



International conference

*Non-Stable Phenomena
in the Universe*

*Byurakan Astrophysical Observatory, Byurakan, Armenia
18-21 September 2023*

ABSTRACT BOOK

Invited speakers

- Ruben Andreyan** (Armenia)
- Haik Harutyunian** (Armenia)
- Dana Kovaleva** (Russia)
- Sergey Makarov** (Russia)
- Oleg Malkov** (Russia)
- Areg Mickaelian** (Armenia)
- Evgeny Mikhailov** (Russia)
- Arthur Nikoghossian** (Armenia)

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Proceedings

The Proceedings of the Conference will be published in the Communications of BAO (ComBAO) refereed journal, Vol. 70, Issue 2 in December 2023. The deadline for submission of papers is 30 November 2023. Instructions for preparation of the papers are given at <https://combao.bao.am/instructionsauthors.php>.

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Invited talks [IT]

1. The role of environment on the formation of different FR type extragalactic radio sources

R. Andreasyan, G. M. Paronyan and A.G. Sukiasyan
(**Affiliation:** Byurakan Astrophysical Observatory, **E-mail:**
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We study the environment of nearby extragalactic radio sources of different morphological type from our sample. We chose 30 3C radio galaxies of different FR class for which we have several observational data on wavelength from radio to X ray. For the study we select the regions with radius of 500 pc around of the parent galaxy of radio sources. We bring the optical maps of these regions that are overlaid on the radio maps and maps in all available wavelength. The preliminary review show that there are some differences in the neighboring regions around radio galaxies of different FR classes.

2. Activity phenomena in the baryonic universe as a result of the interaction of baryonic objects with the carrier of dark energy

H. Harutyunian

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There is no doubt that any active phenomenon in the baryonic world is associated with the release of a certain amount of excess energy. The issue of where this energy comes from has always been one of the liveliest discussions. Over time, many different mechanisms have been proposed. However, scientific mainstream eventually settled on the accretion mechanism as the most efficient source of energy on all scales. Despite this, it can now be easily argued that after the discovery of dark energy, the situation has changed dramatically and again there is a need for new mechanisms. Here we consider a completely different mechanism that pumps portions of dark energy into baryonic objects, which sooner or later turns them into an unstable or active state.

3. Observational evidence of instability phenomena related to open star clusters based on Gaia data

D. Kovaleva

(**Affiliation:** Institute of Astronomy, Russian Acad. Sci., **E-mail:** dana@inasan.ru)

The vast amount of high quality astrometric and photometric data from Gaia space mission opened new prospects in the investigation of the population of galactic star clusters. In particular, a number of observational evidence have emerged in relation to the phenomena of instability which previously were mainly predicted by dynamical simulations. These are signs of former violent relaxation, ongoing tidal disruption, interaction between the clusters and results of disruption of the clusters. We shall discuss methods of discovery of such evidence and its spatial and kinematic characteristics.

4. Terrestrial complex for receiving information from small spacecrafts

S.B. Makarov, S.V. Volvenko, S.V. Zavyalov, I. Lavrenyuk, M.Ya. Vinnichenko, **A. K. Aharonyan**, V.H. Avetisyan

(**Affiliation:** Russian-Armenian University, **E-mail:** aharon.aharonyan@rau.am)

The work is devoted to the development of a terrestrial complex for receive and process information from small spacecrafts. The main requirement for these stations is their simplicity and maximum availability both in terms of cost and operating capabilities. Such stations provide a two-way exchange of information with spacecrafts in the frequency range 435-438 MHz, receive and process data transmitted in the VHF band by amateur and student satellites, and receive communications from the international space station crew and radio amateurs on Earth.

5. Gaia arguments for and against a hypothetical Sun companion

O. Malkov

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The hypothesis that the Sun is a component of a binary star system has been around for about a hundred years. Assumptions about the nature of the companion continue to be published as new observational data become available. The talk shows that the results of the work of the Gaia space observatory impose certain restrictions on the nature and location of the companion. The fact that the companion is not registered by the observatory leaves the following marginal possibilities: a cool brown dwarf (Y3 and later) in an orbit inside the Oort cloud, or an L/T brown dwarf in a higher orbit. At the same time, the companion is quite likely cataloged in the 2MASS and WISE surveys.

6. Viktor Ambartsumian: most important results and achievements

A. Mickaelian

(**Affiliation:** Byurakan Astrophysical Observatory, **E-mail:**aregmick@yahoo.com)

I will review Viktor Ambartsumian's most important scientific results and achievements, both at local and international level. These include his positions, membership, titles, awards, etc.

7. Fine classification of active galaxies from the VCV-13 catalogue

A. Mickaelian

(**Affiliation:** Byurakan Astrophysical Observatory, **E-mail:**aregmick@yahoo.com)

We have developed a fine classification scheme for active galaxies and we have introduced several new types and subtypes, all linked to the most accepted classifications. We have classified this way Markarian galaxies, Blazars, ULIRGs/HLIRGs sample, radio variables, etc. To have a homogeneous understanding on active galaxies (both AGN and Starbursts), we have carried out fine classification for activity types for VCV-13 catalogue objects based on the SDSS spectroscopy (all objects with $V < 17.7$). Some 2000 objects having homogeneous classification will allow statistical analysis of large samples of AGN and Starbursts.

8. Role of galactic disc thickness in magnetic field generation

E. Mikhailov, M.V.Pashentseva

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Nowadays it is well-known that different galaxies have regular magnetic fields. The most probable explanation of their origin is connected with the dynamo mechanism, which is connected with simultaneous action of alpha-effect and differential rotation. It is a principally threshold effect: the possibility of the field generation is described by so-called dynamo number (it is constructed of observed parameters of the galaxy) which should exceed some critical value to make the growth possible. There are various approaches to model the dynamo processes, but they are usually connected with taking into account symmetry of the objects. A large amount of galaxies have been studied using thin disc approximation which considers only two components of the field [1]. The spectral analysis of the corresponding differential operator gives quite accurate results for the critical dynamo number and the field growth rate [2]. However, there are some objects that are quite thick. As for them, the vertical structure plays a significant role. It makes necessary to use the perturbation theory to obtain the growth rates and critical values of the dynamo

number [3]. Here we present our analytical results for thick discs and compare them with numerical modeling and simpler limit case of infinitely thin objects. References: 1. D.Moss. MNRAS, 275, 191 (1995), 2. E.Mikhailov. Magnetohydrodynamics, 56, 281 (2020), 3. E.A.Mikhailov, M.V.Pashentseva. Moscow University Physics Bulletin, 77, 741 (2022).

9. Evolution of spectral lines as a function of physical conditions in the medium illuminated by nonstationary energy sources

A. Nikoghossian

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We summarize the results of our research on the influence of various physical factors on the evolution of linear spectra formed in a medium illuminated by non-stationary energy sources.

Contributed talks [CT]

1. Radio/opt flux ratios of Mrk galaxies and Blazars

H. Abrahamyan

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For understanding some physical properties of Active Galactic Nuclei we must understand what kind of relation have fluxes in radio and optical ranges. In our investigation, we consider Markarian 1515 galaxies and 3561 Blazars (from Massaro et al. BZCAT v.5). Having these fluxes, we estimate radio/opt flux ratios for these objects and try to get connection between different types of Blazars and Markarian galaxies. We give the average flux ratios and its ranges for different types of objects (different activity types for Mrk galaxies and 4 groups for Blazars: BZB, BZQ, BZG and BZU). It is especially useful to understand the differences in radio emission between BL Lac objects and Flat Spectrum Radio Quasars (FSRQ). Mrk galaxies in their turn, are obviously divided into AGN and Starburst subtypes, as well as many Abs line galaxies are present.

2. Infrared study of G25.65+1.05 UCHII region

D. Andreasyan

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Ultra-compact HII (UC HII) regions are an important phase in the formation and early evolution of massive stars. The main objective of this work is to study the stellar content associated with the G25.65+1.05 UCHII region, in particular, to characterize the embedded young stellar objects (YSOs), such as their mass, evolutionary age and age spread, spatial distribution, luminosity function. We used near-, mid-, and far-infrared photometric data to identify and classify the YSOs. Their main parameters were determined by the spectral energy distribution (SED) fitting tool using radiation transfer models.

3. The Fibonacci sequence in galaxies

Z. Ashrafzadeh

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The Universe Basically follows certain patterns that researchers find them in most natural phenomena. Considering the way the leaves, stems and petals of the plant grow, you can clearly see that they grow in a pattern. On the other hand, researchers still observe these patterns in storms, sea waves, elephant ivory and even in the solar system and galaxies. Therefore, these natural patterns show themselves well in the universe, especially in celestial objects such as galaxies. In this study, we investigated and found that the best pattern close to the universe, especially galaxies, is the Fibonacci sequence, that is the series of numbers 0,1,1,2,3,5,8... the next number is found by adding up the two numbers before it. Also, the ratio of successive numbers is very close to the golden ratio, the golden spiral always increase by this ratio, for every quarter turn the spiral makes, it gets winder by a factor of $\varphi = 1.618$. In our study, majority of the time a cosmic constant known as the 'golden ratio' is said to be found in the shape of galaxies and even solar system. The shape of spiral galaxies is a perfect golden spiral, spiral galaxies account for 77% of all galaxies discovered so far, including our very Own Milky Way and the spiral galaxy M81 have spiral patterns resembling the golden spiral. Also the planets are shown to have a trend, which follows the Fibonacci sequence with individual offsets attributed to planetary densities. The golden ratio is one of the most common ratios in nature and it can be used to analyze galaxies, especially the Milky Way because it has several spiralled arms that follow in the Fibonacci sequence.

4. The runaway nature and origin of α Crucis system

N. Azatyan

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Massive stars are always in the center of attention of astronomical research and a significant part of them (10-20%) move in space at a high (supersonic) velocity. We present results of study of the α Crucis system, located at a distance of ~ 114 pc from the Sun with observed bow shock around it. We used the data and images obtained by Gaia and WISE space telescopes. To determine the peculiar velocity of α Crucis system, we used the coordinates, distance, proper motion, and radial velocity. As a result, it was confirmed that α Crucis system is a runaway and has a space velocity of ~ 30 km/s. Then we managed to find a cluster to which the α Crucis system and was not kicked out from its parent cluster, but moves in space together with other members of the cluster. The geometric parameters of the bow shock are compatible to other known bow shocks.

5. The influence of environmental effects on Type Ia Supernovae Standardization

A. Baluta, M. Pruzhinskaya, P. Rosnet, N. Pauna

(Affiliation: Lomonosov Moscow State University, **E-mail:** nast0307@mail.ru)

Type Ia Supernovae (SNe Ia) are known to be good distance indicators in the Universe. It becomes possible thanks to the empirical relation between SN light curve parameters and luminosity. However, the Hubble diagram still shows some remaining intrinsic dispersion, which can be related to the effect of the supernova environment. In this work we study how the host galaxy morphology affects SN Ia standardization and cosmological analysis using 330 supernovae from Pantheon cosmological sample. We reproduce the Pantheon Hubble diagram fit and perform the fit separately for two SN groups according to the morphological type of their host galaxies: early-type and late-type. We found that in passive stellar environment SNe Ia have higher A_V and smaller A_V SALT2 standardization parameters than supernovae hosted by late-type galaxies. The early-type galaxies contain brighter supernovae after stretch and colour corrections. Thus, the host morphology correction does affect the Hubble diagram fit. We also noticed that the host mass correction alone was not enough to take the influence of the environment into account. The observed intrinsic scatter in SNe Ia luminosity can still be partially compensated by a more correct consideration of the environmental correction.

6. Identification of birth places of high-velocity stars: CepOB2 association

S. Ghazaryan, L. Hambardzumyan, K. Gigoyan, A. Grigoryan, K.-U. Michel, V. Hambaryan, R. Neuhaeuser

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We have searched high-velocity stars (runaway, walk-away, pulsars, HMXBs and LMXBs), which could have, most probably, originated in the complex CepOB2 association, i.e. in the cores (small clusters or multiple stellar systems) of it. With the trace-back motion study of them we found at least one triple (core, runaway and neutron star or pulsar), five pairs of runaway and neutron star and few HMXB and LMXB.

7. BL Lacertae: Classification of trajectory patterns of a quasi-stationary feature in a relativistic jet

L. Hambardzumyan, T.G. Arshakian and A.B. Pushkarev

(**Affiliation:** Byurakan Astrophysical Observatory, **E-mail:**
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We investigate the relativistic outflow of BL Lacertae and its special feature, a quasi-stationary component (QSC) most likely representing a master recollimation shock. Very long baseline array (VLBA) observations allow us to study the fine structure and dynamics of the inner parsec-scale jet of BL Lac. VLBA monitoring at 15 GHz showed the existence of QSC located at 0.26 mas from the radio core. Based on 164 epochs taken from the Monitoring of Jets in Active galactic nuclei with VLBA Experiments (MOJAVE) program, we performed a visual inspection of the QSC trajectory and identified repetitive trajectory patterns at different time scales, such as regular and irregular reversals and arc-shaped trajectories. In particular, we identified 20 U-type and 3 V-type reversals, some of which exhibit loop-like patterns. We developed an algorithm that (i) automatically cleans trajectory taking into account QSC positional errors, (ii) finds and classifies repetitive trajectories. Pros and cons of the results obtained with visual and automatic classification will also be presented and discussed.

8. Optical observations of asteroids on Zeiss-2000 telescope of Terskol observatory

D. Kaparulin, E.S. Bakanas, T.Yu. Galushina, P.A. Levkina, A.V. Shein
(**Affiliation:** Tomsk State University, **E-mail:** dsc@phys.tsu.ru)

We present some results of optical observations of asteroids on the Zeiss-2000 telescope of the Terskol observatory performed in 2020-2023. In total, five observational sessions were held, during which 28 unique objects of 18-22 magnitudes among the asteroids were observed. The studied objects included asteroids with small perihelion distances and other near-Earth asteroids. In order to detect faint objects, observational techniques of stacking of images and moving of telescope with the velocity of an asteroid, as well as a technique for construction of search ephemeris, were tested. The results increased the arc length and allowed to precise the orbital parameters of studied objects. The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (theme No. FSWM-2020-0049).

9. Application of small spacecraft for automatic identification of vessels

S.B. Makarov, S.V. Volvenko, I. Lavrenyuk, I.N. Gorbunov, M.Ya.
Vinnichenko, **A. K. Aharonyan, V.H. Avetisyan**

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The work is devoted to the development of a specialized complex based on a CubeSat 3U nanosatellite for receiving and processing signals from the AIS system. With the help of such system it is planned to form a domestic AIS space constellation. The urgency is connected with the current absence of the Russian Federation's own satellite means of obtaining AIS data for monitoring the movement of ships in the world's oceans and in its own water area. Access to this data is becoming critical in connection with the development of the Northern Sea Route and the development of shipping in the Azov, Black Seas and the Far East.

10. Unprecedented insights into the formation and evolution of the Galactic disk

M. Mardini

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The Galactic disk contains a substantial fraction of the baryonic matter angular momentum and at least two main stellar populations. Therefore, the formation and evolution of the Galactic disk is essential for understanding how our Galaxy was formed and evolved. We use accurate photometric metallicity estimates and Gaia Early Data Release 3 astrometries and two independent techniques (velocity and action space behavior) to select a highly pure sample of stars with $[\text{Fe}/\text{H}] < -0.8$ and thick disk-like kinematics. We confirm that the mean rotational velocity of this metal-poor sample lags the canonical thick disk by 30 km/s. Radially our sample has comparable size to the Galactic thick disk's size but is more extended vertically. Also it has orbital eccentricities distribution that bridges the typical thick disk and halo eccentricities. Finally we use the derived gradients the shape of the eccentricity distribution and theoretical thick disk formation scenarios to discuss the origin of our sample stars. Our results strongly indicate that this sample of stars is an independent disk population which we dub the Atari disk. Our sample shows that the Atari contains 11 stars with $[\text{Fe}/\text{H}] < -3.0$ and 261 with < -2.0 . Further investigation of literature stars reveals another 18 metal-poor stars of that kinematically belong our sample five of which have $[\text{Fe}/\text{H}] < -4.0$. This suggests that the Atari disk may harbor a significant portion of the most metal-poor stars. The existence of such metal-poor stars as well as the other observed properties of the Atari disk suggest an accretion origin in which a dwarf galaxy radially plunged into the early Galactic disk at early times.

11. The extragalactic sample of the Combined IRAS PSC/FSC catalogue

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To build the IRAS full extragalactic sample (including both point-like sources - QSOs, and extended ones - galaxies), we have applied several approaches. The cross-correlation of IRAS PSC/FSC Combined Catalogue with SDSS DR16 have revealed all objects marked as Galaxies in SDSS and all objects having extragalactic redshifts (both point-like and extended). For brighter sources, when all IR records are available, we use the IR colors, i.e. we follow the change of the flux from shorter to longer wavelengths; in case of a decrease, it is a high probability star and in case of an increase, it is a high probability galaxy or QSO. We can in fact estimate the type of all sources based on IRAS fluxes and quality flags data, as well as on AKARI and WISE/2MASS measurements. If all data show the same type of object, then we give it as a genuine (most confident) one, and if there is an ambiguity, we give the most probable type with a flag. We also carry out photometric study of IR galaxies and Quasars using SDSS ugriz magnitudes, APM classification of objects into point-like and extended, and the morphological study of the DSS and SDSS images. All this led to construction of a confident sample of optical counterparts of extragalactic objects of IRAS PSC/FSC: galaxies and quasars, the largest ever extragalactic IR sample.

12. Morphology of active galaxies based on SDSS images

**V. Mkrtchyan, A. Mickaelian, H. Abrahamyan, G. Mickaelian, G. Paronyan,
A. Suqiasyan**

(Affiliation: Byurakan Astrophysical Observatory, **E-mail:**
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Activity in galaxies has mainly two major reasons: Active Galactic Nuclei (AGN) and Starburst (SB). Their morphology is quite different. Moreover, different types of AGN have different morphology. However, this question has not yet been properly investigated and due to old low-quality images the morphology of many galaxies are not well described. SDSS images give good possibility to homogeneously classify galaxies and understand differences by the activity types. The concentration to the central part is a subject for detailed study. We use SDSS images to classify different types of active galaxies (both AGN and Starburst) and understand differences between QSOs, Seyferts 1 and 2, LINERS and Composites, as well as Starburst galaxies. The best expectation from our study will be the preliminary classification of active galaxies into activity types before having their spectral types.

13. Two epoch spectro-imagery of PV Cep outflow system

T. Movsessian, T. Yu. Magakian, A. V. Moiseev

(Affiliation: Byurakan Astrophysical Observatory, **E-mail:** tigmov@bao.sci.am)

The well-known variable star PV Cep is a remarkable pre-main-sequence star associated with cone-shape reflection nebula known as GM 1-29 and the Herbig-Haro objects HH 215 and 315, which form giant outflow system. We have performed two epoch scanning Fabry-Perot observations of PV Cep region in H α and [SII] emissions, which allowed us to measure the PM of the spectrally separated emission structures. Observations were carried out with 6m telescope using scanning FP interferometer. Our data are the first more detailed studies of the emission structures near the source. We present full two dimensional radial velocity field as well as the proper motion of emission knots in the outflow system. During of the second epoch observation the new knot was revealed on the distance of about 4 arcsec from the source, estimated kinematical age is about 17 years and corresponds to maximum of brightness of the source. This is the first case proof of outbursts connection with formation of HH jets.

14. High-mass X-ray binary Granat 1915+105 as a possible star formation trigger

E. Nikoghosyan, N. Azatyan, A. Samsonyan, A. Yeghikyan, D. Andreasyan, D. Baghdasaryan

(Affiliation: Byurakan Astrophysical Observatory, **E-mail:** elena@bao.sci.am)

High-mass stars play a key role in the process of star formation. In particular, supernova explosions, creating a significant density gradient in the interstellar medium, can initiate a new wave of star formation. The main goal of this work is to consider the possibility that a supernova explosion could be a trigger for the formation of several young stellar clusters in the Galactic Ring Survey Molecular Cloud (GRSMC) 45.46+0.05. These stellar clusters, associated with IRAS 19110+1045, 19111+1048, 19117+1107, and IRAS 19120+1103 sources, are located in the brightest part of the supershell around the supernova explosion remnant Granat 1915+105. Based on the small age spread of stellar objects, we suggest that the clusters were formed as a result of a single trigger shock.

15. Study of X-ray/opt flux ratios for Mrk galaxies and Blazars

G. Paronyan, A. M. Mickaelian, H. V. Abrahamyan, G. A. Mikayelyan, A. G. Sukiasyan, L. A. Hambardzumyan, V. K. Mkrtchyan

(Affiliation: Byurakan Astrophysical Observatory, **E-mail:** paronyan_gurgen@yahoo.com)

The study of X-ray and optical ranges will be important for understanding some physical properties of Active Galaxies, both AGN and Starbursts. For this purpose, we have collected optical and X-ray data for Mrk galaxies and Blazars. We consider 1515 Markarian galaxies and 3561 Blazars (from Massaro et al. BZCAT v.5). For X-ray data, we have used the catalogs ROSAT, Chandra, XMM, and for optical data, the catalogs SDSS and USNO. Having these fluxes, we estimate X-ray/opt flux ratios for these objects and try to get connection between different types of Blazars and Markarian galaxies. We give the average flux ratios and its ranges for different types of objects (different activity types for Mrk galaxies and 4 groups for Blazars: BZB, BZQ, BZG and BZU). It is especially useful to understand the differences in X-ray emission between BL Lac objects and Flat Spectrum Radio Quasars (FSRQ). Mrk galaxies in their turn, are obviously divided into AGN and Starburst subtypes, as well as many Abs line galaxies are present. An attempt was made to find some correspondence between these ranges, and to give a definition for X-ray AGN (if relevant). Further work will include collection and study of the multi-wavelength data of these objects.

16. Technique of eigenfunctions in the problem of diffuse reflection under incoherent-anisotropic scattering

H. Pikichyan

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The report presents the analytical approach proposed by the author to the original application of the eigenfunctions technique for solving the problems of diffuse reflection of radiation from a scattering absorbing semi-infinite medium. Two cases are considered: in the elementary act of scattering, isotropic scattering occurs under the general law with the redistribution of radiation by frequencies and the more general problem of redistribution of radiation by frequencies and directions. In solving the problems, the separation of the incoming and outgoing characteristics of the radiation initially incident on the medium from the outside is achieved without the use of any expansions or special representations of functions describing the elementary act of scattering.

17. Supernova search with active learning in Zwicky Transient Facility data

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We provide the first results from the complete SNAD adaptive learning pipeline in the context of a broad scope of data from large-scale astronomical surveys. The main goal of this work is to explore the potential of adaptive learning techniques in application to big data sets. Our SNAD team used Active Anomaly Discovery (AAD) as a tool to search for new supernova (SN) candidates in the photometric data from the first 9.4 months of the Zwicky Transient Facility (ZTF) survey, namely, between March 17 and December 31, 2018. We analysed 70 ZTF fields at a high galactic latitude and visually inspected 2100 outliers. This resulted in 104 SN-like objects being found, 57 of which were reported to the Transient Name Server for the first time and with 47 having previously been mentioned in other catalogues, either as SNe with known types or as SN candidates. We visually inspected the multi-colour light curves of the non-catalogued transients and performed fittings with different supernova models to assign it to a probable photometric class: Ia, Ib/c, IIP, IIL, or IIn. Moreover, we also identified unreported slow-evolving transients that are good superluminous SN candidates, along with a few other non-catalogued objects, such as red dwarf flares and active galactic nuclei. Beyond confirming the effectiveness of human-machine integration underlying the AAD strategy, our results shed light on potential leaks in currently available pipelines. These findings can help to avoid similar losses in future large-scale astronomical surveys.

18. Pulsars(x-ray & Gamma-ray) on the Galactic Field vs. Globular Clusters

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19. The Concept of the Massive Photon and Its Astrophysical Implications

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The long-term hypothesis about non-zero mass of photons is discussed in connection with some of its astrophysical implications in physics, astrophysics, and cosmology. We coin the term “mass equivalent” for upper limit of photon mass instead of “relativistic mass” or “effective mass” used in quantum electrodynamics. We have found the proportionality relationship between the average “mass equivalent” of a blackbody radiation and its temperature as well as the CMB radiation mass fraction in the Universe (0.03% of the mass of the Universe). We estimate the difference in arrival time between two spectral bands of Markarian galaxy Mrk 421 and discuss the limits on variations of speed of light with frequency. Corrections to the gravitational and cosmological redshift, caused by the frequently dependent speed of light, are also discussed.

20. Analysis of emission line widths of [CII] 158 μ m and classification of sources

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The sample of 382 extragalactic sources has been analysed that have mid-infrared, high resolution spectroscopy with the Spitzer Infrared Spectrograph (IRS) and also spectroscopy of the [CII] 158 μ m line with the Herschel Photodetector Array Camera and Spectrometer (PACS). The emission line profiles of [NeII] 12.81 μ m, [NeIII] 15.55 μ m, and [CII] 158 μ m are studied, and intrinsic line widths are determined. All line profiles together with overlays comparing positions of PACS and IRS observations are made available in the Combined Atlas of Sources with Spitzer IRS Spectra (CASSIS) found at cassis.sirtf.com. At present, all low resolution and high resolution staring observations with the IRS are available (more than 20,000 spectra of about 15,000 distinct sources). Spectra are provided in various formats to enable easy viewing or measurements. Spectra cover 5 microns to 37 microns in low resolution ($R \sim 60$ to 125) and 10 microns to 37 microns in high resolution ($R \sim 600$) modes. Sources are classified from AGN to starburst based on equivalent widths of the 6.2 μ m polycyclic aromatic hydrocarbon feature. It is found that intrinsic line widths do not change among classification for [CII]. The [NeII] line widths also do not change with classification, but [NeIII] lines are progressively broader from starburst to AGN.

21. Mid-infrared detectors for space electronics based on InAs nanowires

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The infrared (IR) spectral range is one of the richest windows of the electromagnetic spectrum emitted by astrophysical objects during the evolution of planets, stars and galaxies. The Mid-IR (MIR) region is most important for free-space communications and astronomy, since the high transparency of the atmosphere at 3–5 μm and 8–12 μm allows transmission without significant atmospheric absorption. So it can be used to trace star and planet formation. Detectors based on InAs nanowires (NWs) operate in the MIR range of the spectrum with a wavelength of 2 to 5 μm , like Near-IR spectrograph on the James Webb Space Telescope, which covers 0.6–5.3 μm wavelength range. NWs have significant advantages over thin films, quantum wells, and bulk materials due to their small size and small area of contact with the substrate. The band gap of the InAs NWs can be tuned by introducing mechanical strain due to lattice mismatches in the core/shell NWs, providing highly tunable functionality for future devices. Catalystless InAs NWs and an InAs core/InP shell with a coherent shell, as well as previously unsynthesized NWs of the InAsN solid solution, were grown by molecular beam epitaxy on Si. Low-temperature (4 K) photoluminescence (PL) spectra were obtained. All spectra show two peaks in the crystal structure of sphalerite and wurtzite. The PL spectra of the InAs-core/InP-shell NWs demonstrated a nontrivial behavior of the peak corresponding to the polytype hexagonal phase. Surface passivation leads to a shift of the peak towards higher energies, causing mechanical strain on the NW core, and also eliminates surface states. The PL spectra of the NWs of the InAsN solid solution demonstrate a shift of the emission band towards lower energies, which confirms the incorporation of nitrogen into the NWs structure. The results make it possible to adjust the band gap in the NW structures, on the basis of which it is possible to create MIR detectors and sources.

Posters [P]

1. Discovery of new red stars with digitized plates of the μ Cephei range

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The results of the spectral classification of 660 M stars observed in the Cepheus region are presented. Their equatorial coordinates, photographic magnitudes and spectral subclasses were determined using GAIA data. These stars, in all likelihood, are giants and supergiants. None of them was included in the catalog of variable stars. It has been suggested that further study may reveal variability in many of them.

2. New M-type stars found in the BAO Plate Archive centered at $\alpha = +15^{\text{h}}$ $\delta = +58^{\circ}$

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We present new M-type stars selected from the low-resolution spectral plate of the BAO Plate Archive centered at $\alpha = +15^{\text{h}}$ $\delta = +58^{\circ}$. For new detected objects, we present luminosity classes estimated from Gaia DR3, 2MASS and TESS photometry and available proper motions. Six stars have high proper motions. The majority of the objects are dwarfs.

3. ^{60}Fe on Earth and its connection to High-Mass X-ray Binaries

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^{60}Fe has been detected on various places on Earth and the moon, which has originated in a few nearby (ca. 100 pc) recent (ca. 2 Myr) core-collapse supernovae (SNe). Since most massive young stars are in multiples, from such a supernova explosion, these systems either get disrupted, leaving a neutron star and an unbound runaway star, or both components remain bound and form a high mass X-ray binary (HMXB). Investigating those SNe and their corresponding HMXBs, will enhance our understanding of SNe and their yields. Hence, the aim of this project is to identify and

characterize HMXBs among nearby OB-type stars, that could be potential sources of the detected 60-Fe, as it has already been done for the case of the HMXB 1H11255-567 with $\mu 1$ and $\mu 2$ Cru (Neuhäuser et al. 2020, MNRAS 498, 899). Through the analysis of numerous observations in X-rays (e.g. Einstein, ROSAT, XMM-Newton, Chandra, Uhuru) and optical, combined with the astrometric search for close compact binary components, several of these systems could be figured out as possible candidates. Here we will present the latest results of our survey.

4. Analysis of the short wavelength range of QSOs

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The study of UV and optical ranges is important for understanding some physical properties of Active Galaxies, both AGN and Starbursts. For this purpose, we have collected optical and UV data for QSO`s. We consider 1`573`824 quasars (from Milliquas v7.2 catalog). For UV data, we have used the catalogs GALEX GR6+7 (82`992`086 sources), and for optical data, the catalogs SDSS and USNO. Having these fluxes, we estimate UV/opt flux ratios for these objects and try to get connection between different types. We give the average flux ratios and its ranges for different types. For the Blazars, it is especially useful to understand the differences in UV emission between BL Lac objects and Flat Spectrum Radio Quasars (FSRQ). An attempt was made to find some correspondence between these ranges, and to give a definition for UV AGN (if relevant). On the other hand, the SDSS spectra provide the short wavelength range for many QSOs with high redshift. In such cases we have L-alpha, CIV, CIII and MgII lines present and they must be used for classification. We have made a correspondence between subtypes using those intermediate redshifts when both H-beta and MgII are present. The results have been extended to higher redshift objects where MgII is present along with shorter wavelength lines. Further work will include collection and study of the multi-wavelength data of these objects.