



ABSTRACT BOOK

11th OPTICON Gaia Science Alerts Workshop 2020

18-22 January 2021

from the comfort of our homes around the world

The titles are sorted alphabetically by speakers' surnames

Workshop's agenda on-line:

<https://web1.ast.cam.ac.uk/ioa/wikis/gsawgwiki/index.php/Workshop2020:agenda>

TDEs overview

Iair Arcavi
Tel Aviv University

The OMEGA Key Project : detection of cold planets and stellar remnants in the entire Milky Way

Etienne Bachelet
Las Cumbres Observatory

Thanks to the new generation of all-sky surveys such as Gaia, it is now possible to detect microlensing events in the entire sky. However, these surveys do not provide sufficient cadence to well constrain the microlensing models and can also miss planetary deviation. The OMEGA Key Project intends to provide an photometric and spectroscopic follow-up of these events automatically, to start the mapping of exoplanets and stellar remnants in the entire Milky Way. I will describe the observing strategy, as well as the hardware and software architecture developed and finally present the first results.

Monitoring the sky with HATPI

Gaspar Bakos
Princeton University

HATPI is a 64 camera mosaic system that will monitor the entire visible sky from Chile at very high precision, fast cadence, and at any given time conditions permit. I foresee strong possible synergies with GAIA.

On the need of optical polarimetry follow up of flaring AGN in Gaia alerts

Dmitry Blinov
Institute of Astrophysics, FORTH, Greece

After the Gaia data releases it has been found that thousands of AGN demonstrate significant positional offsets (1 - 10 mas) between radio (VLBI) and optical (Gaia) positions of active galactic nuclei (AGNs). These offsets tend to be parallel to the parsec-scale jet direction, which indicates that they are caused by astrometrically resolved structures in AGN. In this brief talk I will discuss how a polarimetric follow-up of Gaia alerts on flaring AGN could help to resolve numerous questions about AGN physics.

Educational telescope at Mt. Kent

Karsten Brogaard
Stellar astrophysics Centre, Aarhus University

A new educational telescope at Mt. Kent in Australia will be made available to all the upper secondary schools in Denmark so that it can be remote controlled in daytime (due to the time difference). I will present the current status and outlook, and how this might connect to your science.

Overluminous transients in Gaia Alerts using photometric redshift

Mateusz Bronikowski
Astronomical Observatory, University of Warsaw

Photometric redshift galaxy catalogues provide a good source of redshift, and consequentially distance, estimates for a larger sample of galaxies than would otherwise be possible using spectroscopic surveys only. By searching extragalactic Alerts' hosts in such catalogues, estimates on absolute magnitudes of those transients were obtained, and from them, overluminous transients which are of special interest were selected. Using this method, several candidate Superluminous Supernovae were found, including three whose hosts have no known spectroscopic redshifts.

Science alerts from the Joan Oró telescope

Josep Manel Carrasco
Universitat de Barcelona

From February 2015 a team of researchers from ICCUB contributes to the Gaia photometric science alerts follow-up programme with the robotic telescope Joan Oró (TJO), at the Montsec Observatory (OAdM), located at Àger (Lleida, Spain). Since then, more than 18000 images in multicolor Johnson-Cousins passbands were obtained with TJO for 72 Gaia science alerts, becoming the third most contributor of the programme.

Automatic classification of Gaia Photometric Alerts using spectra data through Machine Learning and Deep Learning.

Roberto Alexander Cerviño
Department of Data Science, Faculty of Computer Science, Multimedia and Telecommunications,
Universitat Oberta de Catalunya

Since the Gaia mission was launched, billions of diverse events have been detected and registered. As a result, several catalogues have been provided, like the Gaia Photometric Alerts data. This catalogue provides powerful spectrophotometric information about the detected events, such as their lightcurve, BP/RP spectra data or category (i.e. Supernova, QSO...). However, their initial classification is not completely automatic and cannot always be guaranteed due to the complexity of the events or lack of data. We present here a study of the performance and suitability of several Machine Learning and Deep Learning techniques to automatically classify the Gaia Alerts through their spectra data.

The data used in this project was web scraped from the official Gaia Alerts website. Taking into account the total number of correctly labeled available spectra of every event, we selected three types: ULENS, flares, and Supernova Ia. The final dataset was balanced and formed by the BP/RP spectra data of the mentioned types, and an extra class named 'other' that included random samples of the rest of the categories. We implemented multiple Machine Learning (i.e. Random Forest, Gradient Boosting...) and Deep Learning (i.e. Recurrent and Convolutional Neural Networks) methods, also considering different input data formats. Our study provides a detailed comparison of the accuracies obtained, as well as a proposal of the appropriate hyperparameters combination for each method. The most accurate one has been tested on other entries of the catalogue to double-check its performance.

Gaia Alerts and the Serbian-Bulgarian mini-network telescopes during 2020

Goran Damjanovic
Astronomical Observatory

From October 2014 to October 2020 we did about 90 Gaia Alerts (Gaia-FUN-TO) objects using 6 telescopes of local cooperation "the Serbian-Bulgarian mini-network telescopes"; about 15 objects per year. During 2020, 11 objects were observed (mostly, using the 60 cm telescope of the Astronomical Station Vidojevica - ASV of Astronomical Observatory in Belgrade - AOB, Serbia): Gaia17dhv, Gaia19ftm, Gaia19frb, Gaia20dgq, Gaia20djf, Gaia20div, Gaia20dgd, Gaia20ehc, Gaia20egm, Gaia20ejl, Gaia19dke; mostly, we did the Gaia19dke (4 times). Some results are presented, here.

TDA in the OPTICON Radionet PILOT

John Davies
OPTICON

I (if not covered by other speakers) will describe the objectives of the new EC OPTICON-Radionet contract and how astronomers can interact with the team to deliver the project in a way which enables multi-messenger Trans-national Telescope Access for TDA.

Follow-up of some Gaia Alerts

Michel Dennefeld
IAP-Paris

Spectroscopy and Photometry of Gaia20eld (Nova Cas 2020)

Hasan H. Esenoglu
Istanbul University Observatory

We preferred the Gaia20eld source as a newly outburst nova (Nova Cas 2020). We have taken spectroscopic observations of the object with the TUG-RTT150 telescope especially in the nebular phase in order to study the atmosphere model and follow the process. We reported the first results of this study in Atel 13998 (2000). In the meantime, we carried out photometric observations of the object with the TUG-T100 telescope, one-second exposures, binning 2, and without filter for about 9.5 hours since the source is very bright. We will present these new photometric results in the Gaia workshop.

Supernovae and Gaia

Morgan Fraser
University College Dublin

Gaia has proven to be a valuable tool for discovery and followup of supernovae. I will present some recent results where Gaia data has contributed to our understanding of supernovae, supernova impostors and other transients. Along with this, Gaia has enabled the identification of candidate binary companions to historical galactic supernovae, including the Vela SN, as well as ejected companions of some Type Ia SNe. Kinematic searches for SN companions are opening a new window on SN progenitor systems.

Gaia Alert Follow up with the HOYS Citizen Science project

Dirk Froebrich
University of Kent

I will briefly introduce the HOYS citizen science project and how we utilise it to follow up Gaia alerts on YSOs. I will present some particular examples of objects we have followed up. Finally, some result on the detailed analysis of some objects will be discussed.

Photometry of Gaia Microlensing Events from Tomo-e Gozen Survey

Akihiko Fukui
The University of Tokyo

Tomo-e Gozen is a wide-field CMOS camera mounted on a 1.05 m telescope at Kiso Observatory in Japan. With this camera, all northern sky has been surveyed with a cadence up to three visits per night since 2019. This survey can be used to complement the data gap of bright transient events discovered by Gaia. In this poster, I will show light curves of several bright microlensing events discovered by Gaia that I have extracted from archival images of the Tomo-e Gozen survey.

Flarestar Observatory in Malta and AAVSO

Charles Galdies & Stephen Brincat
University of Malta

Photometric classification of Gaia microlensing event candidates with machine learning methods

Ilknur Gezer
Astronomical Observatory, University of Warsaw

Gravitational microlensing method is a powerful method to detect isolated black holes in the Milky Way. During a microlensing event brightness of the source increases and this feature is used by many photometric surveys to alert on potential events. However, some intrinsic variable stars may show similar light curves to microlensing events especially when the cadence of observations is not dense enough. Our aim is to distinguish microlensing event candidates from intrinsic variables using their archival photometric data. Since 2017 we followed-up Gaia-alerted microlensing candidates with ground-based observations. We took spectra for 100 objects so far. In this study, we present a photometric classification method which was confirmed by spectral observations. We used machine learning techniques to classify microlensing event candidates.

Gaia, OPTICON, ORP and time-domain astronomy

Gerry Gilmore
Institute of Astronomy, Cambridge

OGLE-IV Transient Search

Mariusz Gromadzki
Astronomical Observatory, University of Warsaw

OGLE-IV survey for transients is a special sub-survey of the OGLE project, running on 1.3m dedicated Warsaw telescope in Las Campanas Chile. It monitors about 700 sq.deg around the Magellanic Clouds and reports discoveries of supernovae and other extragalactic transients within 1 minute from the observation. Here we present the results of this survey running from 2012.

The Alfred Jensch 2m Telescope and its Use for Targets of Opportunity

Artie Hatzes
Thüringer Landessternwarte Tautenburg

The 2m Alfred Jensch Telescope (AJT) is located in middle Germany in the State of Thuringia. It is equipped a wide field Schmidt camera and a high resolution spectrograph capable of precise stellar radial velocities with a precision of 2-5 m/s. Almost all the telescope time is allocated to scientific projects of staff of the Thueringer Landessternwarte (Thuringian State Observatory) Tautenburg. Because of flexible scheduling and rapid communication between observers the telescope is ideally suited for rapid response and target of opportunity observations. I will discuss several scientific programs that take advantage of these capabilities. These include the confirmation of transiting exoplanets found by space missions (e.g. CoRoT, Kepler, and TESS), the identification of optical counterparts and afterglows of Gamma Ray Bursts, and the monitoring of Near Earth Objects. The AJT can be a useful facility for the follow-up of Gaia alerts.

Gaia Science Alerts Overview

Simon Hodgkin
University of Cambridge

Bowen Fluorescence Flares - new class of nuclear transients

Nada Ihanec
Astronomical Observatory, University of Warsaw

Data from large scale long-term photometric monitoring surveys recently reported on large-amplitude flares and changes in quasar luminosity far exceeding what was known about photometric variability of AGN. The nature of many of these flares remains unknown, however, in the light of recent discoveries, possible interpretations include Changing Look Quasars, Tidal Disruption Events and even microlensing events. Recently, a new type of AGN transients were discovered (Trakhtenbrot 2019, Gromadzki 2019) where they reported on three nuclear flares, showing properties that don't fit into any of currently known categories.

In my talk, I will present the properties of this new class - Bowen Fluorescence Flares (BFFs) and the next transient, Gaia19axp, that fits into this class.

Ground based observations of some transient Gaia alert objects in Shamakhi Observatory

Nariman Ismailov
Shamakhi Astrophysical Observatory

We describe a detailed methodology for performing of the spectral and photometric observations of transient objects within the framework of the Gaia OPTICON program. We have using two telescopes for BVR photometric observations: a 60 cm reflector for long-term observations, and a 30 cm refractor, which operates synchronously with spectral observations, which is performing at the 2 m telescope. The results of observations of the supernova SN Ia Gaia20cgo at the different phases of activity are presented, obtained parameters and the distance to the host galaxy in which the explosion is occurred.

Black Hole Target Observation Manager

Maja Jabłońska
University of Warsaw

I would like to present the Black Hole Target Observation Manager (BHTOM) system, which is an interface for viewing and sharing observational data of microlensing events. It allows the users to request, schedule and manage observations of their chosen targets with many robotic telescopes, as well as upload and view data such as spectroscopy, photometry or fits images.

Lensing events with parallax in Gaia Alerts

Zofia Kaczmarek

Astronomical Observatory, University of Warsaw

In the recent months, we have developed a routine to model parallactic lensing events and recover their most probable masses and distances. We plan to use it on a large scale on both OGLE and Gaia events. I will introduce our methods and the codes we use. I will also briefly present the most interesting lensing events with parallax found in Gaia Alerts, including some ongoing events. I will give an update on their status and any new information we obtained about them from our recent studies.

Webservices in scientific applications, CCDPHOTsvc

Mikołaj Kałużyski

Nicolaus Copernicus Astronomical Center

Web services are a common and standardized way of exposing the functionality of the functions of IT system to other client systems. In the era of hugely increasing complexity of IT systems used in astronomy, the issue of modularization and proper interfacing between system components is of great importance.

We present an overview of webservices in general and more detailed description of Django REST framework which, due to the rapid development and use of the Python language, is well suited for astronomical webservices.

As an example, we present the CCDPHOTsvc – Django REST webservice that exposes the CDDPHOT workflow functionality. BH-TOM web application uses this web service for FITS photometry.

Science with RBT/PST2 and PST3 telescopes.

Krzysztof Kamiński

Astronomical Observatory of Adam Mickiewicz University

We present the main areas of interest for which robotic telescopes RBT/PST2 and PST3 are used by Astronomical Observatory of Adam Mickiewicz University. This includes the analysis of kinematics and 3D shape modelling of Solar System asteroids through photometry, astrophysical modelling of binary and pulsating stars through spectroscopy and investigation of near Earth environment through astrometry.

Data Analysis and Search for Astronomical Transients (AT's)

Malhar Kendurkar

Prince George Astronomical Observatory

I am Malhar R. Kendurkar a student of Physics and Mathematics majors, living in Prince George, BC, Canada. I am doing my research in Sky Surveys to search for Astronomical Transients since 2017 along with my studies. I have been involved in international projects like, ASASSN, GSNST, ZTF to search and follow up of Astronomical Transients. The notable discoveries we have made are ASASSN19-bt and ZTF 19aadyppr. Our work was recognized all over the globe. In addition I have discovered over 90 Supernovae with my research group called Global SuperNova Search Team (GSNST). Moreover, I also have collaboration with LIGO/VIRGO Team to search for Optical Counterparts of Gravitational Waves. I am looking forward to contribute in this groundbreaking mission.

Electromagnetic counterparts of gravitational wave sources with Gaia

Zuzanna Kostrzewa-Rutkowska

Leiden Observatory

The recent discoveries of gravitational wave events and in one case also its electromagnetic (EM) counterpart allow us to study the Universe in a novel way. The increased sensitivity of the LIGO and Virgo detectors has opened the possibility for regular detections of EM transient events from mergers of stellar remnants. Gravitational wave sources are expected to have sky localisation up to a few hundred square degrees, thus Gaia as an all-sky multi-epoch photometric survey has the potential to be a good tool to search for the EM counterparts. In this paper we study the possibility of detecting EM counterparts to gravitational wave sources using the Gaia Science Alerts system. We develop an extension to current used algorithms to find transients and test its capabilities in discovering candidate transients on a sample of events from the observation periods O1 and O2 of LIGO and Virgo. For the gravitational wave events from the current run O3 we expect that about 16 (25) per cent should fall in sky regions observed by Gaia 7 (10) days after gravitational wave. The new algorithm will provide about 10 candidates per day from the whole sky.

Quasar Variability in Gaia: Simulation Perspective

Szymon Kozłowski

Astronomical Observatory, University of Warsaw

I have simulated Gaia light curves for 60000 SDSS quasars to $G < 19.8$ mag (with their actual black hole masses and luminosities) using stochastic processes. I will concentrate on discussing simulated variable light curves that appear in the 10-yr-long data as "fake" transients.

Microlensing Highlights in Gaia Science Alerts

Katarzyna Kruszyńska

Astronomical Observatory, University of Warsaw

The alerting system of the Gaia space mission detects sudden changes in brightness of observed sources and over the last 6 years it has detected almost 15 000 transients. More than 300 of them have been classified as microlensing candidates from all over the sky, with notable examples of Gaia16aye, Gaia18cbf, Gaia8dif, Gaia19bld, Gaia19dke and Gaia20fnr.

Microlensing events detected and observed by Gaia offer a possibility for registering not only photometric effect, but also its astrometric counterpart. This will provide additional data, that will help break degeneracies for single source-single lens events, which might lead to mass measurements of lenses and, in particular, to discovery of lensing black holes.

We will present and update on and highlights of the Gaia microlensing campaign including the results of ground-based follow-up with the OPTICON time-domain network of telescopes. We will show most interesting events and provide a quantitative summary of results obtained in recent years.

First glimpse of the new LT/SPRAT automated pipeline with ASPIRED

Marco Lam

Tel Aviv University

We compare the performance of the new pipeline developed with ASPIRED, a generic pipeline builder, to the existing SPRAT pipeline ("L2 pipeline") that was custom developed alongside the instrument and optimised to both the hardware and LT operational model. The full sample was passed through both pipelines. All raw data and output spectra were qualitatively assessed and rated as to whether the extracted spectrum was a reasonable representation of the data. We achieve a success rate of 90% with the new pipeline before optimising it for the SPRAT instrument configuration.

Linking Education and Research Using Robotic Telescopes

Fraser Lewis

Faulkes Telescope Project & National Schools' Observatory

I will present examples of projects for students and teachers using real data and resources from the Faulkes Telescope Project and the National Schools' Observatory. In particular, I will discuss a Citizen Science project which uses data from Type Ia supernovae discovered by Gaia Alerts. Users are instructed how to perform browser-based photometry on these images using their data to add additional datapoints to the Hubble Plot, enabling them to measure the expansion rate and age of the Universe.

The activity is available at <https://www.schoolsobservatory.org/discover/projects/supernovae>

It is one of several projects I've created that use real data, allowing students to explore the science of these objects as well as associated STEM topics such as graph plotting and measuring uncertainties while exploring data archives. Based in South Wales, the Faulkes Telescope Project provides free access, via both queue-scheduled and real-time observations, to a global network of 2-metre, 1-metre and 0.4-metre telescopes. The National Schools' Observatory (NSO) is located at Liverpool John Moores University. It has a mission to enable Access to the Universe for All and provides access to the 2-metre Liverpool Telescope on La Palma. Both projects have recently celebrated their 15th anniversary and both provide free access via the internet to robotic telescopes.

ZTF, ML, and Variability

Ashish Mahabal

Caltech

ZTF recently had its DR4 (<https://www.ztf.caltech.edu/page/dr4>). It boasts of close to 400 billion detections, and will soon be providing a forced photometry service. The large data volume has resulted in our developing various machine learning routines to handle data from the telescope in its raw form, to complete processing, and all the way to selecting objects for follow-up. In the process we also make use of cross-matched Gaia sources. We will describe a few of the programs and pipelines we use, concentrating in particular on the search for different types of variables.

Search for AGN counterparts of unidentified Fermi-LAT sources with optical polarimetry. Demonstration of the technique

Nikolaos Mandarakas

University of Crete, Physics Department

The third release of the Fermi-LAT catalog (3FGL) contained 3034 gamma-ray sources. Classification of these extremely energetic sources is important for studying high-energy astrophysical processes. After the fourth release, (4FGL) more than 1000 gamma-ray sources remain un-associated with a lower-energy counterpart. We introduce optical polarimetry as a practical tool in the hunt for optical counterparts of the unidentified gamma-ray sources (UGSs) and we demonstrate its advantages. Using data from the RoboPol project, we validated that a significant fraction of active galactic nuclei (AGN) associated with 3FGL sources can be identified due to their high optical polarization exceeding that of the field stars. We performed an optical polarimetric survey within the 3σ uncertainty of four unidentified 3FGL sources and discovered a previously unknown extragalactic object at a redshift of $z = 0.0609 \pm 0.0004$. Using these measurements and archival data we demonstrate that this source is a candidate counterpart for the Fermi field 3FGL J0221.2+2518 and most probably is a hybrid star-forming – AGN galaxy. We conclude that polarimetry can provide powerful complementary information on the nature of sources detected in wide-field surveys. For the particular case of AGN counterparts for un-associated Fermi sources, future extensive polarimetric surveys (e.g., PASIPHAE) will allow the association of a significant fraction of currently unidentified γ -ray sources.

Discovering radio transients from Gaia Alerts

Benito Marcote
Joint Institute for VLBI ERIC (JIVE)

Several transient events produce emission from radio to high energies. While optical observations are fundamental to pinpoint them in the sky, their radio emission typically appears on longer time scales and exhibits a more gradual evolution. This is related to the origin of this emission: in most cases related to the electrons that are relativistically launched away from the system. This phenomena allows astronomers to trigger radio observations after the alerts sent in the optical range and study a wide number of transient events like gamma-ray bursts, supernova explosions, tidal disruption events, or maybe in the future fast radio bursts. This talk would explore the synergy that can be established between Gaia alerts and radio observations to unveil these events.

Classification of Gaia Alerts with machine learning algorithms

Gábor Marton
CSFK Konkoly Observatory

Last year a project was started within the Gaia CU5 to create an algorithm that can automatically decide if a Gaia Photometric Science Alert is worth to be published or not. To do so several approaches and algorithms were tested on the current database of Gaia alerts eyeballed by the members of CU5. I will present a summary of the ideas we had during last year, describe the numbers, parameters and images we used and show some of the most promising results we have at the moment.

Preliminary results for the microlensing event Gaia19dke

Marius Maskoliunas
Institute of Theoretical Physics and Astronomy, Vilnius University

In my presentation I will present Gaia19dke event which began in 2019 and is still ongoing. Gaia19dke was discovered by the Gaia satellite and later followed-up with a network of ground based observatories including Moletai Astronomical Observatory which is part of a joint Polish-Lithuanian Black Hole hunt project based on Gaia data.

Gaia18aen: First symbiotic star discovered by Gaia

Jaroslav Merc
Astronomical Institute of Charles University in Prague

Besides the astrometric mission of the Gaia satellite, its repeated and high-precision measurements also serve as an all-sky photometric transient survey. Gaia18aen is a transient detected at the beginning of 2018, tentatively classified as a "nova" on the basis of subsequent spectroscopic observation. In this talk, the results of our analysis of two spectra of Gaia18aen and available photometry of the object are presented. Our results confirmed, that the object is a classical symbiotic star, first one detected by Gaia. The giant in the system belongs to one of the brightest symbiotic giants.

CCDPhot for automated photometric processing

Przemysław Mikołajczyk
Astronomical Institute, University of Wrocław

In my presentation I will briefly show capabilities of the CCDPhot pipeline dedicated for precision photometry and astrometry of CCD images. Although CCDPhot has been mainly developed to be used as a computational engine behind BHTOM (CPCS 2.0), it may be used separately by anyone to perform aperture as well as PSF photometry.

It also utilizes the newest astrometric catalogues (including Gaia-EDR3) in order to supply precise WCS coordinates grid for every processed image.

CCDPhot is very easy to use and does not require any advanced astronomical know-how to be used properly and efficiently. Its biggest advantage is an ongoing attempt to perform calculations in a very homogeneous, unified way, so it produces science-ready measurements from diverse data sources: small, medium-sized and large telescopes. I will briefly demonstrate how the software works in dense and sparse stellar fields and show how to supply CCDPhot with information about your telescope, observing site and CCD camera.

Overview of variable objects processing within the Gaia consortium

Nami Mowlavi

Department of Astronomy, University of Geneva

Several hundred million stars are expected to be detected all over the sky by Gaia over its-more-than-five-year mission. Their identification, characterization and classification are performed within the Gaia Consortium by a dedicated Coordination Unit, CU7. In this presentation, I will give an overview of the CU7 activities, summarize the achievements in the 2018 Gaia Data Release 2 (DR2), and present the expectations for DR3 and beyond.

I will also discuss the unique features of the Gaia mission with respect to variability studies of celestial objects, and, if time permits, show the power of combining the consolidated data published in the Gaia archive at successive data releases with the near real time data made available in the Gaia Science Alert archive.

All-sky searches for gravitational microlensing events with data from the Zwicky Transient Facility

Przemek Mroz

California Institute of Technology

Gravitational microlensing surveys (such as OGLE, MOA, KMTNet) are renowned for their long-term monitoring of the Galactic center, where the probability of microlensing (and the event rate) is highest. However, a sizable population of microlensing events is also expected in the Galactic plane, outside the Galactic bulge fields. The Zwicky Transient Facility (ZTF) is one of a few all-sky surveys that can observe the northern part of the Galactic plane and so it complements and extends current microlensing surveys to include these fields that have been under-explored to date. I will present the survey and its alert system. I will also describe my work on searching for gravitational microlensing events in the ZTF data.

Dipper-like variability of the Gaia alerted young star V555 Ori

Zsofia Nagy

Konkoly Observatory, Research Centre for Astronomy and Earth Sciences

V555 Ori is a classical T Tauri star, whose 1.5 mag brightening was published as a Gaia science alert in 2017. We carried out optical and near-infrared photometric and optical spectroscopic observations to understand the origin of the light variations. The light curves show that V555 Ori was faint before 2017, entered a high state for about a year, and returned to the faint state by mid-2018. In addition to the long-term flux evolution, quasi-periodic brightness oscillations were also evident, with a period of 5 days. At optical wavelengths both the long-term and short-term variations exhibited colourless changes, while in the near-infrared they were consistent with changing extinction. This is supported by the accretion rate, which is insufficient to explain the optical flux differences. This behaviour makes V555 Ori similar to the pre-main sequence star AA Tau, where the light changes are interpreted as periodic eclipses of the star by a rotating inner disc warp. Unlike in AA Tau, the periodic behaviour was also detectable in the faint phase, implying that the inner disc warp remained stable in both the high and low states of the system. The long-term variability was probably also due to extinction. The brightness maximum of V555 Ori was a moderately obscured ($A_V=2.3$ mag) state, while the extinction in the low state was 6.4 mag. Our study

revealed that while the Gaia alert first hinted at an accretion burst, V555 Ori is a standard dipper, exhibiting many similarities to the prototype AA Tau.

VVV Microlensing events in the Galactic bulge

Maria Gabriela Navarro
Sapienza / MAS / UNAB

We search for microlensing events in the innermost area of the Milky way using the VVV Survey data. From the analysis of $\sim 10^8$ time series, we discovered for the first time 630 microlensing events (Navarro et al. 2017 and Navarro et al. 2020b) in the Galactic plane. From the final sample we detect an asymmetry in the spatial distribution with more events towards negative longitudes, probably due to the inclination of the bar (Navarro et al. 2018). We expanded the area to analyse the latitude dependence, adding the 238 new events to the final sample. We found that the microlensing event ratio increases with a much steeper slope along the semi-minor axis than on the longitudinal axis. This flattened distribution has an axial ratio of $b/a \sim 1.5$ (Navarro et al. 2020a). We searched for microlensing candidates with sources in the far disk and found 20 distant microlensing events (Navarro et al. 2020c) that correspond to 11% of the sample. This is the first time that a population of events has been discovered with sources in the far disk which allows us to study the other side of the Milky Way. Furthermore, some events require special attention and have been analysed separately, such as long duration "parallax" events which are excellent candidates for stellar-mass black holes, and binary events as for example the discovery of the planet Jovian closest to the plane of the Galaxy (Ryu et al. 2020).

The Large Array Survey Telescope and time delay estimation

Eran Ofek
Weizmann Institute of Science

I will describe the Large Array Survey Telescope (LAST) - a new cost effective, large grasp, survey telescope, currently under construction. I will discuss the motivation and main goals, as well as new methods for time delays estimation.

TDEs in AGNs

Tsvi Piran
The Hebrew University

TDEs in AGNs are different from TDEs around regular SMBHs. I discuss recent theoretical predictions on possible light curves and observational signatures of such events.

Gaia overview

Timo Prusti

New Zealand Time Critical Astrophysics

Nicholas Rattenbury
The University of Auckland

I will summarise some of the time-critical astrophysical projects under way at The University of Auckland, including gravitational microlensing planet discovery, minor planet analysis and UV space astronomy.

Update on Gaia19bld event

Kris Rybicki

Astronomical Observatory, University of Warsaw

Gaia19bld was a spectacular microlensing event detected by Gaia in 2019. We managed to observe it using multiple channels, including spectroscopy, interferometry, ground and space-based photometry. I will present what we have learned from the analysis of these data.

In search for new eruptive young stars among Gaia Alerts

Michał Siwak

Konkoly Observatory

In this talk we would like to present the entire process of selection (based on Gaia Alerts Index tool) and preliminary results of characterization (by means of ground-based photometric and spectroscopic follow-up observations) of potentially new young eruptive stars. This phenomenon is caused by brief (0.1-100 yr) events of enhanced accretion during the classical T Tauri type stage, and has major consequences for formation of rocky planets, among others.

Orbital and physical parameters distributions of exoplanets in the light of GAIA DR2 catalogue

Agnieszka Słowikowska

Institute of Astronomy, Nicolaus Copernicus University in Toruń

Gaia Data Release 2 catalogue contains an enormous number of stellar parameters with unprecedented accuracy. There are also more than 4000 confirmed exoplanets in the NASA Exoplanet Archive, and every week new planets are reported. For most of them many orbital and physical parameters are determined. We used both superior quality databases in order to find correlations between planets and their host stars parameters at the Gaia epoch.

Future of detecting Black Holes with ground-based telescopes

Algita Stankevičiūtė

Astronomical Observatory, University of Warsaw

Black Holes (BHs) are one of the most intriguing and mysterious objects in the Universe. There are still many unresolved problems related to their formation and influence on the evolution of the stellar systems and galaxies as well as the nature of the Dark Matter. With only few dozens of stellar-mass Black Holes known, detecting new cases is necessary in order to increase the sample for further studies. One of the most promising methods for discovering BHs is gravitational microlensing phenomenon, which originates from Einstein's General Relativity Theory. The intense gravitational field of a foreground BH acts like a powerful lens in space and creates two separated images of a background source. Recent developments in the ground-based observatories open a opportunity to hunt for BHs with gravitational microlensing. In 2025, European Southern Observatory (ESO) is going to open the Extremely Large Telescope (ELT) with 39.3 m primary mirror. One of the instruments that will be used in the ELT is MICADO (Multi-AO Imaging Camera for Deep Observations). Extreme high angular resolution of MICADO will allow for discovering BH lenses in the Milky Way. This research is based on MICADO calibration assembly (MCA) and includes the analysis of Fabry-Perot (FP) etalon and Superluminescent emitting diode (SLED) in response with temperature. Both FP and SLED are important parts in MCA.

Software tools to enhance alert-based science

Rachel Street

Las Cumbres Observatory

The wide range of science that is made possible by the rapid production of alerts often requires additional characterization observations to be made. As the number of available candidate targets, and their speed of discovery, dramatically increases with modern surveys, software tools become more essential to manage the flow of information. I will present the TOM Toolkit, an open source package designed to enable alert-based follow-up programs.

PRIME

Takahiro Sumi
Osaka University

We report the status of the NIR microlensing exoplanet search project, the Prime-focus Infrared Microlensing Experiment (PRIME). We are building a new 1.8m wide field infrared telescope at the Sutherland in South Africa. One of the largest NIR camera will be build by using four H4RG-10 detectors loaned from the Roman project. Thanks to 1.3 deg^2 FOV, we can conduct the first high cadence microlensing survey in H-band towards the central region of the galactic bulge, where high dust extinction prevents optical observations. Because the stellar density is higher at the lower galactic latitude, we expect higher event rate. We can compare the planet abundances in high and low stellar density for the first time, which is important for the study of the planetary formation scenarios. The event rate map produced by PRIME can be used to optimize the Roman observing fields. If the PRIME telescope and Roman observe the same fields simultaneously, different light curves will be observed due to the different line of sights, so-called the space-based microlensing parallax. This enables us to measure the mass and the distance of the lens system and enhance the Roman's yields. The telescope will also be used for the ToO observations for various transients including GW, GRB and so on.

Gaia follow-up of the uncatalogued Solar System Objects

William Thuillot
Paris Observatory / IMCCE

Gaia detects continuously uncatalogued Solar System Objects which requires a ground based follow-up both to validate the detection and to better characterize this type of object. Since 2016 we deal with these detections thanks to several observatories in the frame of the Gaia-FUN SSO activity. I will give the status of this activity and describe the results obtained up to now.

Resolving the Mystery of Changing Look AGN with Responsive Follow-up Observations

Benny Trakhtenbrot
Tel Aviv University

A growing number of transient phenomena in galaxy nuclei have recently begun to shed new light on SMBH demographics and the physics of gas accretion onto these objects, tracing events where this accretion has drastically intensified, diminished, or otherwise changed its nature. I will present some recent results concerning the class of highly variable, "changing-look" AGN, focusing on insights obtained with responsive, multi-wavelength follow-up observations. I will discuss a "switch on" changing look AGN where we were able to temporally resolve the appearance of the AGN-like blue continuum and of the broad Balmer emission lines, with a lag that is broadly consistent with the predicted travel time to the broad line region. While this event observationally differs from the tidal disruption events known to date, the physics behind these phenomena may be interlinked. The ever-expanding landscape of time-domain surveys will allow us to discover many more similar events, determine their occurrence rates, and try to link them to specific SMBH and host galaxy properties.

Search for variable stars in the northern sky

Ruta Urbonaviciute
Institute of Theoretical Physics and Astronomy at Vilnius University

Observations of northern sky stars are vital, because vast majority of observatories are located in the southern hemisphere or closer to the equator, so stars near the north pole are inaccessible to them and therefore, the stars seen in this part of the sky are less studied. To attain this intent, chosen fields were near the north pole. We studied five fields, of which the central stars are NSV26138, NSV0255, NSV13673, NSV15053, NSV25919. We found twenty previously unknown candidates of variable stars. For them we determined amplitudes, periods, phases of their brightness variations and possible variability types.

ORP - PILOT = TOM + EVN

Harro Verkouter
Joint Institute for VLBI in Europe

The ORP-PILOT project that will start this year is a joint OPTICON / RadioNet project where one of the targets is making multi-facility multi-frequency observations easier for the ORP-PILOT partners. The Joint Institute for VLBI ERIC is involved for the cm wavelength / radio band and hopes to bring unified access to the European VLBI Network to the OPTICON network. In this talk I will describe the plans and what specific challenges the radio domain poses.

A snapshot survey of polarised light in optical transients

Klaas Wiersema
University of Warwick

Large scale optical snapshot (single epoch) linear imaging polarimetry is a promising new tool in transient follow-up. Transients exist in a large volume of observational parameter space, and polarimetry has a unique capability to highlight sources of particular astrophysical interest within that parameter space, and add value to near-real-time transient survey streams. In particular, polarimetry can diagnose (non-thermal) physical processes that do not map clearly onto spectra and lightcurves, the traditional tools of the trade. To quantify the practical requirements of a large scale polarimetric survey in the era of huge transients streams (ZTF, LSST), such as the influence of instrument choice, wavelength, source selection and calibration fidelity, we initiated a variety of polarimetric transient follow-up programmes, using the NTT and LT, following up 100 randomly selected optical transients. I will show some results of these programmes, and outline ambitions for the future.

Introduction to the Black Hole Target Observation Manager (BHTOM)

Lukasz Wyrzykowski
Astronomical Observatory, University of Warsaw

Introduction and main principles of the BHTOM operated by the Warsaw University Astronomical Observatory people within the OPTICON and ORP Time-Domain Astronomy Work Package.

Gaia alert observations and reductions in Lithuania

Justas Zdanavičius
Astronomical Observatory of the Vilnius University

We report on the photometric observations and data reductions. The Gaia alert observations was obtained with CCD cameras on the wide-field Maksutov-type 35/51cm telescope of the Molėtai Observatory in Lithuania.

Spectroscopic classification of Gaia microlensing event candidates

Pawel Zieliński

Astronomical Observatory, University of Warsaw

In order to early distinguish genuine microlensing events from other types of outbursts and variables, we perform a spectroscopic observations of selected transients detected by Gaia on both hemispheres. Typically, we use various telescopes equipped with low-resolution spectrographs to recognise a continuum shape and distinctive absorption/emission features and classify the targets. These spectra help us in selecting a sample of microlensing events for which an intensive OPTICON follow-up monitoring is continued. Moreover, for the most interesting targets we apply for high-resolution spectra and conduct spectral lines analysis of the source star in microlensing event. Based on that, we can determine atmospheric parameters of the source, line-of-sight extinction and estimate the source distance that is essential in solving the microlensing puzzle.

Uploading data to BHTOM

Pawel Zieliński

Astronomical Observatory, University of Warsaw

Black Hole Target Observation Manager is a new tool for managing the observations of microlensing events candidates detected by sky surveys, e.g. Gaia, ZTF, LSST, etc. One of the most important feature of BHTOM is a processing of CCD FITS images in an automatic manner in order to obtain science-ready data points on a light curve of observed target. In this talk, I will present how to upload the astronomical images on the BHTOM and what does happen next with them. The connection between BHTOM and the Cambridge Photometry Calibration Server will be discussed in detail.
