptdeveloped by a large European collaboration under study by ESA since2018 and currently one of the three candidate M7 mission for a launch in mid '30s. THESEUS aims at fully exploiting Gamma-Ray Bursts for investigating the early Universe and as keyphenomena for multi-messenger astrophysics. By providing an unprecedented combination ofX-/gamma-ray monitors, on-board IR telescope and spacecraft autonomous fast slewing capabilities,THESEUS would be a wonderful machines for the detection, multi-wavelength characterization andredshift measurement of any kind of GRBs and many classes of X-ray transients, includinghigh-redshift GRBs for cosmology (pop-III stars, cosmic reionization, SFR and metallicityevolution up to the "cosmic dawn") and electromagnetic counterparts to sources of gravitationalwaves, especially short GRBs, possible soft X-ray emission and KN emission from NS-NS / NS-BHmergers. THESEUS would thus provide an ideal synergy with the very large astronomical facilitiesof the future working in the e.m. (e.g.,ELT, CTA, SKA, Athena) and multi-messenger (e.g., Einstein Telescope, Cosmic Explorer, km3NET).

Author: Dr AMATI, Lorenzo (INAF - OAS Bologna)

Presenter: Dr AMATI, Lorenzo (INAF - OAS Bologna)

Session Classification: TDE and other transients

Contribution ID: **4** Type: **Regular**

Low-mass galaxy interactions trigger AGN activity

Tuesday 8 October 2024 11:35 (15 minutes)

Recent discoveries of supermassive black holes existing less than 500 million years after the Big Bang represent a major puzzle. How did these black holes grow so much in such a short time? In this talk, I will discuss how the early Universe environmental conditions could have led to an accelerated black hole growth. The prevailing wisdom suggests that the early Universe is dominated by dwarf galaxies that are undergoing concurrent and consecutive interactions with other dwarfs. I constructed the largest sample of low-z dwarf-dwarf pairs and groups using the 3D-HST survey, which can be used as local analogs of high-z interacting dwarfs. Then, I used Chandra deep sky surveys to discover 6 AGN in these systems, increasing the number of known dwarf-dwarf merger-related AGN from 1 to 7. I constructed a sample of isolated dwarfs, with the same redshift-stellar mass distribution as interacting dwarfs, and found that interacting dwarfs are 6-10 times more likely to host AGN. This discovery demonstrates that low-mass galaxy interactions are very efficient in triggering black hole activity and opens new avenues in studying the growth mechanisms of the first supermassive black holes.

Author: MICIC, Marko

Presenter: MICIC, Marko

Session Classification: Physics of AGN

Contribution ID: **5** Type: **Invited**

Multi-messenger emission from AGN

Tuesday 8 October 2024 09:00 (30 minutes)

After the 2017 association between the blazar TXS 0506+056 and high-energy IceCube neutrinos, there has been a surge of research exploring the potential link between blazars and neutrinos. In 2022, somewhat surprising evidence emerged for neutrino emission from the nearby prototype Seyfert II galaxy, NGC 1068. This raises the question: which, if any, AGN are neutrino emitters, and why? What role do jetted and non-jetted AGN play? I will attempt to answer these questions based on the current state of the field, focusing primarily on the observational side but trying to give also a high-level theoretical perspective.

Author: PADOVANI, Paolo

Presenter: PADOVANI, Paolo

Session Classification: Physics of AGN

Contribution ID: **8** Type: **flash talk**

Radio properties of radio-loud high-redshift quasars at z>3

Friday 11 October 2024 16:45 (5 minutes)

We present a study of the radio properties of distant quasars at z>3. The complete sample consists of 101 objects with a flux density level greater than 100 mJy at 1.4 GHz selected in a declination range from -35° to +49°. The study based on simultaneous RATAN-600 observations at frequencies of 1.2, 2.3, 4.7, 8.2, 11.2, and 22.3 GHz in 2017-2020. The flux density measurements uncertainties are about 9-31% and the detection rate is 100, 89, and 46% at 4.7, 11.2, and 22 GHz, respectively. For more detailed analysis we included available radio data from the literature.

We have analysed the averaged radio spectra of the quasars and classify 46% of radio spectra as peaked-spectrum, 24% as flat, and none as ultra-steep spectra ($\alpha <$ -1.1). The multifrequency data reveal that a peaked spectral shape (PS) is a common feature for bright high-redshift quasars. This indicates the dominance of bright compact core emission and the insignificant contribution of extended optically thin kpc-scale components in observed radio spectra.

The variability index V_S, which quantifies the normalized difference between the maximum and minimum flux density while accounting for measurement uncertainties, ranges from 0.02 to 0.96 for the quasars. Approximately half of the objects in the sample exhibit a variability index within the range of 0.25 to 0.50, comparable to that observed in blazars at lower redshifts. The distribution of V_S at 22.3 GHz is significantly different from that at 2.3-11.2 GHz, which may be attributed to the fact that a compact AGN core dominates at the source's rest frame frequencies greater than 45 GHz, leading to higher variability indices obtained at 22.3 GHz (the V_S distribution peaks around 0.4) compared to the lower frequencies (the V_S distribution at 2.3 and 4.7 GHz peaks around 0.1–0.2).

We propose 7 new candidates for gigahertz peaked-spectrum (GPS) sources and 5 new megahertz peaked-spectrum (MPS) sources based on their spectrum shape and variability features. Only 6 out of 23 sources previously reported as GPS demonstrate a low variability level typical of classical GPS sources ($V_S < 0.25$) at 4.7-22.3 GHz. When excluding the highly variable peaked-spectrum blazars, we expect no more than 20% of the sources in the sample to be GPS candidates and no more than 10% to be MPS candidates.

Author: Dr SOTNIKOVA, Yulia (Special Astrophysical Observatory of the Russian Academy of Sciences)

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(Special Astrophysical Observatory of the Russian Academy of Sciences)

Presenter: MUFAKHAROV, Timur (Special Astrophysical Observatory of the Russian Academy of Sciences)

Session Classification: Flash talks

Contribution ID: **9** Type: **flash talk**

X-ray emission from the nuclear stellar disk based on SRG/ART-XC data

Thursday 10 October 2024 17:55 (5 minutes)

The Nuclear Stellar Disk (NSD), along with the Nuclear Stellar Cluster (NSC) and the supermassive black hole Sgr A*, forms the central region of the Milky Way. Observations have well established that the Galaxy's X-ray emission is associated with the stellar population and predominantly arises from the integrated emission of accreting white dwarfs. This study focuses on the NSD emission in the 4-12 keV range, using data from the M.N. Pavlinsky ART-XC telescope of the SRG observatory, based on observations of the Galactic center in 2019. Stellar population models for the observed sky region were reconstructed. During this work, the specific X-ray emissivity of the NSD in various parts was measured, and the NSD luminosity in the 4-12 keV range was estimated.

Author: NEZABUDKIN, Valentin (Space Research Institute, MIPT)

Co-author: KRIVONOS, Roman (Space Research Institute)

Presenter: NEZABUDKIN, Valentin (Space Research Institute, MIPT)

Session Classification: Flash talks

Contribution ID: **11** Type: **Regular**

Supernova Gravitational Waves with Machine Learning

Core-collapse supernovae are powerful explosions marking the end of massive star's lives. These events give birth to neutron stars and, in some cases, black holes. Despite extensive research, the intricate details of these explosions remain elusive. Strong gravitational waves (GWs) emitted during these events carry vital information about their origins. Detecting these waves could significantly enhance our understanding of these supernovae.
In this talk, I will review our current knowledge of GW emission in core-collapse supernovae. I will then highlight our research, where we simulate numerous rotating star models. By applying machine learning techniques, we aim to determine whether it is possible to extract source parameters, such as progenitor rotation, mass, and the properties of high-density nuclear matter, from the GW signals produced at the moment of collapse.

Author: ABDIKAMALOV, Ernazar (Nazarbayev University)

Presenter: ABDIKAMALOV, Ernazar (Nazarbayev University)

Session Classification: Sources of gravitational waves

Contribution ID: **12** Type: **flash talk**

Average energy of the X-ray spectrum as a model-independent proxy for the mass of galaxy clusters

Friday 11 October 2024 16:55 (5 minutes)

Temperature of the hot gas in galaxy clusters is known to be a reliable proxy for the their total gravitating mass, allowing one to use spectroscopic X-ray observations for halo mass function measurements. Data of shallow wide area surveys, however, often precludes direct fitting of the X-ray spectra, given possible biases arising due to unresolved (multitemperature) inner structure of the intracluster medium (ICM), projection effects and necessity of certain model assumptions to be made to allow for robust spectral fitting. We consider using a simple observable value - the average energy of the observed cluster X-ray spectrum - as a model-independent proxy for the ICM temperature and, consequently, cluster's mass. We calibrate relation of this proxy to the cluster parameters using mock obsesrvations for a sample of 84 massive galaxy clusters extracted from the *Magneticum* cosmological hydro simulations. We consider observational parameters corresponding to the all-sky survey observations by *SRG/eROSITA*. Taking into account contributions of various background and foreground signals, average energy of the simulated X-ray spectra in the $0.4-7.0$ keV band is shown to be a stable indicator of the ICM temperature with $\sim 10\%$ scatter and cluster's mass M_{500} with a $\sim 20\%$ scatter. A database containing simulated X-ray images and their spectra is publicly available.

Authors: KRUGLOV, Aleksei; Mr KHABIBULLIN, Ildar; LYSKOVA, Natalia

Presenter: KRUGLOV, Aleksei

Session Classification: Flash talks

Contribution ID: **14** Type: **Regular**

Reflection-dominated Compton-thick AGN Candidates in the SRG/eROSITA Lockman Hole Survey

Tuesday 8 October 2024 11:20 (15 minutes)

We search for reflection-dominated Compton-thick active galactic nuclei (CT AGN) candidates in the Lockman Hole region using the SRG/eROSITA Lockman Hole survey data. To this end, we selected sources with anomalously hard photon indexes in the $0.3 - 8.0$ keV band, untypical for type I AGN. In particular, we required that the upper end of the 90% error interval did not exceed a fudicial boundary of $\Gamma = 1.3$. We thus found 291 sources which constitute a rare subpopulation among extragalactic X-ray sources detected by eROSITA in the Lockman Hole field, $\approx 5\%$. These sources constitute the eROSITA sample of CT AGN candidates in the Lockman Hole field. We further divide the sources into three categories depending on the availability of the reliable redshift and statistically significant detection of the intrinsic absorption. We present two catalogues, the bright subsample (37 sources) and the faint one (254). We estimate their fraction and sky density. We show examples of individual spectra and use stacking analysis to search for possible redshift evolution of their properties with redshift. The catalogues of CT AGN candidates are meant to be used to plan future studies and follow-ups.

Author: BELVEDERSKY, Mikhail (IKI RAS, HSE University)

Co-authors: Prof. GILFANOV, Marat; Dr BYKOV, Sergei (Max Planck Institute for Extraterrestrial Physics)

Presenter: BELVEDERSKY, Mikhail (IKI RAS, HSE University)

Session Classification: Physics of AGN

Contribution ID: **15** Type: **flash talk**

Superflare of a Sun-like star as observed with XMM-Newton and SRG/eROSITA

Thursday 10 October 2024 17:50 (5 minutes)

In this work, we studied X-ray source SRGe J021932.4-040154, that we associated with a single X-ray active star of spectral class G2V-G4V and the rotational period $P_{\rm rot} = 3.2 \pm 0.5$ days. The SRGe J021932 was observed with the SRG/eRROSITA during eUDS survey in 2019 in much dimmer state compared to the XMM-Newton catalogue 4XMM-DR12. Detailed analysis revealed that the archival XMM-Newton observations captured the source during a flaring event in 2017. The XMM light curve demonstrates a strong flare described with the Gaussian rise and exponential decay, typical for stellar flares, characterized by timescale of $\sim$ 400 s and $\sim$ 1300 s, respectively. The spectral analysis of the quiescent state reveals $\sim$ 10 MK plasma at luminosity of $(1.4 \pm 0.4) \times 10^{29}$ erg/s (0.3-4.5keV). The spectrum of the flare is characterized by temperature of $\sim$40 MK and luminosity $(5.5 \pm 0.6) \times 10^{30}$ erg/s. The total energy emitted during the flare $\sim 1.7 \times 10^{34}$ erg exceeds the canonical threshold of 10^{33} erg, allowing us to classify the observed event as a superflare on a Sun-like star. We additionally present an upper limit on the starspot area based on the quasi-period modulations of the stellar brightness and an analysis of the observed abundance and luminosity of the star derived from the X-ray spectral fitting.

Author: MUKHIN, Andrey (Space Research Institute (IKI), Russian Academy of Sciences; Moscow Institute of Physics and Techonlogy)

Co-authors: KRIVONOS, Roman (Space Research Institute (IKI), Russian Academy of Sciences); BIKMAEV, Ilfan (Kazan Federal University; Academy of Sciences of Tatarstan Republic); GORBACHEV, Mark (Kazan Federal University); KHAMITOV, Irek (Kazan Federal University); SAZONOV, Sergey (Space Research Institute (IKI), Russian Academy of Sciences); GILFANOV, Marat (Space Research Institute (IKI), Russian Academy of Sciences; Max-Planck Institute for Astrophysics); SUNYAEV, Rashid (Space Research Institute (IKI), Russian Academy of Sciences; Max-Planck Institute for Astrophysics; Institute for Advanced Study)

Presenter: MUKHIN, Andrey (Space Research Institute (IKI), Russian Academy of Sciences; Moscow Institute of Physics and Techonlogy)

Session Classification: Flash talks

Contribution ID: **16** Type: **Invited**

All-sky view of high-energy neutrinos with IceCube, Baikal-GVD and KM3NeT

Thursday 10 October 2024 12:20 (30 minutes)

While most of neutrinos can traverse the Earth, the sensitivity of high-energy neutrino telescopes varies significantly depending on whether the neutrinos are detected from above or below the horizon. The deployment of large-scale detectors in both hemispheres, such as Baikal-GVD and KM3NeT in addition to IceCube, is essential for full-sky studies of neutrinos across a wide energy range. I will present the latest results on astrophysical neutrinos with energies above tens of TeV, emphasizing the contribution of the new Northern hemisphere experiments.

Author: TROITSKIY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Presenter: TROITSKIY, Sergey (Institute for Nuclear Research, Russian Academy of Sciences (RU))

Session Classification: Neutrino astronomy

Contribution ID: **17** Type: **Invited**

From the Lone Pioneer ”Insight-HXMT” to the Satellite Constellation ”CATCH”

Monday 7 October 2024 16:10 (30 minutes)

As China’s first X-ray astronomy satellite, Insight-HXMT has been successfully operating in orbit for over seven years since its launch in 2017, producing substantial findings in the study of compact objects. As a next-generation space mission, CATCH will utilize the collaborative capabilities of a multi-satellite constellation, presenting significant scientific potential in exploring the dynamic universe. This talk will highlight the scientific contributions of Insight-HXMT and provide an overview of the CATCH constellation.

Author: TAO, Lian (Institute of High Energy Physics, Chinese Academy of Sciences)

Presenter: TAO, Lian (Institute of High Energy Physics, Chinese Academy of Sciences)

Session Classification: Surveys and missions

Contribution ID: **18** Type: **Regular**

Orphan GRB Afterglows –Detailed Predictions and Survey Strategies

Friday 11 October 2024 10:00 (20 minutes)

A gamma-ray burst (GRB) afterglow is considered an orphan when it is detected without a targeted search triggered by the prompt GRB emission. This can occur when the GRB jet points away from us or if the prompt emission along our line of sight is dim (e.g. a "dirty fireball"). We present a semi-analytic model for the afterglow lightcurves based on and calibrated with numerical simulations. Such an approach better captures the peak time and flux for off-axis observers, as well as the shape of the lightcurves near the peak at different frequencies, which are the most relevant properties for transient surveys or targeted searches triggered by gravitational-wave detections. We use this model to calculate the rates of both single-epoch and multiple-epoch detections of orphan afterglows for different surveys as a function of their wavelength, sensitivity, and cadence. Additionally, we discuss an optimization scheme for observational strategies and potential methods for distinguishing orphan afterglows from other transients.

Author: CHAND, Vikas (Astrophysics Research Center of the Open University, Israel, Ra'anana)

Presenter: CHAND, Vikas (Astrophysics Research Center of the Open University, Israel, Ra'anana)

Session Classification: GRBs and SNe

Contribution ID: **19** Type: **flash talk**

X-ray correlations due to extreme lensing by black holes

Friday 11 October 2024 16:50 (5 minutes)

Constraining the mass and spin of black holes is among the holy grails of contemporary research into accreting sources. Any image of a sufficiently optically thin source near a black hole exhibits contributions of extremely lensed light rays, which orbit the black hole due to its inexorable pull before travelling to the observer. In interferometric images like those produced by the Event Horizon Telescope, these source-independent, universal effects are expected to give rise to the (yet unresolved) photon ring. Here we provide a proof-of-concept demonstrating that the signature of the photon ring may be detected as spectro-temporal correlations in the X-ray band of active black holes, potentially allowing to probe their fundamental properties in numerous sources. To substantiate our claim, we perform ray tracing calculations and map the energy and arrival time of photons that reach the observer based on the number of half-orbits they experienced around the black hole due to extreme lensing. We will show results for the monochromatic emission from a hot spot orbiting the black hole at the innermost stable circular orbit. The resulting spectro-temporal correlations show a clear dependence on the black-hole spin and inclination. Analogous results will be shown for a different class of emission models that emulate a stochastic accretion disc. Future perspectives on deciphering photon-ring signals using X-ray observations of Active Galactic Nuclei and X-ray binaries using upcoming missions like New Athena will be discussed.

Author: Dr HARIKESH, Sreehari (University of Haifa, Israel)

Co-authors: Prof. CHELOUCHE, Doron (University of Haifa, Israel); Dr HADAR, Shahar (University of Haifa, Israel)

Presenter: Dr HARIKESH, Sreehari (University of Haifa, Israel)

Session Classification: Flash talks

Contribution ID: **20** Type: **Regular**

LST-1 observations and multiwavelength study of blazar 1ES 1218+304

Tuesday 8 October 2024 16:35 (20 minutes)

The blazar 1ES 1218+304 is a high-frequency peaked BL Lac object at a cosmological redshift z of 0.182. It was first detected in Very-High Energies (VHE, E>100 GeV) by the MAGIC telescope in 2006. 1ES 1218+304 is known for showing strong flux variability with occasional outbursts across the electromagnetic spectrum. This source also exhibits an atypically hard VHE spectrum. The Large-Sized Telescope prototype (LST-1) for the Cherenkov Telescope Array Observatory (CTAO) observed 1ES 1218+304 during its high activity in the VHE band from February to April 2023. In this presentation, we report the detection of 1ES 1218+304 by LST-1 above 100 GeV with >5σ significance along with a preliminary multiwavelength study including quasi-simultaneous observations by Fermi-LAT, Swift-XRT, and Swift-UVOT.

Author: ROY, Abhradeep

Presenter: ROY, Abhradeep

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **21** Type: **Invited**

Sky Surveys in the radio

Monday 7 October 2024 09:40 (30 minutes)

Surveys of the radio sky have a long history, dating back to the very early days of radio astronomy. These early surveys provided crucial input to our understanding of both cosmology and the AGN/quasar population. As the field of radio astronomy has evolved so to have survey techniques, resulting in the current "Golden Age" of radio surveys. Wide-field surveys today cover frequency ranges from ˜30 MHz to several GHz, some with resolutions comparable to optical/infrared surveys. Furthermore, many surveys are being carried out in multiple epochs, finding radio transients and variables that give us new insights into the both the radio and general high energy source populations.

Author: LACY, Mark (National Radio Astronomy Observatory)

Presenter: LACY, Mark (National Radio Astronomy Observatory)

Session Classification: Surveys and missions

Contribution ID: **22** Type: **Regular**

A joint SRG/eROSITA + ZTF search: Discovery of two eclipsing cataclysmic variables SRGeJ045359.9+622444 and SRGeJ041130.3+685350

Friday 11 October 2024 16:00 (20 minutes)

We report the study and characterization of two new eclipsing CVs (SRGeJ045359.9+622444 (SRGeJ0453) and SRGeJ041130.3+685350 (SRGeJ0411)) discovered from a joint SRG/eROSITA and ZTF program. These objects were identified as CV candidates in a crossmatch of a 1200 deg^2 patch of sky of SRG/eROSITA X-ray data with Gaia proper motion data and the optical ZTF database. SRGeJ0453 and SRGeJ0411 were called to our attention by their proper motion, which was statistically significantly detected by Gaia, the high ratio of X-ray flux to optical flux, and their placement in the Gaia color-magnitude diagram near the white dwarf region. We obtained optical photometry to confirm the eclipse of SRGeJ0453 and SRGeJ0411 and determine the orbital periods to be ≈ 55.1 and ≈ 97.5 minutes, respectively. Optical spectra of these objects show prominent emission lines, typically seen in CVs. Optical spectroscopy suggests that the SRGeJ0453 is a new AM CVn, and the donor star could have initially been a He star or a He white dwarf. The binary parameters of SRGeJ0411 are consistent with evolutionary models for post-period minimum CVs, suggesting that SRGeJ0411 is a new period bouncer. X-ray spectroscopy hints that the white dwarf in SRGeJ0453 and SRGeJ0411 could be magnetic, but verifying the magnetic nature of these systems requires further investigation. The lack of optical outbursts has made SRGeJ0453 and SRGeJ0411 elusive in previous surveys, and joint X-ray and optical surveys highlight the potential for discovering similar systems in the near future.

Author: GALIULLIN, Ilkham (Kazan Federal University)

Presenter: GALIULLIN, Ilkham (Kazan Federal University)

Session Classification: Galactic sources

Contribution ID: **24** Type: **Solicited**

INTEGRAL: 20 years of hard X-ray surveys and Background measurements

Monday 7 October 2024 17:10 (25 minutes)

The INTEGRAL hard X-ray surveys have proven to be of fundamental importance. In more than twenty years of operation, the INTEGRAL observatory has given us a sharper view of the hard X-ray sky, and provided the triggers for many follow-up campaigns from radio frequencies to gamma-rays. In addition to conducting a census of hard X-ray sources across the entire sky, INTEGRAL has carried out unique observations of the Galactic X-ray background and large-scale cosmic X-ray background, which will without question be included in the annals of X-ray astronomy as one of the mission's most salient contribution to our understanding of the hard X-ray sky.

Author: KRIVONOS, Roman (Space Research Institute (IKI), Moscow, Russia)

Presenter: KRIVONOS, Roman (Space Research Institute (IKI), Moscow, Russia)

Session Classification: Surveys and missions

Contribution ID: **25** Type: **Regular**

X-ray variability of the jet power in NGC 1275

Tuesday 8 October 2024 11:50 (15 minutes)

We present a comprehensive multi-wavelength analysis of NGC 1275/Perseus A, focusing on its X-ray and gamma-ray emission over a 24-year period (2000-2024). Our study utilizes data from multiple space-based observatories, including SUZAKU, XMM-Newton, SWIFT, and INTEGRAL. The X-ray data observed by Suzaku/XIS were treated using a model-independent method for separating the spectral components of the active galactic nucleus NGC 1275 from the surrounding emission of the Perseus cluster. The 2000-2024 X-ray and gamma-ray lightcurves and spectra of NGC 1275 were obtained; the spectral analysis shows that jet emission mainly dominates in the 3-300 keV spectra of this object. We also estimated jet power variations over time. This approach provides insights into the long-term behavior of NGC 1275's active galactic nucleus and its jet dynamics.

Author: FEDOROVA, Elena (1) INAF-OAR 2) AO KNU)

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Presenter: FEDOROVA, Elena (1) INAF-OAR 2) AO KNU)

Session Classification: Physics of AGN

Contribution ID: **26** Type: **flash talk**

X-ray and Optical Identification and Characterization of AGN Candidates in Low-Stellar-Mass Galaxies Selected by Variability

Thursday 10 October 2024 18:10 (5 minutes)

The origins of supermassive black holes (SMBHs) at the centers of massive galaxies are a topic of intense investigation. One way to address this subject is to identify the seeds of SMBH as intermediate-mass black holes (IMBHs; $100M_{\odot} < M_{BH} < 10^{6}M_{\odot}$). Given the observed relationship between the mass of a black hole and the mass of its host galaxy, IMBHs are expected to be found at the centers of low-stellar-mass galaxies. To this end, we used a random forest algorithms to classify all objects in a large portion of the sky, using optical light curves obtained or built from images provided by the Zwicky Transient Facility (ZTF). The AGN candidates selected through this method were cross-matched with objects in the NASA-Sloan Atlas (NSA) of local galaxies, selecting those with $M_{*} < 2 \times 10^{10}M_{\odot}$ and z< 0.15. We obtained a sample of 506 candidates AGN candidates in low mass galaxies.

From these candidates, we found 415 good archival optical spectra from the SDSS. We performed spectral fitting to verify the AGN nature and characterize the candidates, using the broad Hα and Hβ emission lines as probes of AGN activity. As a result, we identified 357 candidates exhibiting significant broad emission lines, and were able to estimate the mass of 355 objects. We found a median mass of $1.1 \times 10^{7}M_{\odot}$, with 2% of the objects having a mass lower than $10^{6}M_{\odot}$.

We further established the fraction of candidates with detection in the eROSITA Data Release 1 catalog of X-ray sources and studied some of their properties. From the sample of 415 candidates with archival spectra, 195 are in the eROSITA-DE sky, and 130 (67%) have an X-ray counterpart within 10" in the eRASSv1.1 catalog. For these objects, we found that the X-ray luminosity at 0.2-2.3 keV and Hα luminosity follows the same relation previously found with the 2-10 keV band for more massive galaxies (e.g., Ho et al, 2001, ApJ, 549, L51; Panesa et al, 2006, A and A, 455, 173).

We conclude that the applied methodology is significantly more successful selecting low-stellar mass galaxies with X-ray counterpart when comparing with previous works that use similar data (see Arcodia et al, 2004, A and A, 681, A97). This shows that AGN discoverable by optical variability in low mass galaxies are in fact not significantly X-ray weaker than more massive objects.

Author: BERNAL, SANTIAGO ALEJANDRO (Instituto de Física y Astronomía, Universidad de Valparaíso)

Co-authors: ARÉVALO, Patricia (Instituto de Física y Astronomía, Universidad de Valparaíso); SÁNCHEZ-SÁEZ, Paula (European Southern Observatory)

Presenter: BERNAL, SANTIAGO ALEJANDRO (Instituto de Física y Astronomía, Universidad de Valparaíso)

Session Classification: Flash talks

Contribution ID: **27** Type: **Regular**

Broadband radio properties of the FR0 radio galaxies.

Tuesday 8 October 2024 16:55 (15 minutes)

The modern radio sky surveys have shown that compact radio sources, so named FR0 radio galaxies, are the majority among radio loud active galactic nuclei of the local Universe. The numerous FR0 population have to make a significant contribution to cosmic background emissions. These sources have mildly relativistic jets at parsec scales despite lack of prominent extended kpc radio structures. At the same time FR0s are a γ-ray emitting population as it was established recently. The issue about FR0s nature and their evolution status is open. There is a deficit of radio continuum measurements FR0s until recently. We present the study of 34 FR0s properties at the centimeter range based on monitoring data RATAN-600 in 2020-2024. We show that most of these objects have flat and convex radio spectra with peaks in the GHz range. The spectral modeling of broadband radio spectra shows that a convex spectrum shape can be determined by synchrotron self absorption (SSA) processes with a contribution of the inhomogeneous free-free absorption (FFA) effects in some sources. The FR0s variability doesn't exceed 20 % mostly, although there are sources with variability up 40 %. We discuss different reasons for observed FR0s variability. The analysis of the light curves at 5, 8 and 11 GHz allows us to determine characteristic time scales 100-900 days and to get constraints of emitting regions sizes about 0.1-0.7 pc.

Author: MIKHAILOV, Alexander

Co-authors: STOLYAROV, Vlad (Special Astrophysical Observatory of RAS); Dr SOTNIKOVA, Yulia (Special Astrophysical Observatory of RAS)

Presenter: MIKHAILOV, Alexander

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **28** Type: **Regular**

The Hubble Tension and Primordial Magnetic Fields

Friday 11 October 2024 12:10 (20 minutes)

The Hubble tension hints at a missing ingredient in our model describing the universe around the epoch of recombination. A stochastic magnetic field, if present in the plasma prior to last scattering, would induce baryon inhomogeneities and speed up the recombination process, reducing the sound horizon at last scattering and potentially helping to relieve the Hubble tension. Intriguingly, the strength of the magnetic field required to alleviate the Hubble tension happens to be of the right order of magnitude to explain the origin of magnetic fields in galaxies, clusters of galaxies and the intergalactic space. I will review this proposal and provide an update on its current status.

Author: POGOSIAN, Levon

Presenter: POGOSIAN, Levon

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **29** Type: **Invited**

Status of Wide-Field X-ray Telescope onboard Einstein Probe mission

Monday 7 October 2024 15:10 (30 minutes)

The Einstein Probe mission is a dedicated satellite for time-domain astrophysics collaborated with ESA, MPE as well as CNES, which was launched on Jan. 9, 2024. There are two payloads onboard EP, the Wide-Field X-ray telescope (WXT) and the Follow-up X-ray telescope (FXT). WXT employ the Lobster-Eye Optics with FOV of about 3830 square degrees by 12 modules. FXT employ traditional Wolter-I type Optics with effective area larger than 600 square centimeters @ 1 keV by two modules.
EP has passed the commission phase and in nominal science operations now. In this talk, we will present the overall status of the EP mission, emphasized on the WXT performances. The preliminary results are also presented.

Author: EINSTEIN PROBE MISSION, The WXT Collobration (CAS, ESA)

Presenter: ZHANG, Chen (National Astronomical Observatories, Chinese Academy of Sciences)

Session Classification: Surveys and missions

Contribution ID: **31** Type: **Regular**

Where does AGN activity occur within the cosmic web?

Tuesday 8 October 2024 10:00 (20 minutes)

The cosmic environments of accreting supermassive black holes provide powerful insights on the intertwined histories of structure growth, black hole growth, and galaxy evolution. One way to probe these environments is via the spatial clustering of active galactic nuclei (AGN). Using new data from the BASS and HETDEX wide-field surveys, I will present recent AGN clustering measurements as a function of various AGN properties at low (z˜0.03) and moderate (z˜2.5) redshifts. To interpret these measurements, I forward-model AGN in cosmological simulations to determine the main drivers of AGN clustering and to constrain the relationship between black holes and their host dark matter halos. I will discuss how these results inform the physical mechanisms for how black hole growth is triggered and quenched over cosmic time.

Author: POWELL, Meredith (Leibniz Institute for Astrophysics Potsdam (AIP))

Presenter: POWELL, Meredith (Leibniz Institute for Astrophysics Potsdam (AIP))

Session Classification: Physics of AGN

Contribution ID: **32** Type: **Regular**

Change in the brightness of the cosmic X-ray, soft gamma-ray and radio background toward clusters of galaxies

Friday 11 October 2024 15:00 (20 minutes)

We show that Compton scattering by electrons of the hot intergalactic gas in galaxy clusters should lead to peculiar distortions of the cosmic background X-ray and soft gamma-ray radiation - an increase in its brightness at energies smaller than 60-100 keV and a drop at higher energies. In the cluster frame the maximum of the background decrease occurs at ˜500-600 keV due to the recoil effect. The photoionization of hydrogen- and helium-like iron and nickel ions leads to additional distortions in the background spectrum - a strong absorption line at ˜9 keV (and also to an absorption jump at ˜2 keV for cold clusters). Also, we explore the possibility of detecting the excess of the cosmic radio background toward galaxy clusters due to its scattering by electrons (which should replace the known decrement of the cosmic microwave background at higher frequencies). We note that in many cases the measurement of the excess will be hindered by the thermal (bremsstrahlung) radiation from the intergalactic gas and the scattered radio emission from cluster galaxies associated with their past activity (and the synchrotron radiation from ejected relativistic electrons). We show that hot ($kT > 8$ keV) clusters at high ($z > 0.5$) redshifts are most promising for such measurements.

Author: GREBENEV, Sergei (Space Research Institute)

Co-author: SUNYAEV, Rashid

Presenter: GREBENEV, Sergei (Space Research Institute)

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **33** Type: **flash talk**

Exploring Multi-Messenger Evidences of a Magnetar Birth in Gamma-Ray Bursts

Thursday 10 October 2024 18:00 (5 minutes)

Gamma-ray bursts (GRBs) are among the most explosive and brightest transient phenomena in the universe, occurring at cosmological distances. After decades of investigation, the origin of the jet composition, the radiation, and energy dissipation mechanisms of GRBs are among the most important open questions regarding the nature of the GRB central engine.
Here, we consider the evolution of a newly formed magnetized NS as a power source of GRBs through multi-Messenger Evidences. Both compressible and incompressible Maclaurin spheroid are adopted to model the time evolution of the magnetar and the resulting Electromagnetic (EM) and gravitational wave (GW) emissions. The properties of the EM and GW luminosities are significantly affected by NS parameters, including the magnetic field's strength and structure, ellipticity, and the fluid's equation of state (EOS).
We show that some of the observed characteristics of GRB light curve such as the appearance of X-ray flares can be captured by our model. Our findings indicate that the ongoing and upcoming joint multi-messenger observations of GRBs can be used to understand the nature of the central engine and to give hint about the possible formation of a highly magnetized NS at the early times of the burst formations.

Authors: Prof. LI, Liang (ICRANet); Prof. MORADI, Rahim (ICRANet); Dr SHAKERI, Soroush (Isfahan University of Technology); Prof. WANG, Yu (ICRANet); HASHEMI, parisa (Isfahan University of Technology)

Presenter: HASHEMI, parisa (Isfahan University of Technology)

Session Classification: Flash talks

Contribution ID: **34** Type: **Regular**

Recent Progress in the Iranian National Observatory for Transient Events Monitoring

Wednesday 9 October 2024 13:15 (20 minutes)

The Iranian National Observatory (INO) is poised to become a significant contributor to the global effort in monitoring and following up on transient astronomical events. With its 3.4-meter optical telescope strategically located in a low-density region of telescopes on Mount Gargash at 3600 m above sea level in central Iran, the INO offers a unique opportunity to fill critical gaps in the global observational network. This talk will provide an in-depth report on the recent progress in the commissioning of the INO, highlighting the technical milestones achieved and the strategies implemented to ensure the observatory's readiness for transient event monitoring.

We will discuss the capabilities of the INO's 3.4-meter telescope, focusing on its optical performance, instrumentation, and site characteristics that make it particularly suited for time-sensitive observations of transients such as supernovae, gamma-ray bursts, gravitational wave counterparts and kilonoveas. As we move closer to full operational status, the INO is preparing to actively participate in international collaborations for real-time follow-up observations. This talk will outline the steps being taken to integrate the INO into global transient monitoring networks, ensuring that it becomes a valuable asset in the quest to understand the dynamic universe.

Author: Prof. SHAKERI, soroush (IUT, INO & ICRANet-Isfahan)

Presenter: Prof. SHAKERI, soroush (IUT, INO & ICRANet-Isfahan)

Session Classification: TDE and other transients

Contribution ID: **35** Type: **Regular**

Surveys in TeV Astronomy with Cherenkov telescopes in a multi messenger and multifrequency context

Tuesday 8 October 2024 15:15 (20 minutes)

Extragalactic TeV astronomy with Cherenkov telescopes is synergistic with multi-frequency and multi-messenger observations, conducted through observational campaigns or triggers (target of opportunities).

We will outline these two main directions by presenting recent results from multifrequency observations of blazars, such as the quasi-periodic PG1553+113, and by discussing the prospects for TeV observations of transient sources, gravitational wave counterparts, and gamma-ray bursts. In this context, we will also show how Cherenkov telescopes, specifically the next generation Cherenkov Telescope Array Observatory (CTAO), can benefit from and contribute to future surveys like the Rubin Observatory's LSST. A dedicated INAF in-kind project will enable multiwavelength analysis through the cross-matching of high-energy events with LSST data.
The CTAO will also conduct its own extragalactic survey. When complemented by surveys or dedicated observations in other frequency domains, the CTAO surveys promise an unbiased and comprehensive exploration of the spectral energy distribution parameter space of AGN and blazars.

Authors: STAMERRA, Antonio (INAF-OAR); CONSORTIUM, CTAO; PRANDINI, Elisa (Padova University and INFN Padova, Italy); COLLABORATION, MAGIC; HOVATTA, Talvikki

Presenter: STAMERRA, Antonio (INAF-OAR)

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **36** Type: **flash talk**

Exploring the Formation of Heavy Elements in Kilonovea via Rapid Neutron Capture Process

Thursday 10 October 2024 18:05 (5 minutes)

The formation of heavy elements beyond iron in the universe has long been a subject of astrophysical inquiry, with the rapid neutron capture process (r-process) playing a critical role. Kilonovae, explosive events resulting from the merger of neutron stars, have emerged as key sites for r-process nucleosynthesis. This study explores the formation of heavy elements in kilonovae through detailed modeling of their light curves, focusing on the blue and red kilonova components. The blue kilonova, typically associated with less neutron-rich ejecta, is powered by the radioactive decay of lighter r-process elements, while the red kilonova arises from the more neutron-rich ejecta producing heavier elements.

To understand the complex interplay between these components, we model the kilonova light curve of AT2017gfo, the first observed kilonova associated with the gravitational wave event GW170817. By adjusting key model parameters such as ejecta mass, velocity, and opacity, we explore how different physical conditions affect the observed light curve. Our results demonstrate that a combination of blue and red kilonova models is essential to replicate the multi-band observations of AT2017gfo. This work not only provides insights into the r-process element synthesis but also sheds light on the diverse outcomes of neutron star mergers, contributing to our understanding of the origins of the universe's heavy elements.

Authors: KARIMI, Sara; HASHEMI, parisa (Isfahan University of Technology); Prof. SHAKERI, soroush (ICRANet-Isfahan & IUT)

Presenter: KARIMI, Sara

Session Classification: Flash talks

Contribution ID: **37** Type: **Solicited**

A problem of classification the eROSITA Tidal disruption events among other variable X-ray sources

Wednesday 9 October 2024 12:25 (20 minutes)

The four completed SRG Observatory half-year all-sky surveys have yielded a significant number of variable X-ray sources.
The SRG/eROSITA telescope has discovered a rich population of tidal disruption events (TDE) that exhibit strong X-ray variability.
Searching for TDE in the X-ray band offers certain advantages over a selection in the optical range. In X-rays, the background flux of the host galaxy is negligible, allowing us to detect X-ray TDEs with lower luminosity and at greater distances, compared to optical TDE sample.
We present a study of a sample of TDEs selected on the basis of the X-ray flux variability factor (R>10) between surveys. This corresponds to TDEs with peak X-ray luminosities above 5e43 erg/s at a typical redshift of z=0.2 of the eROSITA X-ray TDEs.
Unfortunately, a significant number of AGN show similar X-ray flux variability on a half-year scale, thus contaminating the list of TDE candidates. Furthermore, a considerable number of TDE candidates lack spectroscopic redshift and classification.
A constellation of optical telescopes observes variable SRG sources to obtain a complete spectroscopic sample of TDE.
We present the complex method of spectroscopic classification helps to rule out the most AGN. The key relationship between X-ray luminosity and O[III] (5007A) luminosity can be used to confirm the TDE candidate even for an optical spectrum of moderate quality. This makes it possible to classify X-ray TDE archive sources with lower variability factor (R~5) and to extend the TDE sample to lower luminosities. Only extremely rare - one might even say unique - variable AGN (Sy2 or LINERS) with soft X-ray spectra can be misclassified using to this criterion. Fortunately, with a high quality optical spectrum and considering a full set of the X-ray and optical properties, one can reliably exclude such objects.

Author: KHORUNZHEV, George ((IKI RAS) SPACE RESEARCH INSTITUTE RUSSIAN ACADEMY OF SCIENCES)

Co-authors: Prof. GILFANOV, Marat; SAZONOV, Sergey (Space Research Institute (IKI), Russian Academy of Sciences)

Presenter: KHORUNZHEV, George ((IKI RAS) SPACE RESEARCH INSTITUTE RUSSIAN ACADEMY OF SCIENCES)

Session Classification: TDE and other transients

Contribution ID: **38** Type: **Regular**

Discovery of six high-luminosity and high-mass quasars in 0.3<z<0.6

We present the discovery of six low-redshift quasars, identified through spectral observations conducted with the RTT-150 telescope in Türkiye. With redshifts ranging from 0.3 to 0.6, these quasars were selected from candidates listed in the ROSAT survey catalog, focusing on those with i-band magnitudes brighter than 19.5. Our analysis includes detailed modeling of their continuum and emission line properties, which allowed us to estimate their luminosities, central black hole masses, and Eddington ratios. The findings reveal that these quasars exhibit exceptionally high luminosities and high masses for their redshift values, making them rare examples in the low-redshift quasar population. The results contribute to our understanding of quasar characteristics and their role in probing the structure and evolution of the nearby universe.

Author: AK, nurten (Dr.)

Co-author: Mr HÖKELEK, Seyit

Presenter: AK, nurten (Dr.)

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **39** Type: **flash talk**

Imprints of spin on the solution and emission spectrum of accretion ows around black holes

We investigate accretion flows around rotating black holes (BHs) and obtain self-consistent transonic solutions in full general relativistic prescription. The flow is assumed to be viscous and radiative. Viscosity helps in the removal of angular momentum outwards, allowing matter to get accreted inwards. In addition, viscous heat dissipated makes the matter hotter. On the other hand, radiation mechanisms like bremsstrahlung, synchrotron, and their inverse-Comptonisations cools down the matter. Thus, the solution depends highly on the interplay between heating and cooling processes. In our work we investigate the entire energy–angular momentum parameter space and obtain both shocked and shock-free accretion solutions. Because of the spin in Kerr black holes, the event horizon is dragged to a region $<2GM/c^2$, increasing the efficiency of accretion process. Ample of works showed a rotating BH to yield high temperature solutions compared to a Schwarzschild BH. This suggests higher emission. Interestingly we have found a distinct annihilation line present only in extremely rotating BHs arising from regions very close to the central object. We have investigated further the other effects of spin on the spectrum obtained from accretion flows around BHs. We find efficiencies reaching >30% for maximally rotating BHs.

Author: SARKAR, Shilpa (Harish Chandra Research Institute (HRI))

Co-author: CHATTOPADHYAY, Indranil (ARIES)

Presenter: SARKAR, Shilpa (Harish Chandra Research Institute (HRI))

Session Classification: Flash talks

Contribution ID: **40** Type: **Regular**

SRG/ART-XC Galactic Bulge deep survey

Friday 11 October 2024 15:40 (20 minutes)

We describe the survey of the Galactic Bulge, performed by the Mikhail Pavlinsky ART-XC telescope on board the SRG observatory. In order to obtain the maximal sensitivity the special source detection algorithm was developed, which helped to reduce unusable areas around bright sources, populating the region. Using this algorithm a total of 172 point sources were detected. Of these, 153 are registered on the average 4–12 keV map and 18 sources are either extremely hard (detected only at energies above 7˜keV) or highly variable (detected only in individual scans shorter than a day). For 121 sources, there are plausible counterparts in other X-ray source catalogs, including 43 with known classification. The remaining 51 sources are previously unknown objects, discovered by SRG/ART during the Galactic Bulge survey. Using our estimation of the sensitivity and Galaxy mass model we produced the prediction of the content of the obtained sample with different classes of sources.

Authors: LUTOVINOV, Alexander (Space Research Institute); SEMENA, Andrei (Space Research Institute)

Presenter: SEMENA, Andrei (Space Research Institute)

Session Classification: Galactic sources

Contribution ID: **41** Type: **flash talk**

Mapping modified gravity signatures with cosmic volumes

The new generation of galaxy surveys will provide unprecedented data allowing us to test gravity at cosmological scales. A robust cosmological analysis of the large-scale structure demands exploiting the nonlinear information encoded in the cosmic web. This study delves into the meticulous task of mapping modified gravity (MG) signatures within cosmic volumes by employing a large state-of-the-art particle mesh N-body simulations including modified gravity models. On the one hand, we model the effective nonlinear and nonlocal bias between a tracer distribution of MG with respect to a dark matter field obtained by assuming the Lambda Cold Matter (LCDM) scenario. This technique provides fast calculation of MG mock catalogs using a small number of reference simulations. On the other hand, we implement Bayesian neural networks with enriched approximate posterior distributions for estimating cosmological parameters with uncertainty estimations. This approach contributes to setting the path to extracting cosmological parameters from complete small cosmic volumes towards the highly nonlinear regime.

Author: Mr GARCÍA-FARIETA, Jorge (Universidad de Córdoba)

Presenter: Mr GARCÍA-FARIETA, Jorge (Universidad de Córdoba)

Session Classification: Flash talks

Contribution ID: **42** Type: **Invited**

30 years of Konus-Wind: overview and recent results

Friday 11 October 2024 09:00 (30 minutes)

For nearly 30 years, Konus-*Wind* has been a tireless workhorse for high-energy astrophysics.In this talk, we provide an overview and recent results from Konus-*Wind* observations of short, long, and ultra-long gamma-ray busts, Galactic and extragalactic magnetars, and solar flares. The recent results include the detection of giant flares from extragalactic magnetars, the famous SGR/FRB 200428 event, and the two brightest gamma-ray bursts in history, GRB 221009A (the BOAT) and GRB 230307A (a long GRB from a compact binary merger).

Author: Dr FREDRERIKS, Dmitry (Ioffe Institute)

Presenter: Dr FREDRERIKS, Dmitry (Ioffe Institute)

Session Classification: GRBs and SNe

Contribution ID: **43** Type: **flash talk**

New Constraints on Decaying and Annihilating Dark Matter

Friday 11 October 2024 17:00 (5 minutes)

In this talk we discuss constraints on the parameters of decaying sterile neutrinos as candidates for dark matter particles from the data of telescopes ART-XC and NuSTAR. We also discuss constraints that can be obtained from the data of these telescopes for annihilating dark matter.

Author: BARINOV, Vladislav (INR RAS)

Presenter: BARINOV, Vladislav (INR RAS)

Session Classification: Flash talks

Contribution ID: **44** Type: **Regular**

Between Hard Theory and Opaque AI: A middle path for source localization in twenty-first-century gravitational wave astronomy

Thursday 10 October 2024 17:30 (20 minutes)

Currently, parameter estimation schemes in gravitational wave astronomy fall into one of two wildly divergent categories: matched filtering schemes which rely on resource-intensive numerical modeling of full (strong curvature) general relativity or deep learning neural networks which rely on black box model training. The situation is only slightly improved for source localization algorithms, in which the parameters of interest are only the source and polarization angles of the gravitational wave, but which must run extremely quickly in order to allow electromagnetic follow-up as close as possible to the time of merger. In this case, innovative matched filtering algorithms like Bayestar (Singer and Price, 2016) allow huge performance improvements over classic matched filtering schemes like LAL-Inference (Veitch et al., 2015), while recent versions of deep learning neural networks promise to soon allow source localization of binary neutron star mergers *before* the time of merger (Baltus et al., 2021, VanStraalen et al., 2024). Even in this reduced parameter space, however, Bayestar remains slower than the neural networks, while the neural networks operate as black boxes, giving no information about how their parameter estimates are made, and therefore when and where they might fail. In this talk, I will give a brief overview of the current state of the art in source localization algorithms – both matched filter and neural network – then proceed to outline a strategy that seeks a middle road between the two. By building on my previous source localization work (McClain 2018, McClain 2019) using a combination of empirical signal modeling, physical intuition, and powerful (but fast) numerical methods, I will outline a novel approach to source localization that offers the potential to run as quickly as neural networks while maintaining full control over built-in assumptions (and therefore likely failure modes).

Author: MCCLAIN, Tom

Presenter: MCCLAIN, Tom

Session Classification: Data analysis methods

Contribution ID: **45** Type: **Regular**

Observational properties of electromagnetic components of LIGO-Virgo-KAGRA

Thursday 10 October 2024 17:10 (20 minutes)

The LIGO-Virgo-KAGRA detectors have so far registered only 2 mergers of binary neutron stars GW170817 and GW190425. Based on the experience of searching and observing electromagnetic components of these mergers (GRB 170817 and GRB 190425), we consider the properties of these components in the gamma-range and discuss the possibility of registering electromagnetic components in the future.

Author: POZANENKO, Alexei (Space Research Insitute (IKI))

Co-author: Dr MINAEV, Pavel (Space Research Insitute (IKI))

Presenter: POZANENKO, Alexei (Space Research Insitute (IKI))

Session Classification: Sources of gravitational waves

Contribution ID: **46** Type: **Regular**

Lower limit on dark matter mass from phase space density in dwarf galaxies

Friday 11 October 2024 12:30 (25 minutes)

Brief overview and new results

Author: GORBUNOV, Dmitry (Russian Academy of Sciences (RU))

Presenter: GORBUNOV, Dmitry (Russian Academy of Sciences (RU))

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **47** Type: **Regular**

Searching for X-ray transients on the ART-XC sky

Friday 11 October 2024 15:20 (20 minutes)

The Mikhail Pavlinsky ART-XC telescope is ideally suited for sensitive wide-field X-ray surveys covering tens to hundreds square degrees per day. This allows us to search for new populations of X-ray transients, that are too weak to be discovered by all-sky monitors and too rare to be serendipitously found by other grazing-incidence mirror X-ray telescopes. Most of these transients are Galactic X-ray binaries of differThe Mikhail Pavlinsky ART-XC telescope is ideally suited for sensitive wide-field X-ray surveys covering tens to hundreds square degrees per day. This allows us to search for new populations of X-ray transients, that are too weak to be discovered by all-sky monitors and too rare to be serendipitously found by other grazing-incidence mirror X-ray telescopes. Most of these transients are Galactic X-ray binaries of different classes that we are catching during active episodes.

Author: MEREMINSKIY, Ilya

Co-authors: LUTOVINOV, Alexander (Space Research Institute); SEMENA, Andrei (Space Research Institute)

Presenter: MEREMINSKIY, Ilya

Session Classification: Galactic sources

Contribution ID: **48** Type: **flash talk**

Black Hole Imaging: Tackling the SgrA* orbital motion riddle

The GRAVITY instrument made a remarkable observation during the Near-Infrared flares of 2018, detecting a fast-moving hot spot in what seemed to be a circular orbit around SgrA, the supermassive black hole in our Galactic Center. The Gravity Collaboration attempted to fit the observed flaring behavior with a circular Keplerian orbit, a few gravitational radii from the supermassive black hole. However, the short orbital period and broad angular extent of the observed trajectory raised concerns about the suitability of this model. Motivated by these results, we developed a Python code for General-Relativistic Radiative Transfer calculations within the framework of Kerr spacetime. In our most recent work, we employ our radiative transfer algorithm to reproduce the observed flaring behavior in the vicinity of SgrA, and seek out the optimal orbital parameters for modeling similar phenomena. Specifically, we investigate the kinematics of the July 22 flare and calculate the impact of the hot spot angular velocity, the observer inclination, and the black hole spin in the resulting trajectory. Most importantly, this parametric study encompasses physically motivated ejected hot spot configurations, such as conical and parabolic models, that represent the most suitable candidates for replicating the observed flares, in accordance with the latest state-of-the-art GRMHD simulations.

Authors: NATHANAIL, Antonios (Academy of Athens); ANTONOPOULOU, Eleni (National & Kapodistrian University of Athens/ Academy of Athens)

Presenter: ANTONOPOULOU, Eleni (National & Kapodistrian University of Athens/ Academy of Athens)

Session Classification: Flash talks

Contribution ID: **49** Type: **Invited**

Wide Field Survey Telescope (WFST): Overview and Recent Progress

Monday 7 October 2024 15:40 (30 minutes)

Wide Field Survey Telescope (WFST) is the largest time-domain survey facility in the northern hemisphere. The telescope is a dedicated photometric surveying facility being built jointly by the University of Science and Technology of China (USTC) and the Purple Mountain Observatory(PMO). It is equipped with a 2.5-meter diameter primary mirror, an active optics system, and a mosaic CCD camera with 0.73 gigapixels on the primary focal plane for high-quality image capture over an FOV of 6.5-square-degree.

WFST is located on the Tibetan Plateau, near Lenghu Town in Qinghai Province, at an altitude of 4200 metres. The WFST project began in 2018 and has already been completed and started astronomical observations in September 2023. In September 2024, after a year of commissioning and pilot survey, WFST will begin formal time domain survey observations. In this report, I will present the performance and scientific progress of WFST.

Author: Prof. KONG, Xu (University of Science and Technology of China)

Presenter: Prof. KONG, Xu (University of Science and Technology of China)

Session Classification: Surveys and missions

Contribution ID: **50** Type: **Invited**

Black Holes at Cosmic Dawn

Tuesday 8 October 2024 17:10 (40 minutes)

Supermassive black holes are ubiquitous in the nearby Universe. AGN feedback is thought to be a key mechanism that regulates the growth of supermassive black holes and their joint evolution with their host galaxies. How and when did these mysterious objects form? How did they grow quickly enough to power high-redshift quasars? I will summarize recent discoveries made with the JWST that offer important, new insights on the earliest phases of black hole growth and their connection to galaxy evolution during the first billion years after the Big Bang.

Author: HO, Luis (Kavli Institute for Astronomy and Astrophysics, Peking University)

Presenter: HO, Luis (Kavli Institute for Astronomy and Astrophysics, Peking University)

Session Classification: Black holes, QSOs and galaxies at cosmic down

Contribution ID: **51** Type: **Invited**

Primordial Black Holes - Positivist Perspective and Quantum Quiddity

Friday 11 October 2024 11:40 (30 minutes)

Primordial black holes are black holes that may have formed in the early Universe. Their masses potentially span a range from as low as the Planck mass up to many orders of magnitude above the solar mass. This, in particular, includes those black holes recently discovered by LIGO/Virgo/KAGRA, and (part of) these may conceivably be of primordial origin. After a general introduction on primordial black holes, I review the observational hints for their existence – from a variety of lensing, dynamical, accretion and gravitational-wave effects. As I will show, all of these (over 20) may be explained by a single and simple unified model, naturally shaped by the thermal history of the Universe. If time permits, I will comment on vorticity, which we recently conjectured to be a novel feature of (near-extremally rotating) black holes, this possibly yielding the very first astrophysical observable for quantum effects in these compact bodies.

Author: KÜHNEL, Florian

Presenter: KÜHNEL, Florian

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **52** Type: **Invited**

221009A and other TeV GRBs

Friday 11 October 2024 09:30 (30 minutes)

Recent observations of TeV emission from Gamma-Ray Bursts (GRBs)
demonstrated with certainty that it belongs to the afterglow phase. Afterglows' emission from radio frequencies to GeV gamma-rays is of synchrotron origin, whereas the TeV component is produced via distinct physical process (inverse Compton). Thus, TeV observations open an entirely new window into physics of relativistic shocks. We discuss three best studied TeV GRBs (190114C, 190829A, and 221009A); each of them observed at different evolutionary stage. GRB 190114C was an example of early afterglow (few minutes since the trigger), and GRB 190829A was observed much later, beginning from 4 hours after the trigger. Although two GRBs belong to distant evolutionary stages, their parameters (determined from broad-band spectra) fit nicely into predictions of pair-balance model of relativistic shocks. GRB 221009A is a unique example of TeV afterglow observed simultaneously with the prompt emission. In this case the parameters of afterglow only allow order-of-magnitude estimates, but again the values predicted by
the pair-balance model are consistent with observations. The lightcurve of this GRB was measured over the entire duration of the prompt phase. This allows one to check models intended to describe hydrodynamic evolution of external blast wave with intermittent energy supply. We present such a model, tested against observations. Our best-fitting solution for GRB 221009A is a surprisingly narrow jet with an opening angle of the order of 0.07 deg propagating into a wind-like external medium.

Author: DERISHEV, Evgeny (Institute of Applied Physics, RAS)

Presenter: DERISHEV, Evgeny (Institute of Applied Physics, RAS)

Session Classification: GRBs and SNe

Contribution ID: **53** Type: **Regular**

Nuclei of heavy elements in ultra-high energy cosmic rays on the Earth

Monday 7 October 2024 18:05 (15 minutes)

We discuss propagation of heavy nuclei at energies higher than 10 19 eV from their sources to the Earth, assuming them to be of extragalactic origin. In extragalactic space nuclei interact with background emission and inevitably decay. Analyzing the content of heavy nuclei arriving the Earth we reveal their energy at the Earth as a function of the source-Earth distance. It is found that the nucleus energy can be used to restrain the distance from its source.

Author: URYSON, Anna (Lebedev Physical Institute of Russian academy of science)

Presenter: URYSON, Anna (Lebedev Physical Institute of Russian academy of science)

Session Classification: Cosmic rays

Contribution ID: **54** Type: **Invited**

Type Ib/c Supernovae and Gamma-ray Bursts

Wednesday 9 October 2024 09:30 (30 minutes)

The properties of the broad-lined Type Ic Supernovae that are typically discovered in coincidence with long-duration Gamma-ray Bursts will be reviewed, and compared to those of other Supernovae for which GRBs are not observed.

The SNe associated with GRBs are of Type Ic. They are brighter than the norm, and show very broad absorption lines in their spectra, indicative of high expansion velocities and hence of large explosion kinetic energies.
There is strong evidence for gross asymmetries in the SN ejecta.
SNe associated with X-ray flashes are significantly less luminous, massive and energetic. They also appear to be less aspherical. This evidence suggests that GRB/SNe come from more massive stars.

For GRB/SNe the collapsar model is traditionally favoured, while XRF/SNe may host magnetars.
While the properties of the associated GRB can vary widely, those of the SNe seem to be almost constant. Possible implications of this will be discussed.

Finally, the recent extension of the SN-GRB connection to ultra-long GRBs and a subclass of Superluminous SNe will be presented, and its implications discussed.

Author: MAZZALI, Paolo

Presenter: MAZZALI, Paolo

Session Classification: GRBs and SNe

Contribution ID: **55** Type: **Invited**

Mysterious repeating signals from the centers of galaxies

Wednesday 9 October 2024 10:30 (30 minutes)

Almost all galaxies contain a supermassive black hole (masses > 100,000 solar masses) residing at their center. In the last decade or so a subsample of these black holes are found to exhibit repeating X-ray modulations with timescales ranging from a few minutes to up to a month. The nature of these recurring signals is currently debated but most ideas can be put into two categories: they are either a result of instabilities occurring in the inner accretion flow or from interaction of orbiting objects with the accretion disk. I will present an overview of the various flavors of repeating extragalactic nuclear transients that we have identified using multi-wavelength studies of several classes of astrophysical objects including stellar tidal distribution events, quasi-periodic eruptions, and AGN outbursts. I will also present state-of-the-art general relativistic hydrodynamic simulations of objects embedded in AGN disks and argue that, in some cases, these repeating transients could be double compact object binaries with direct implications for multi-messenger astrophysics. I will end by highlighting the exciting prospects of discovering more such systems in the imminent era of the Rubin/LSST observatory.

Author: PASHAM, Dheeraj (MIT)

Presenter: PASHAM, Dheeraj (MIT)

Session Classification: TDE and other transients

Contribution ID: **56** Type: **Invited**

A new era of high-resolution spectroscopy in X-ray astronomy

Thursday 10 October 2024 15:40 (30 minutes)

The field of X-ray astronomy has entered an era of spatially-resolved high-resolution spectroscopy, as driven by the technology of microcalorimeters. Through sounding-rocket experiments and the (brief) Hitomi mission in the past, the scientific potential of a microcalorimeter-based X-ray spectrometer is well illustrated and is highly exciting. All eyes are now on XRISM, with the expectation of scientific breakthroughs. Looking further into the future, ESA has approved the NewAthena satellite for launch in the late 2030s, while key technology development is ongoing for HUBS in China and LEM in the US. These missions will employ a new generation of microcalorimeters, based on superconducting technologies, which are expected to deliver even more superior spectral resolution. In this talk, I will briefly describe the development in the case of HUBS, and highlight some of the unresolved scientific issues that are expected to be addressed in the new era of the field.

Author: Prof. CUI, Wei (Tsinghua University)

Presenter: Prof. CUI, Wei (Tsinghua University)

Session Classification: Future missions

Contribution ID: **57** Type: **Invited**

Studying the geometry of the emitting region in X-ray binaries using X-ray polarimetry

Thursday 10 October 2024 10:10 (30 minutes)

The launch of the Imaging X-ray Polarimetry Explorer (IXPE) in Dec 2021 opened a new era in the study of compact astrophysical objects. For unresolved sources, polarimetry is the only way to learn about the source geometry. In this talk, I will highlight the progress made thanks to IXPE in understanding the geometry and physics of emitting regions in accreting black holes and neutron stars.

Author: POUTANEN, Juri

Presenter: POUTANEN, Juri

Session Classification: X-ray polarimetry and spectroscopy

Contribution ID: **58** Type: **Solicited**

The halo-galaxy link at high redshift JWST galaxies

The evolution of massive halos at high redshifts (z>9) is examined using constrained N-body simulations. The simulations are used to establish the relationship between the star formation rate and halo mass. A simple model based on the local (z=0) star formation is shown to account for the mildly elevated star formation rate at high redshifts.

Author: NUSSER, Adi

Presenter: NUSSER, Adi

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **59** Type: **Invited**

JWST View of the Earliest Supermassive Black Holes

Tuesday 8 October 2024 17:50 (30 minutes)

The formation and growth of the earliest supermassive black holes (SMBHs) and the assembly of early massive galaxies are among the most important open questions. As the most luminous non-transit objects, quasars at z > 6 are indispensable probes of the early Universe. The recent high-z quasar surveys have pushed quasar frontier to z>7.5. The launch of JWST opens up a new era in the study of early quasars, with the unparalleled wavelength coverage, high sensitivity, and high spatial resolution. I will summarize recent studies of high-redshift (z>˜6) quasars using JWST with regard to these early SMBHs and their host galaxies. These new results include measurements of BH masses, direct image of UV/optical emission in the quasar host galaxy, evidence of strong AGN feedback, detailed investigation of the quasar-galaxy merging system, and constraints on the quasar environment. All of these can provide us with a more comprehensive picture, helping to connect active SMBHs, their host galaxies, and large-scale environments as a whole in the early Universe. In addition, JWST offers the first chance to systematically search for obscured and faint AGN at high redshift, complementary to the findings from luminous quasars.

Author: YANG, Jinyi

Presenter: YANG, Jinyi

Session Classification: Black holes, QSOs and galaxies at cosmic down

Contribution ID: **60** Type: **Invited**

Particle acceleration in the high-energy Universe

Tuesday 8 October 2024 15:35 (30 minutes)

The acceleration of charged particles to very high energies in powerful astrophysical sources such as pulsar winds, active galactic nuclei, gamma-ray bursts etc., represents a central question in modern high-energy astrophysics, astroparticle physics and nowadays, multi-messenger astronomy. Accelerated particles can interact with and radiate in ambient fields to produce secondary photon or neutrino fluxes, or escape the source to become part of the cosmic ray spectrum. This seminar will discuss the physics of (Fermi-type) acceleration scenarios from first principles and present some applications in concrete astrophysical phenomena.

Author: Dr LEMOINE, Martin (APC (CNRS - U. Paris Cite))

Presenter: Dr LEMOINE, Martin (APC (CNRS - U. Paris Cite))

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **61** Type: **Invited**

SMBH transients and extreme AGN variability in the era of wide-field time-domain surveys

Wednesday 9 October 2024 10:00 (30 minutes)

Wide-field time-domain surveys across the multi-wavelength spectrum have revealed a complex array of transient and variable phenomena from SMBH populations, including flares from tidal disruption events (TDEs), 'changing-look'events when AGN broad lines appear or disappear following an optical flare, and other classes of extreme AGN variability. These events provide important insights into the formation and growth of the SMBH population, as they help us understand the SMBH mass function across redshift, and the physical mechanisms behind accelerated accretion episodes arising from disk instabilities and tidal disruption of stars. I will provide an overview of how optical, spectroscopic, and radio surveys have identified populations of such transient phenomena, and discuss the big questions that we hope to answer in the era of LSST at Rubin Observatory, Ultrasat, and new time-domain radio surveys such as the ASKAP Variable and Slow Transients Survey.

Author: Dr WARD, Charlotte (Princeton University)

Presenter: Dr WARD, Charlotte (Princeton University)

Session Classification: TDE and other transients

Contribution ID: **62** Type: **Invited**

Extragalactic X-ray Surveys from Deep to Wide

Monday 7 October 2024 09:00 (40 minutes)

I will briefly review what X-ray surveys and their multiwavelength follow-up have revealed about the sources constituting the cosmic X-ray background (CXRB), focusing on results from the past 25 years from missions including Chandra, Einstein Probe, INTEGRAL, NuSTAR, SRG, Swift, and XMM-Newton. I will first detail the identification, classification, and basic nature of the extragalactic sources detected in X-ray surveys: active galactic nuclei, galaxies, clusters and groups, and transients. Since active galactic nuclei are the dominant contributors to the CXRB, I will present some fundamental insights about their demographics, physics, and ecology revealed by X-ray surveys. I will conclude by describing some significant unresolved questions and prospects for advancing the field with new observations, future missions, and complementarity with multiwavelength very wide-field surveys.

Author: BRANDT, William (Penn State University)

Presenter: BRANDT, William (Penn State University)

Session Classification: Surveys and missions

Contribution ID: **63** Type: **Invited**

Two types of extreme nuclear transients

Wednesday 9 October 2024 11:30 (30 minutes)

Galactic nuclei are extreme environments where stars are densely packed around a supermassive black hole (SMBH). Occasionally, dynamical interactions in the galactic center cause stars to interact violently at short distances with each other or with the SMBH, resulting in the formation of nuclear transients. In this talk, I will discuss two types of extreme nuclear transients: extreme tidal disruption events (eTDEs) and high-velocity destructive stellar collisions. TDEs are one of the most dramatic nuclear transients in which a star is tidally disrupted by the SMBH, generating a bright flare. eTDEs are the most relativistic observable TDEs, constituting the majority of TDEs by relatively massive BHs (> 10ˆ7Msol) with observational signatures qualitatively different from those of ordinary TDEs. On the other hand, high-velocity destructive stellar collisions occur when two stars collide at velocities exceeding their surface escape velocity (> 1000km/s) near the central SMBH. The collision product, a homologously expanding gas cloud, can generate a UV/optical flare as bright as TDEs. Subsequently, the expanding gas cloud would interact with the nearby SMBH, generating a second, possibly even brighter, accretion-driven flare. I will conclude the talk with the implications of these events.

Author: RYU, Taeho (Max Planck Institute for Astrophysics)

Presenter: RYU, Taeho (Max Planck Institute for Astrophysics)

Session Classification: TDE and other transients

Contribution ID: **64** Type: **Invited**

Don’t Kill the Messenger: Electromagnetic Spectroscopy of Back Holes

Thursday 10 October 2024 10:40 (30 minutes)

The advent of gravitational wave astronomy has fundamentally changed our view of Black Holes, as far as their demographics are concerned. Likewise, the VLBI submm interferometric observations have finally directly shown us the relativistic distortions of spacetime close to a Black Hole. We may also detect neutrinos from extragalactic sources. I will argue that these novel observations nicely complement, but not supersede, the capabilities of ‘classical’ electromagnetic observations, specially spectroscopic ones.

Author: PAERELS, Frederik

Presenter: PAERELS, Frederik

Session Classification: X-ray polarimetry and spectroscopy

Contribution ID: **65** Type: **Invited**

Are We Prepared to Observe the Next Galactic Supernova?

Wednesday 9 October 2024 09:00 (30 minutes)

Supernovae are among the most energetic and luminous events in the universe, providing unique opportunities to study stellar evolution, nucleosynthesis, the dynamics of interstellar matter, and the physics of stellar remnants such as neutron stars and black holes. The next galactic supernova could offer unprecedented insights if we are adequately prepared to discover it. This paper briefly discusses the current astronomical capabilities to detect, monitor, and analyze the next supernova occurring within our galaxy.

Author: Prof. DELLA VALLE, Massimo (INAF-Capodimnonte, Naples)

Presenter: Prof. DELLA VALLE, Massimo (INAF-Capodimnonte, Naples)

Session Classification: GRBs and SNe

Contribution ID: **66** Type: **Regular**

The X-ray-UV Luminosity relation of AGNs revisited

In this work we will scrutinize the universality of the well-known non-linear relation between the UV and X-ray luminosity of AGNs. The LX-LUV correlation provides insights on the energy generating mechanisms and structural characteristics of AGNs, but it has also been proposed as a cosmological probe, under the assumption that it is redshift independent. However, recent works on the subject report a possible evolution of the relation, with an unclear yet interpretation. We revisit the LX-LUV correlation, based on the latest SDSS QSO catalog combined with new X-ray observations from the German eRosita DR1 (ERASS1) and archival XMM-Newton data. We develop a novel hierarchical Bayesian model, which accounts for the Poisson nature of the X-ray observations and allows a uniform treatment of upper limits and non-detections. The complex likelihood of the problem is efficiently sampled by the Hamiltonian Markov Chain Monte Carlo code STAN to yield robust constraints on the correlation and its possible evolution. Moreover, we will explore the possible imprints of interesting AGN subsets on the UV/X-ray correlation, i.e., via their deviation from the correlation of the average population. These populations include, e.g., AGN outflows, possibly linked to systems that show radio emission or reddened optical continua, and X-ray weak AGNs.

Author: Dr CHIRA, Maria (IAASARS, National Obs. Athens)

Co-authors: Dr RUIZ, Angel (IAASARS, National Obs. Athens); Dr GEORGAKAKIS, Antonis (IAASARS, National Obs. Athens)

Presenter: Dr CHIRA, Maria (IAASARS, National Obs. Athens)

Session Classification: Physics of AGN

Contribution ID: **68** Type: **Invited**

Machine learning models for SRG/eRosita extragalactic sky: challenges, results and perspectives.

Monday 7 October 2024 12:10 (30 minutes)

During the 2.5 years in 2019-2022 the eROSITA telescope onboard the SRG space observatory produced a deep all-sky survey in soft X-rays. The competitive analysis of this unique data requires: firstly, massive usage of publicly available sky surveys (photometric, spectroscopic, astrometric) in the broad spectral range from Radio to UV; secondly - intensive application of modern machine learning techniques, such as - Gradient Boosting and Random Forest quantile regression and classifiers, t-distributed Stochastic Neighbor Embedding, Density-Based Spatial Clustering of Applications with Noise, and other techniques suitable for tabular data of astronomical catalogs.

I will review the current status and main results achieved so far with SRGz system for analysis of eRosita X-ray data in the Eastern Galactic Hemisphere. SRGz contains machine learning methods adopted for X-ray astrophysics tasks, such as, X-ray object optical/IR match, object physical classification and photometric redshift measurement. I will discuss identification of distant and luminous X-ray quasars at z>5 and photometric prediction of BPT-class and optical spectral lines properties for X-ray objects at z<0.4.

Author: MESHCHERYAKOV, Alexander

Presenter: MESHCHERYAKOV, Alexander

Session Classification: Surveys and missions

Contribution ID: **69** Type: **Solicited**

The new era of extragalactic Fast X-ray Transients

Wednesday 9 October 2024 12:00 (25 minutes)

Extragalactic Fast X-ray Transients (FXTs) are X-ray flashes lasting minutes to hours. Their nature is unclear, but the most remarkable scenarios related to them are shock breakout supernovae, tidal disruption events involving white dwarf stars and intermediate massive black holes, and binary neutron star mergers. Observing them using different wavelength facilities in the coming hours and days after the X-ray emission is essential to understand their nature. In this talk, I will discuss the most important results of FXTs (e.g., energetics, host galaxies, and progenitors) detected by Chandra and XMM-Newton (identified through mining data methods), as well as the last detections done by the Einstein Probe mission and their novel multi-wavelength detections.

Author: QUIROLA, Jonathan (Radboud university)

Presenter: QUIROLA, Jonathan (Radboud university)

Session Classification: TDE and other transients

Contribution ID: **70** Type: **Invited**

SRG/eROSITA results in the Western Galactic hemisphere

Monday 7 October 2024 11:10 (30 minutes)

5 years after the launch from the Russian Baikonur Cosmodrome, all systems and instruments of the Spektr-RG (SRG) observatory are working perfectly. With eROSITA, the German contribution to this mission, half of all 8 sky surveys have been completed so far. Millions of X-ray sources, mostly of an extragalactic nature, have been discovered. This has confirmed what we had hoped for before the launch: In principle, we could easily achieve our goals of discovering 100,000 galaxy clusters, 3 million AGN and nearly 1 million galactic sources across the entire sky. Although the operation of eROSITA is suspended, fundamental discoveries and surveys have already been made with unprecedented sensitivity. I will report on discoveries in the western half of the sky that the German eROSITA consortium is responsible for analyzing. These include galactic objects such as stars, supernova remnants and extragalactic objects at great distances such as AGN and galaxy clusters.

Author: PREDEHL, Peter (Max-Planck-Institut für extraterrestrische Physik)

Presenter: PREDEHL, Peter (Max-Planck-Institut für extraterrestrische Physik)

Session Classification: Surveys and missions

Contribution ID: **71** Type: **Invited**

Multi-wavelength surveys in the Cherenkov Telescope Array era

Tuesday 8 October 2024 14:45 (30 minutes)

The Cherenkov Telescope Array will bring an entirely new view on high-energy transients. This opportunity will be enhanced by the coming on line of various large field-of-view ground-based and orbiting facilities that will paint a multi-wavelength picture of the variable sky. I will discuss some of the exploration areas and projects development, including the VST Polarimetric camera (VSTPol).

Author: Dr PIAN, Elena (INAF-OAS, Bologna)

Presenter: Dr PIAN, Elena (INAF-OAS, Bologna)

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **72** Type: **Invited**

Recent Developments Towards All-sky Surveys and Selected Results from Ground-based Gamma-ray Astrophysics

Tuesday 8 October 2024 14:15 (30 minutes)

In this report we would like to discuss recent developments in ground-based gamma-ray astrophysics. Since the 1990s, very high energy gamma rays have been studied with the Imaging Atmospheric Cherenkov Telescopes (IACT), which measure the Cherenkov light component of air showers. These have high sensitivity in a field of view of several degrees and can provide angular resolution on the order of 0.05°-0.1°, but can only measure during clear, dark nights, for a total of about 1000 hours per year. Typically, a single source can be observed with an IACT for about 200 hours per year. Ground-based detectors such as HAWC, TIBET and LHAASO perform source observations by measuring elementary particles from air showers. These high-altitude detectors measure sources in their 1-2 srad wide field of view for about 6 hours per day, a total of about 2000 hours per year. Their angular resolution is 5-6 times worse compared to the IACT technique. The sensitivity of both techniques is similar, scaling linearly with the signal detection area and the background rejection efficiency. We plan to discuss some selected source detections using these different techniques and outline the prospects for the future developments that will be based on the combination of both techniques.

Author: Dr MIRZOYAN, Razmik (Max-Planck Institute for Physics)

Presenter: Dr MIRZOYAN, Razmik (Max-Planck Institute for Physics)

Session Classification: X-rays and VHE gamma-rays

Contribution ID: **73** Type: **Invited**

An Overview of the China Space Station Telescope

Thursday 10 October 2024 15:10 (30 minutes)

The 2m-aperture China Space Station Telescope (CSST, also known as the Xuntian Space Telescope) is a major science project of China Manned Space Program. With a Cook-type three-mirror anastigmat design, the CSST can achieve superior image quality within a large field of view (FoV). It will be equipped with 5 first-generation instruments including a Survey Camera, a Terahertz Spectrometer, a Multichannel Imager, an Integral Field Spectrograph, and a Cool Planet Imaging Coronagraph. The primary task of the CSST is to carry out a high-resolution large-area multiband imaging and slitless spectroscopy survey covering the wavelength range of 255 nm to 1000 nm. It will take the Survey Camera roughly 7 years of operation accumulated over 10 years of orbital time to image roughly 17,500 square degrees of the sky in NUV, u, g, r, i, z, and y bands and take slitless spectroscopy of the same sky in 3 bands. In this talk, I will give a brief introduction of the project and show recent test results of the instruments.

Author: Prof. ZHAN, Hu

Presenter: Prof. ZHAN, Hu

Session Classification: Future missions

Contribution ID: **74** Type: **Invited**

Black holes all over the Universe

Tuesday 8 October 2024 10:20 (40 minutes)

We were quite fortunate with John Wheeler introducing the concept of Black Hole (BH) and more important using the Kerrr mathematical solution to find the BH mass energy formula with Christodoulou and Hawking. We have been equally fortunate to participate in developing the largest observational effort extending to the earliest million years from the Big Bang and observing BH in all range of Masses from 10 to 10+11 Solar masses (SMBH). In all this the development of the Binary Driven Hypernova model based on a simple CO core of 10 Msun and a companion binary NS , with its seven Episodes, is guiding to establishing new physical laws in yet unobserved extra-galactic systems and, equally important in challenging and were appropriate,dismantling some of the acquired astrophysical knowledge in our Galaxy. We are further expanding the understanding of the BDHN model at earlier times. We are using this acquired knowledge in:
1) probing how to extend these results to SMBH in active galactic nuclei
2) in identifying one of the most elusive components to identify the origin of SMBH. We proceed by accurately studying the physics ongoing in our galactic Center
3) we need to further comprehend the fundamental role of the 4 parameters of a BH : mass, charge, angular momentum and irriducible mass which severely limit the possibility of extracting energy from a BH or a SMBH using gravitational non linear interactions while allowing the, same processes, to proceed with more elementary linear interactions.This is crucial to understand the inner structure of our Universe

Author: Prof. RUFFINI, Remo (ICRANet)

Presenter: Prof. RUFFINI, Remo (ICRANet)

Session Classification: GRBs and SNe

Contribution ID: **75** Type: **Invited**

Astrophysics after almost three years of the Imaging X-ray Polarimetry Explorer (IXPE)

Thursday 10 October 2024 09:30 (40 minutes)

X-ray Astronomy emerged in the early 1960s, and it quickly became evident that X-ray polarimetry would be crucial for interpreting data from celestial sources discovered thereafter. However, the experimental results from those early attempts were limited. On one hand, the sources were less polarized than expected; on the other, the sensitivity of the experimental techniques was still inadequate. Despite these initial challenges, scientists continued to refine their methods, and by 2001, it was demonstrated that the photoelectric effect in gas—a key to unlocking a new window in Astrophysics—could be used efficiently. It wasn't until 2021 that it became possible to launch an observatory with sufficient sensitivity, utilizing the photoelectric effect. The Imaging X-ray Polarimetry Explorer (IXPE), a NASA-ASI mission, is the first Small Explorer to feature three mirror units designed specifically for this purpose.
In this talk, I will present the enabling technology that led to this breakthrough in Astrophysics, the IXPE mission profile, and the main and latest scientific results achieved in its first $\sim$ 2.7 years of operation. These include angularly resolved polarimetry of Supernova Remnants, Pulsar Wind Nebulae, and Molecular Clouds, as well as studies of compact objects like black holes and neutron-star binaries, and Active Galactic Nuclei. Lastly, I will outline potential future directions following IXPE's discoveries.

Author: Dr SOFFITTA, Paolo

Presenter: Dr SOFFITTA, Paolo

Session Classification: X-ray polarimetry and spectroscopy

Contribution ID: **76** Type: **Invited**

Electron-positron pair creation in electrosphere of compact astrophysical objects

Tuesday 8 October 2024 12:05 (20 minutes)

We will discuss pair creation by electrically neutral compact astrophysical objects, having sufficiently sharp positively charged surface boundary to create an electrosphere with overcritical electric field. Two types of energy sources will be considered: heat and radial electromagnetic perturbation. Implications for astrophysical observations will be outlined.

Author: VERESHCHAGIN, Gregory

Co-author: PRAKAPENIA, Mikalai (ICRANet-Minsk, Belarus)

Presenter: VERESHCHAGIN, Gregory

Session Classification: Physics of AGN

Contribution ID: **77** Type: **Invited**

Application of Neural Networks to Study Blazars

Tuesday 8 October 2024 09:30 (30 minutes)

The integration of Artificial Intelligence (AI) into astronomy and astrophysics marks a transformative era in the exploration of the Universe, enhancing the analysis of vast data sets with unparalleled efficiency and precision. AI is revolutionizing the usability of observational data, expanding our understanding of various cosmic phenomena. Blazar research particularly benefits from the application of AI. In this talk, I will present a pioneering effort in employing a Convolutional Neural Network (CNN) for the efficient modeling of blazar emissions. Blazars are among the most powerful extragalactic sources, emitting across the entire electromagnetic spectrum, from radio to very high-energy gamma-ray bands. As significant sources of non-thermal radiation, blazars are frequently monitored by various telescopes, leading to the accumulation of substantial multi-wavelength data over different time periods. Also, over the years, the complexity of models of blazar emission has dramatically increased which hinders parameter exploration and makes data interpretation through model fitting challenging. By training the CNN on lepton-hadronic emission models generated for a set of models computed with the kinetic code SOPRANO, which considers the interaction of initial and all secondary particles, the resultant CNN can accurately model the radiative signatures of electron/proton interactions in relativistic jets. This CNN-based approach significantly reduces computational time, thereby enabling fitting to multi-wavelength (photons) and multi-messenger (neutrinos) datasets. The adoption of this AI-driven methodology enables self-consistent modeling of blazar emissions, offering profound insights into their underlying physics and potentially uncovering new astrophysical phenomena. I will present and discuss several results where these networks have been used to model multi-wavelength, multi-temporal data from blazar observations.

Author: SAHAKYAN, Narek (ICRANET-Armenia IO)

Presenter: SAHAKYAN, Narek (ICRANET-Armenia IO)

Session Classification: Physics of AGN

Contribution ID: **78** Type: **Invited**

Recent Results from the Pierre Auger Observatory and its upgrade AugerPrime

Monday 7 October 2024 17:35 (30 minutes)

The Pierre Auger Observatory is conceived to study ultra-high energy cosmic rays from about 10ˆ17 eV to beyond 10ˆ20 eV. It is a multi-hybrid Observatory comprising 1660 surface detector stations spread over an area of 3000 km2 over-looked by 27 imaging Fluorescence telescopes erected at four sites at its periphery. Each of the detector stations consists of a 10 m2 water Cherenkov detector which is covered by a 3.8 m2 plastic scintillator and with a dual-polarized radio antenna (30-80 MHz) placed at the top.
The first phase of data-taking began in 2004 and continued until the end of 2021. In this contribution, results from the Phase I data analysis of the Pierre Auger Observatory are presented. They include, among others, measurements of the cosmic-ray energy spectrum, composition, arrival directions, and multi-messenger studies involving searches for UHE photons and neutrinos. The plethora of results have provided many surprises that have significantly advanced the understanding of the Universe at the highest energies and it has also laid the foundation for second-phase studies with the upgraded AugerPrime detector. The status of the AugerPrime upgrade and its performance will be also discussed.

Author: KAMPERT, Karl-Heinz (Universität Wuppertal)

Presenter: KAMPERT, Karl-Heinz (Universität Wuppertal)

Session Classification: Cosmic rays

Contribution ID: **79** Type: **Invited**

The Multiwavelength Luminosity-luminosity correlation of AGNs can shed light on the relation between the AGN jet and accretion disk emisions

AGN jets are detected via their radio and/or gamma-ray emissions while the accretion disks by their X-ray to IR radiation. The relation between these two mechanism can be investigated using broad band spectra of bright sources or through population studies, in particular the luminosity-luminosity (L-L) correlation at different wavelength for large samples of AGNs. In general, there is a large dispersion in the strength of emission, and the luminosities calculated based on an assumed cosmological model show strong correlations. However, most of these correlations are not intrinsic to the source. A large part is due to the same dependence on redshift (or luminosity distances) that enter in calculating the luminosities from observed fluxes. A second factor is due to similar, but not identical, luminosity evolution of at different wavelengths. Thus, the determination of intrinsic L-L correlations is not straightforward. It is affected by the observational selection effects and other factors that truncate the data, sometimes in a complex manner. I will describe some non-parametric methods that allow us to correct the correlations for these effects and determine the true intrinsic correlation, which can shed light on the true relation between jet and accretion disk emissions. I will show results on L-L correlation between several pairs of wave bands.

The observed L-L correlations often show a non linear relation: [log(L_i)=nLog (L_j)+ C, with n not equal to 1]. Recently Risaliti and Lusso have claimed that this fact can be used to determine the redshift dependence of the luminosity distance, thus cosmological model parameters. This has given rise to a large number of publication. I will describe the problem with this procedure.

Author: PETROSIAN, Vahe' (Stanford University)

Presenter: PETROSIAN, Vahe' (Stanford University)

Session Classification: Physics of AGN

Contribution ID: **80** Type: **Invited**

Highlights and discoveries from SRG/ART-XC

Monday 7 October 2024 11:40 (30 minutes)

An overview of highlights and discoveries from Mikhail Pavlinsky ART-XC telescope on board the SRG observatory is presented. Since 2019 SRG/ART-XC has conducted several full all sky surveys as well as a deep survey of our Galaxy. As a result, we obtained the catalogue of hard X-ray sources detected at the all sky, which includes more than one and a half thousand objects, most of them are active galactic nuclei. Hundreds of new objects have been detected during all sky and galactic surveys, including the microquasars, slowly rotating neutron stars, dwarf novae flares, Swift J1727.8-1613 - the brightest object in the X-ray sky of 2023. In February 2024 SRG/ART-XC discovered a new accreting millisecond pulsar demonstrating quasi regular X-ray bursts and effects of the GR in its pulse profile. We also detected a number of gamma-ray bursts, including the most powerful one, GRB221009A. At this moment SRG/ART-XC continues the all sky surveys.

Author: LUTOVINOV, Alexander

Presenter: LUTOVINOV, Alexander

Session Classification: Surveys and missions

Contribution ID: **81** Type: **Invited**

BIack Holes and Massive Galaxies in the Early Universe

Friday 11 October 2024 10:20 (30 minutes)

Recent observations with the JWST and ALMA identified at z > 10 massive star forming galaxies of up to 1011 solar masses that are already quench at z > 3. This very early formation and rapid evolution of massive galaxies produced great surprise, because it is difficult to reconcile with standard ΛCDM predictions alone. I will show that BH feedback regulate the formation and evolution of massive galaxies in the early Universe. Since the diameter of the Universe decreases with redshift z as 1/(1+z), the global gas density of the Universe increases with redshift, positive BH-feedback becoming a relevant mechanism in the early Universe. Observations with JWST and ALMA confirm this prediction, and in this context, the existence of massive star formation galaxies at z > 10 that are already quench at z > 3 is not surprising. If the SMBHs of more than 107 solar masses found in quasars up to z = 7 result from rapidly growing BH seeds, I conclude that BHs come first and their feedback regulate the early formation, growth and quench of massive galaxies in the early Universe.

Author: MIRABEL, Felix

Presenter: MIRABEL, Felix

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **82** Type: **Invited**

Overview of SRG/eROSITA results in the Eastern Galactic hemisphere

Monday 7 October 2024 10:10 (30 minutes)

After more than two years of scanning the sky the eROSITA X-ray telescope aboard SRG orbital observatory produced the best ever X-ray maps of the sky and discovered more than three million X-ray sources, of which about 20% are stars with active coronas in the Milky Way, and most of the rest are galaxies with active nuclei, quasars and clusters of galaxies. eROSITA detected over 10ˆ3 sources that changed their luminosity by more than an order of magnitude, including about a hundred tidal disruption events. Two tidal disruption events are associated with IceCube neutrinos. SRG/eROSITA samples of quasars and galaxy clusters will make it possible to study the large-scale structure of the Universe at z˜1 and measure its cosmological parameters. I will review some of the SRG/eROSITA results in the Eastern Galactic hemisphere.

Author: Prof. GILFANOV, Marat

Presenter: Prof. GILFANOV, Marat

Session Classification: Surveys and missions

Contribution ID: **83** Type: **Invited**

Multimessenger View of High-Energy Cosmic Neutrino Sources

Thursday 10 October 2024 11:40 (40 minutes)

The discovery of high-energy cosmic neutrinos opened a new window of astroparticle physics. Their origin is a new mystery in the field, which is tightly connected to the long-standing puzzle about the origin of cosmic rays. I will discuss theoretical implications of the latest results on high-energy neutrino observations, and demonstrate the power of multimessenger approaches. In particular, I will highlight the recent developments about astrophysical neutrino emission from supermassive black holes and the Galactic plane.

Author: Dr MURASE, Kohta (Penn State University)

Presenter: Dr MURASE, Kohta (Penn State University)

Session Classification: Neutrino astronomy

Contribution ID: **84** Type: **Regular**

Formation of the first halos, galaxies and magnetic fields

Friday 11 October 2024 11:20 (20 minutes)

Cosmic objects with magnetic fields (quasars, AGNs) are observed at redshifts z≥7 and more (for instance, for z=10.073±0.002) indicates the early creation of magnetic fields. The observations of the cosmic telescope JWST show that the first galaxies were formed at redshifts z≃15 - 20. The early formation of galaxies creates favourable conditions for high impact of the Compton scattering of the relic radiation photons and electrons on the electron temperature and leads to the partial separation of electrons and protons. Together with turbulent motions such separation stimulates creation of magnetic fields on a galactic scale.

Author: LARCHENKOVA, Tatiana

Presenter: LARCHENKOVA, Tatiana

Session Classification: Promoridial black holes, sky surveys and Cosmology

Contribution ID: **85** Type: **Invited**

SRG/eROSITA and microwave observations of clusters of galaxies - synergy and competition

Monday 7 October 2024 14:30 (40 minutes)

SRG/eROSITA and microwave observations of clusters of galaxies

Author: SUNYAEV, Rashid

Presenter: SUNYAEV, Rashid

Session Classification: Surveys and missions

Contribution ID: **86** Type: **Invited**

NewAthena Update

Thursday 10 October 2024 14:40 (30 minutes)

I will briefly review the current status of the NewAthena mission, with particular emphasis on its NewScience Performances for surveys and spectroscopic follow-ups

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Science highlights of the APEX X-ray probes

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The National Academies'2020 Decadal Survey in Astronomy and Astrophysics, Pathways to Discovery in Astronomy and Astrophysics for the 2020s recommended probe missions to be competed to accomplish the survey's scientific goals. In particular, a far-infrared or an X-ray probe was recommended. In response to this, NASA posted the Astrophysics Probe Explorer Announcement of Opportunity (AO), to select one between a far infrared imaging or spectroscopy mission, and X-ray probe. In this talk, I will present highlights from the 5 X-ray concepts that were proposed for this AO, focusing on their science goals.

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