The second international Workshop

The UX Ori type stars and related topics

30 September - 4 October , 2019

Program & Abstracts

St. Petersburg

Conference key topics:

- Photometry, polarimetry and spectroscopy of UXORs
- Infrared activity of UXORs and related objects
- The circumstellar disks, disk winds and the nearest environment of young stars
- Shadows on the disks, the disks in polarized light
- Hydrodynamic processes in protoplanetary disks, periodic perturbations and protoplanet formation
- The UXOR phenomena in T Tauri stars, connection with the AA Tau variables and dippers
- The evolutionary trends of the UXORs activity

Invited speakers

Megan Ansdell
Tatjana Demidova
Goesta Gahm
Antonio Garufi
Stefano Facchini
Catrina Hamilton-Drager
Alexander Kreplin
Rebeca Garcia Lopez
Ignacio Mendigutia
Benjamin Montesinos
Peter Petrov
Ilya Potravnov
Timo Prusti
Jorick Vink
Eduard Vorobyov
Claudio Zanni

Organizing Committee

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Jerome Bouvier
Vladimir Grinin (co-chair)
Sergej Lamzin
Geoffroy Lesur
Agnes Kospal
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Rene Oudmaijer
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T. Ermolaeva
L. Tambovtseva

Organizers

- Crimean Astrophysical Observatory of RAS
- Star Formation Team of the Pulkovo Astronomical Observatory of RAS

Program

Session 1: UX Ori stars

Monday, September 30

Chair: ***Antonella Natta***

09:55 - 10:00 *Welcoming speech*

10:00 - 10:30 **Vladimir Grinin**
Introduction to the physics of UX Ori stars

10:30 - 11:00 **Alex Kreplin**
UX Ori objects: From an interferometric perspective (Invited talk)

11:00 - 11:20 **Sergei Shulman, V. P. Grinin**
Influence of the disk wind on the intrinsic polarization of young stars

11:20 - 11:50 *Coffee Break*

11:50 - 12:20 **Stefano Facchini**
Observables of inner disks dynamics (Invited talk)

12:20 - 12:40 **Evgeni Semkov, S. Peneva., S. Ibryamov, A. Mutafov**
Long term photometry of UXor stars with large amplitudes

12:40 - 13:00 **Suslina Elena, A. Dodin**
Inhomogeneous eclipses in the UX Ori type stars

13:00 - 13:10 **Group photo**

13:10 - 14:30 *Lunch*

Chair: ***Megan Ansdell***

14:30 - 15:00 **Goesta Gahm**
Young stars shielded behind dust and molecules (Invited talk)

15:00 - 15:20 **Larisa Tambovtseva, V. P. Grinin**
Modern view of the close vicinity of UXORs based on modeling their emission spectra

15:20 - 15:50 **Jorick Vink**
Linear spectro-polarimetry to unravel inner disk dynamics (Invited talk)

15:50 - 16:20 *Coffee Break*

16:20 - 16:40 **Ágnes Kóspál, G. Zsidi, P. Ábrahám, J. A. Acosta-Pulido, O. Fehér, M. Kun, Z. M. Szabó**
An UXor among FUors: extinction-related brightness variations of the young eruptive star V582 Aur

16:40 - 17:00 **Asen Moutafov, E. H. Semkov, S. P. Peneva, S. I. Ibryamov**
Multi-color photometry of the stars GM Cep and V1180 Cas

17:00 - 17:20 **Sergei Belan, D. N. Shakhovskoy**
Results of photopolarimetric observations of UX Ori at a uniquely deep minimum

17:20 - 18:00 **Discussion**

18:00 - 21:00 **Welcome party in the hotel Moscow**

Session 2: UXOrs and related objects

Tuesday, October 1

Chair: ***Timo Prusti***

10:00 - 10:20 **Victor Shenavrin, V. P. Grinin, A. N. Rostopchina-Shakhovskaya, T. V. Demidova, and D. N. Shakhovskoy**
The long-term photometric study of UXOrs in the near infrared and visual wavelengths

10:20 - 10:40 **Péter Abrahám, R. Szakáts, Á Kóspál**
Time-variability and disk geometry in Herbig Ae stars: a simultaneous optical – infrared study of the UXor phenomenon

10:40 - 11:00 **Svetlana Artemenko, P. P. Petrov, K. N. Grankin, E. V. Babina**
Photometric and spectroscopic time series of cTTS RY Tau and SU Aur

11:00 - 11:30 *Coffee Break*

11:30 - 12:00 **Peter Petrov**
Dust in the near environment of classical T Tauri stars (Invited talk)

12:00 - 12:20 **Sergei Lamzin, A. Dodin, B. Safonov, P. Petrov, M. Takami, A. Tatarnikov, I. Antokhin, M. Burlak, D. Cheryasov, G. Chuntonov, A. Gusev, A. Nadjip, K. Malanchev, O. Vozyakova**
RW Aur binary: asymmetrical effect of the fly-by on the inner regions of circumstellar discs of the components

12:20 - 12:40 **Boris Safonov, A. Dodin, S. Lamzin**
Dichroic absorption by circumstellar dust as a possible polarigenic mechanism of RW Aur A and RY Tau

12:40 - 14:30 *Lunch*

Chair: ***Evgeni Semkov***

14:30 - 14:50 **Dmitry Shakhovskoy, S. Belan, K. Grankin, A. Savushkin**
Long UXOR type events in RW Aur and AA Tau: polarimetric observations and their implications

14:50 - 15:20 **Timo Prusti**
Gaia and young stars (Invited talk)

15:20 - 15:40 **Miguel Vioque, R. D. Oudmaijer, M. Schreiner, D. Baines, R. Pérez-Martínez**
New UX Ori type candidates detected using Gaia DR2 and Machine Learning

15:40 - 16:00 *Coffee Break*

16:00 - 16:20 **Lei Chen, Á. Kóspál, P. Abrahám**
Photocenter motion during UXor events: understanding disc structure with Gaia

16:20 - 16:50 **Claudio Zanni**
Modelling magnetospheric accretion and outflows in T Tauri stars (Invited talk)

16:50 - 17:20 **Ilia Potravnov**
Accretion and outflow activity on the late phases of Pre-main sequence evolution (Invited talk)

17:20 - 18:00 **Poster Session**

Session 2: UXORs and related topics

Wednesday, October 2

Chair: ***Sergei Lamzin***

10:00 - 10:30 **Antonio Garufi**
Shadows on the outer disk as maps of the inner disk (Invited talk)

10:30 - 10:50 **Sergei Khaibrakhmanov, A. E. Dudorov**
Dynamics of toroidal magnetic flux tubes in the accretion disks of T Tauri stars

10:50 - 11:10 **Ya. N. Pavlyuchenkov, A. V. Tutukov, Lomara Maksimova, E. I. Vorobyov**
Evolution of a viscous protoplanetary disc with convectively unstable regions

11:10 - 11:40 *Coffee Break*

11:40 - 12:10 **Tatiana Demidova**
Perturbations in the disks and their hydrodynamic simulations (Invited talk)

12:10 - 12:30 **Simon Casassus**
Warps in Transition Disks

12:30 - 13:00 **Eduard Vorobyev**
Accretion bursts and their effect on the pre-main-sequence stellar evolution (Invited talk)

13:00 - 14:30 *Lunch*

14:30 **Excursion to the Pulkovo Observatory**

19:00 **Conference Dinner**

Session 2: UXORs and related topics

Thursday, October 3

Chair: ***Rebeca Garcia Lopez***

10:00 - 10:30 **Ignacio Mendigutia**
Measuring stellar accretion rates of Herbig Ae/Be stars (Invited talk)

10:30 - 10:50 **Tamara Ermolaeva, D. V. Dmitriev, V. P. Grinin**
Formation of the He I 10830 line in the spectra of UXOrs

10:50 - 11:10 **Mikhail Pogodin, N. G. Beskrovnaya, O. V. Kozlova, I. Yu. Alekseev, S. E. Pavlovskiy**
The helium line at 5876 A in the spectrum of the Herbig Ae/Be star HD37806 as an indicator of magnetospheric accretion

11:10 - 11:40 *Coffee Break*

11:40 - 12:10 **Megan Ansdell**
A review and update on the dipper systems (Invited talk)

12:10 - 12:30 **Tigran Magakian, H. R. Andreasyan, T. A. Movsessian, M. H. Gevorgyan**
Simultaneous photometry and spectroscopy of V1686 Cyg

12:30 - 12:50 **Aleksandr Kholtygin, O. Tsiopa**
An enigma of the Herbig Ae/Be magnetic stars evolution

12:50 - 14:30 *Lunch*

Chair: ***Alexander Kreplin***

14:30 - 15:00 **Catrina-Hamilton Drager**
The History of KH 15D (V582 Mon) and the Status of Observations and New Interpretations (Invited talk)

15:00 - 15:30 **Rebeca Garcia Lopez**
The inner astronomical units of protoplanetary disks (Invited talk)

15:30 - 15:50 **Antonio Hales, L. Cieza, S. Pérez, J. Williams, D. Ruiz-Rodriguez**
ALMA Studies of Young Eruptive Stars

15:50 - 16:10 *Coffee Break*

16:10 - 16:30 **Sebastián Pérez**
Resolving the FU Ori system with ALMA: co-planar twin disks

16:30 - 17:00 **Benjamin Montesinos**
A Circumstellar material around main-sequence stars: looking for exocomets and related phenomena (Invited talk)

17:00 - 17:20 **Denis Dmitriev, V. P. Grinin**
Magnetospheric model of the gas accretion onto RZ Psc

17:20 - 18:00 **Final Discussion and Concluding Remarks**

Friday, October 4

10:00 - 16:00 **Excursion**
Excursion to the Hermitage "Gold of the Scythians"
Permanent exhibition of the General staff "French painting of XIX-XX centuries. Impressionists"
Sightseeing bus tour

Posters

1. **A. Arkharov, V. Larionov, N. Efimova and S. Klimanov, (on behalf of a team of Italian astronomers)** Photometric activity of the EXORs type stars in the near infrared wavelengths

2. **S. Artemenko and I. Potravnov** BP Psc: young UXOR at the extremely high galactic latitude?

3. **O. Barsunova, V. Grinin, S. Sergeev, S. Shugarov and N. Efimova** Photometric activity of the UX Ori stars in the young cluster IC 348

4. **T. Demidova and I. Shevchenko** Long-term planetesimal dynamics in planetary chaotic zones

5. **N. Efimova, A.Arkharov, V. Grinin, V. Larionov and S. Klimanov** Observations of two UX Ori stars VX Cas and V517 Cyg in the near infrared wavelengths

6. **N. Katysheva, V. Grinin, T. Ermolaeva and D. Dmitriev** Radiation and thermodynamic characteristics of hydrogen gas at the magnetospheric accretion

7. **M. Khazraei and S. Momeni** The differency between two type of telescope (Cassegrain & Niutonis) in photometry

8. **S. Momeni and M. Khazraei** Estimating and manufacturing a Corrector Blade, to Balance the Aberration Elimination Capability and enhancement picturing and photometry for an Amateur telescope

9. **A. N. Rostopchina-Shakhovskaya, V. P. Grinin, D. N. Shakhovskoy** Thirty years of Herbig Ae/Be stars photopolarimetric monitoring in CrAO

10. **Ch. Wichittanakom, R. Oudmaijer, J. Fairlamb, I. Mendigutía, M. Vioque, and K. Ababakr** Determination of accretion rates of Herbig Ae/Be stars

11. **M. Wienen** Ammonia survey of cold high-mass clumps discovered with ATLASGAL

Abstracts

Contents

Posters

Introduction to the physics of UX Ori stars

V. Grinin[1,2]

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The UX Ori type stars are the photometrically most active young objects in our Galaxy. The main reason of their activity is the variable circumstellar extinction. The role of the other mechanisms of variability is small. Therefore the photometric and polarimetric observations of UXOrs are the important and in some respect unique source of information about the non-stationary processes in the inner regions of the protoplanetary disks. In this report, after brief review of observational properties of UXORs, we discuss the physics of the observed phenomena and models suggested for their explanation.

The disk wind influence on the intrinsic polarization of young stars

S. G. Shulman[1], *V. P. Grinin*[2]

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[2]Pulkovo Astronomical Observatory of RAS, Saint Petersburg, Russia

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The behaviour of the linear polarization parameters of UX Ori stars during their eclipses and after them is studied. A circumstellar disk with a puffing in the dust sublimation zone is considered. Dust clouds and large scale disk perturbations in circumstellar disks are considered as causes of eclipses.

It is shown that the disk puffing can strongly affect the degree of polarization and colour index of the star during its eclipse. The scattered radiation from a thin disk is polarized perpendicularly to its plane, but the radiation from a disk with the puffing can be polarized along the disk plane. An intermediate situation when the disk scattered radiation is not polarized in a certain spectral band is also possible. The scattered radiation may have different orientations of the linear polarization in different spectral bands.

It is also shown that perturbations of the geometrically thin flared disk could not influence on the polarization positional angle after a photometric minimum significantly. Otherwise, in the case of the disk with the puffed-up inner rim, the perturbation may give changes of the positional angle up to 60 degrees. This model explains the unusual changes of the linear polarization observed in UX Ori and WW Vul after the long-lasting photometric minima.

Observables of inner disks dynamics

(Invited talk)

S. Facchini

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High angular resolution observations can access the inner few astronomical units of planet forming disks. In particular, scattered light images can probe the 3D geometry of the very inner regions, which affects the illumination pattern onto the outer disk. Complementary information is provided by ALMA, which can determine the gas kinematics of similarly small-scale regions. One unexpected result from these observations is that the inner regions of a subsample of protoplanetary disks are misaligned with respect to the outer disk, in particular in disks hosting large cavities at (sub-)mm wavelengths. In this talk I will show recent and new observations aimed at characterising this peculiar phenomenon, focusing on the theoretical effort to interpret these puzzling findings. Possible explanations range from misaligned (sub-)stellar companions, to tilted magnetic fields and accretion funnels.

Long term photometry of UXor stars with large amplitudes

E. Semkov[1], *S. Peneva*[1], *S. Ibryamov*[1,2], *A. Mutafov*[1]

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2 Department of Physics and Astronomy, University of Shumen, Shumen, Bulgaria

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The study of different kinds of variability of young stellar objects is very important for understanding stellar evolution. For several decades we have been performing photometric monitoring of some of the star formation regions. As a result, we were able to investigate the photometric behavior of many variable stars with uncertain classification. When an object exhibiting high-amplitude brightness variability is detected, it is generally assumed that this variability will be explained as an outburst. Our results and those of other authors indicate that the deeps in brightness as a result of variable extinction are no less widespread as the outbursts. Recent studies show that variable extinction is characteristic of all PMS stars, regardless of their mass and spectral class.

In this presentation we show our results from optical photometric studies of some UXor variables located in the star forming regions: the bright nebula NGC 7129, the North America and Pelican nebulae and the unique object V1184 Tau. Our monitoring is carried out in BVRI filters, which allows studying the variability in color indexes also. Our results show the usefulness of photometric studies of the stars in the long-term scale.

Inhomogeneous eclipses in the UX Ori type stars

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The observed photometric and spectral variability of CQ Tau implies that circumstellar dust clouds cover the stellar disc inhomogeneously, or, in other words, that a typical scale of inhomogeneities in the clouds is comparable to the stellar radius. Due to that reason the observed extinction law seems more grey than the intrinsic one. Therefore all conclusions about the size distribution of the dust grains in the circumstellar environment of the UX Ori type stars derived from the optical photometry are controversial. Inhomogeneous obscuration of the rotating stellar surface produces features in the line profiles. Those features give an opportunity to study distribution of the dust absorption over the stellar disc at each moment of observation, i.e. to see the clouds along with their movements.

Young stars shielded behind dust and molecules

(Invited talk)

G. Gahm

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Various properties and phenomena observed for UX Ori stars are reviewed with comments on structures, orientations, and molecular contents of the disks and the occulting bodies. Comparisons are made to similar phenomena in T Tauri stars. Some results from a recent spectroscopic and photometric monitoring of the stars UX Ori and RR Tau are presented.

Modern view of the nearest vicinity of UXORs based on modeling their emission spectra

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Modeling of hydrogen emission lines is a powerful tool to study physical processes in the nearest vicinity of young stars. A special case is modeling of emission spectra of the UX Ori type stars (UXORs) observed nearly edge-on through their protoplanetary disks. We consider different types of hybrid models to reproduce spectroscopic observations for such UXORs as UX Ori, RR Tau, VV Ser, WW Vul. We computed models of a magneto-centrifugal disk wind in combination with magnetospheric accretion models. For VV Ser we also computed visibilities together with line profiles of the Br gamma line for the disk wind model in combination with a magnetospheric accretion, Cranmer's polar wind powered by accretion, and scattered light from circumstellar dust, and compared them with the available VLTI-AMBER interferometric and LBT-LUCIFER spectroscopic observations of the single-peak profile of the Br gamma line to constrain model parameters. Contribution of all emitting regions to the radiation of the hydrogen lines is discussed.

Linear spectro-polarimetry to unravel inner disk dynamics

(Invited talk)

J. Vink

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Linear spectropolarimetry is uniquely capable of resolving the innermost region between pre-main sequence stars, allowing us to map both the geometry and the kinematics of accreting gas on spatial scales that remain out of reach by any other means. Here we present a technique that combines linear H-alpha spectropolarimetry data, known inclination angles, and an established Monte Carlo model to determine inner disk sizes and compare them to expected magnetospheric radii. This allows us to test the mode of mass accretion as a function of stellar mass.

An UXor among FUors: extinction-related brightness variations of the young eruptive star V582 Aur

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V582 Aur is a pre-main-sequence FU Orionis-type young eruptive star, which has been in eruption since 1985. In order to analyze the temporal evolution of the outburst and to examine the stellar environment, we studied archival photographic plates, obtained new optical, infrared, millimeter wavelength observations between 2010 – 2019, and used mid-infrared Wide-field Infrared Survey Explorer (WISE) data as well. Based on the pre-outburst data and the millimeter continuum measurements, we suggest that the progenitor of V582 Aur is a low mass T Tauri star with average properties. The mass of an unresolved circumstellar structure, probably a disk, is 0.04 $M_{\odot}$. Based on the photometric measurements, we found that V582 Aur shows significant optical-infrared variability. The light curves show two deep minima due to changes in the line-of-sight extinction, one in 2012 and one that is still ongoing since 2016, reminiscent of the UXor phenomenon. If the present dimming originates from the same orbiting dust clump that caused the brightness variation in 2012, then our results suggest a viscous spreading of the dust particles along the orbit. Alternatively, the current minimum may be caused by a dust structure entering and leaving the inner part of the system. The WISE measurements could be consistent with this scenario. Fitting the near-infrared spectral energy distributions at different epochs with a simple accretion disk model shows that until 2017 April, the mass accretion rate was approximately constant, while the extinction episodically increased during the dimming periods in 2012 and in 2016 – 2018. In 2018, however, the accretion rate was lower by a factor of 2 than before 2017. Our long-term data and accretion disk modeling hint at a general fading of V582 Aur, suggesting that the source will reach the quiescent level in ~ 80 yr.

Multicolor photometry of the stars GM Cep and V1180 Cas

A. S. Mutafov[1], *E. H. Semkov*[1], *S. P. Peneva*[1], *S. I. Ibryamov*[2]

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Results from long-term optical photometric observations of the pre-main sequence stars GM Cep and V1180 Cas from UX Orionis type are reported. The UBVRI CCD observations were performed in two observatories with four telescopes and nine different types of CCD cameras: the 2-m Ritchey-Chretien-Coude, the 50/70-cm Schmidt and the 60-cm Cassegrain telescopes of the National Astronomical Observatory Rozhen (Bulgaria) and the 1.3-m Ritchey-Cretien telescope of the Skinakas Observatory in Crete (Greece).

During ongoing photometric monitoring of the GM Cep three deep minimums in brightness are observed. The collected multicolor photometric data shows the typical of UXor variables color reversal during the minimums in brightness. Recent BVRI photometric observations of GM Cep have been collected from November, 2014 to August 2019.

The object V1180 Cas exhibited large amplitude brightness variations (D$I_C \sim 5-6$ mag.). Data from our BVRI photometric monitoring show drops in stellar brightness with similar amplitude in the period October 2011 – August 2019.

Results of photopolarimetric observations of UX Ori in uniquely deep minimum

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The minimum of UX Ori observed in 2018-2019 was about 0.5 mag deeper than earlier observed minima. It seems to be the central part of a long lasting fading event lasting since 2014. We present polarimetric observations obtained during the minimum. Compared to earlier minima, higher degree of polarization (up to 10% in V band) was observed, but the PA of polarizations is remarkably constant. Our interpretation of polarimetric data is that in the deepest part of this minimum the central star was totally obscured (at least in V and shorter-wave bands). Very high degree of polarization observed as well as the grater than normal depth of the minimum may be due to partial obscuration of the inner disk by a large-scale dust structure which caused a decade-long fading.

The long-term photometric observations of UX Ori stars in the near infrared and visual wavelengths

V. I. Shenavrin[1], V. P. Grinin[2,3], A. N. Rostopchina-Shakhovskaya[4], T. V. Demidova[4], and D. N. Shakhovskoy[4]

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We present the results of the long-term observations of several UX Ori stars in the near-IR (JHKL) and visual (V) wavelengths. For the photometrically most active UX Ori stars: BF Ori, CQ Tau, UX Ori and WW Vul, the Algol-like declines of brightness in the visual, which are due to sporadic enhancements of the circumstellar extinction, are also observed (with decreasing amplitude) in the IR bands. A strict correlation between the V and J brightness variations is observed for all the stars except for SV Cep. For some of the UX Ori stars, a strong correlation between the visual and IR activity is observed up to L band, where the main contribution to the emission is made by circumstellar dust. In the case of SV Cep, the visual variability is not correlated with the variability of the IR fluxes. On one occasion, a clear anti-correlation was even observed: a shallow, but prolonged decrease of the visual brightness was accompanied by an increase in the IR fluxes. This indicates that circumstellar clouds themselves can become powerful sources of IR emission. Our results provide evidence that the photometric activity of UX Ori stars is a consequence of instability of the innermost regions of their CS disks.

Time-variability and disk geometry in Herbig Ae stars: a simultaneous optical-infrared study of the UXor phenomenon

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The optical-infrared variability of Herbig Ae/Be stars is often attributed to unsteady accretion and/or orbiting dust clumps in edge-on disks. The latter, called the "UXor-phenomenon", provides information about the inner disk structure, the formation site of terrestrial planets. Here we present multi-color and multi-epoch photometric observations of 8 Herbig Ae/Be stars (BF Ori, RR Tau, SV Cep, UX Ori, V517 Cyg, VV Ser, VX Cas and WW Vul), aiming to study observationally UXor-events over a broad wavelength range. The data set was taken during our Konkolyvar program in 2009 and 2010. In this 14-days long monitoring campaign the targeted stars were observed simultaneously from ground based observatories at optical and near-infrared wavelengths, and with the Spitzer Space Telescope in the mid-infrared. We processed the raw data, and created the multiwavelength lightcurves of each object from the B-band to 4.6 micrometer. We found that in spite of the relatively short campaign, we detected several fading events in the sample that could be attributed to the UXor phenomenon. We analysed the results with special emphasis on the relationship between the optical (stellar radiation) and the mid-infrared (thermal emission of dust particles in the inner disk) lightcurves. The high precision Spitzer data may help the understand whether the inner disk is obscured – similarly to the star – by passing dust clouds at larger distances, or the eclipses are caused by the inner disk itself. We also try to link the observed variability to the Group I / Group II classification of Herbig Ae/Be stars based on the structure of the circumstellar medium.

Photometric and spectroscopic time series of cTTS RY Tau and SU Aur

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Long series of simultaneous spectroscopic and photometric observations of the classical T Tauri stars RY Tau and SU Aur have been carried out since 2013. The aim is to quantify the accretion and outflow dynamics at time scales from days to years.

It is shown that dust in the disc wind is the main source of the photometric variability of these stars. Intrinsic variations of the H-alpha emission flux is analysed. The gradual change of the accretion and outflow activity is supposedly related to the magnetic cycles of the stars.

Dust in the near environment of classical T Tauri stars

(Invited talk)

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Classical T Tauri stars (cTTS) are young low mass stars with accretion disks. In the paradigm of magnetospheric accretion, the light variability of a cTTS is mainly due to accretion processes. This is obvious in the episodic accretion events of EXors and FUors, while in an ordinary cTTS the circumstellar dust plays an equally important and often dominant role in the irregular light variability. The pattern of light variability of cTTS depends on the inclination angle. The inner edge of the accretion disk may be warped by the stellar magnetic fields. The axial asymmetry of the warp causes periodic or quasi-periodic obscurations of the cTTS viewed nearly equator-on. In lower inclinations, the dust in the disk wind is the source of irregular variability. In rare cases there happen a deep and long-lasting dimmings of a cTTS which for many years has been an ordinary variable. The nature of the deep dimmings is still a matter of debates. Among possible scenarios, the inner disk perturbations and/or destruction of planetesimals has been discussed.

RW Aur binary: asymmetrical effect of the fly-by on the inner regions of circumstellar discs of the components

S. Lamzin[1], A. Dodin[1], B. Safonov[1], P. Petrov[2], M. Takami[3], A. Tatarnikov[1], I. Antokhin[1], M. Burlak[1], D. Cheryasov[1], G. Chuntonov[4], A. Gusev[1], A. Nadjip[1], K. Malanchev[1], O. Vozyakova[1]

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Components of the visual young binary RW Aur A+B recently had a close encounter. It is assumed that subsequent enhancement of the disk accretion rate onto RW Aur A, the appearance of its HH-229 jet and dusty disk wind are the consequences of rearrangement of inner regions of RW Aur A's protoplanetary disk caused by the fly-by of the companion RW Aur B. However nothing was known about the effect of the fly-by on the inner regions of RW Aur B's disk. We present here results of our photometric, polarimetric and spectral observations of RW Aur B, and conclude that activity of the star differ significantly from that of RW Aur A. Posssible reasons of the difference are discussed.

Dichroic absorption by circumstellar dust as a possible polarigenic mechanism of RW Aur A and RY Tau

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For UX Ori variables rise of polarization degree during fading is classicaly explained by the increased contribution of scattered radiation of circumstellar material. In most cases, the character of polarization-magnitude dependence can be interpreted in the frame of this model. UX Ori variable RW Aur A appears to be an exception. We present observations of this object using the Differential Speckle Polarimetry (DSP). DSP allows not only to measure total polarization of object, but to localize the sources of polarized radiation at diffraction limited resolution as well (50 mas). We managed to model the obtained data only with the involvement of the polarization of direct star radiation by aligned dust in circumstellar environment. A similar situation is observed for another UX Ori variable RY Tau. In conclusion we discuss the feasibility of dust alignment in circumstellar environment.

Long UXOR type events in RW Aur and AA Tau: polarimetric observations and their implications

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Recent and still ongoing long-lasting fading events in two Classical T Tau stars, AA Tau and RW Aur, may be considered another instance of UXOR phenomenon. Our polarimetric observations during the minima confirm that the primary mechanism of fading is circumstellar dust extinction, but unlike in proper UXORs, parameters of polarization are quite different from ones observed during "normal" state, and incompatible with disk-dominated scattering geometry. We discuss two mechanisms for this unusual polarimetric variability: radical change in the geometry of circumstellar environment and the dominance of aligned dust grains absorption over scattering during these events.

Gaia and young stars

(Invited talk)

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Gaia has completed its 5-year long nominal mission and at the moment we are at the start of the extended operations. The spacecraft is expected to function till end-2024 when Gaia runs out of consumables. Gaia DR2 provided astrometry and photometry to more than a billion stars and more than 7 million radial velocities. The data has been utilised extensively in more than 1,000 papers published. The impact is enormous in all fields of Galactic astronomy including studies of young stars. The most notable progress has been made with parallaxes not only to get precise distances to young stars, but also to disentangle 3D structures within star formation complexes (e.g. Taurus). Proper motions have been utilized to clean up membership lists and to study kinematics of young clusters. The presentation will summarise the progress made with Gaia in general and for young stars in particular.

New UX Ori type candidates detected using Gaia DR2 and Machine Learning

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As shown in Vioque et al. (2018), highly photometrically variable Herbig Ae/Be stars in the Gaia passbands contain most of the so-called UX Ori variables reported in the literature.

We have now developed an algorithm to discover a new homogenous set of Pre-Main Sequence candidates within Gaia DR2, AllWISE and 2MASS and the IPHAS and VPHAS+ catalogues, spanning all the mass range visible in the optical by using a combination of different Machine Learning algorithms.

Several features were chosen for identifying the new set of Pre-Main Sequence objects based on our current knowledge of this class, which is characterized by infrared excesses, photometric variabilities and Hα emission lines. Among these sources, there is a set of around 150 very likely Herbig Ae/Be candidates displaying strong irregular photometric variabilities, that we now present as new UX Ori candidates.

Photocentre motion during UXOR events: understanding disc structure with Gaia

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A most natural interpretation of the UXOR phenomena is transient obscuration to the central star caused by clumpy dust. In this scenario the disc is likely inclined, and the photocentre of the scattered stellar light is therefore generally not coincident with the position of the star. The photocentre of the whole star-disc system is a weighted average of the star position and the scattered light photocentre, and therefore will move back-and-forth during an obscuration event. Using radiative transfer simulation, we studied photocentre motion from such a mechanism, and found it can be as much as several au during a typical event. At the typical distance of 100–1000 pc for young stars, such a motion is readily detectable with ESA's high-precision astrometric instrument Gaia. Therefore, by combining the astrometric and photometric time series from Gaia, UXOR events could be detected with higher reliability than using photometry only. Moreover, the astrometric data provide spatial information of the disc. For example, the position angle of the photocentre motion indicates the disk position angle. The amplitude of photocentre motion is sensitive to disc size, disc flaring, and disc inclination. While the full times series are currently not yet available for most sources in Gaia DR2, we endeavour to look for signs of photometric variabilities and astrometric motions in the database.

Modelling magnetospheric accretion and outflows in T Tauri stars

(Invited talk)

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Many observational properties of classical T Tauri stars are commonly interpreted in the framework of the magnetospheric star-disk interaction scenario. I present a review of different numerical results aimed at modeling this scenario. I will first characterize the constituents of these models, both accreting (the circumstellar disk, the accretion funnels) and ejecting (stellar, magnetospheric and disk outflows). I will then present the best efforts devoted to extract from these models synthetic observables that can be directly compared to observations. I will finally try to compare the dynamical variability displayed by the numerical models with the observed one.

Accretion and outflow activity on the late phases of Pre-main-sequence evolution

(Invited talk)

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The spectroscopic activity of the young classical T Tauri stars are mainly caused by the accretion and related outflow processes. The vanishing of the accretion signatures on the timescale of about 10 Myr indicates to the gas depletion and structural changes in the inner disc due to photoevaporation and planets formation. However, it is not well investigated yet how the magnetospheric accretion evolves in the course of the inner discs depletion. In my talk I will review the observational and theoretical points to the processes which are important on the late stages of accretion and also will discuss the cases of prolonged accretion activity.

This research was supported in part by the grant RFBR No.18-32-00501

Shadows on the outer disk as maps of the inner disk

(Invited talk)

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High-resolution NIR and ALMA images of protoplanetary disks have revealed, over the last decade, a variety of peculiar features. Among these, the azimuthally localized dark lanes, soon interpreted as shadows, caught our attention because their variable morphology could be related to that of the very inner disk. As of today, more than a dozen disks are known to show these shadows and the diversity of such features is suggesting very different environments around the young central star, with the possible presence of multiple warped disk components, misaligned companions, or asymmetric accretion flows. The geometrical and physical structure of the outer disk is also constrained by the shape and the variation in time of the shadows. In this talk, I review what we learned over the last few years from these fascinating structures and discuss how to exploit the increasing number of high-resolution images of protoplanetary disks to map the disk inner regions.

Dynamics of toroidal magnetic flux tubes in the accretion disks of T Tauri stars

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Dynamics of slender magnetic flux tubes (MFTs) in the accretion discs of T Tauri stars (TTSs) is investigated. We perform simulations taking into account buoyant, aerodynamic, and turbulent drag forces, radiative heat exchange between MFT and ambient gas, and magnetic field of the disc. Model of cylindrical MFTs [1] is supplemented by the equation for the major radius of the toroidal MFT following Dudorov [2]. The equations of MFT dynamics are solved using RungeвЂ“Kutta method of the fourth-order. Structure of the accretion disks is simulated using the magneto-gas-dynamic model of Dudorov and Khaibrakhmanov [3, 4]. We investigate dynamics of the MFTs in the inner regions of the accretion disks, where thermal ionization operates. Possibility of thermal and magnetic oscillations of the MFTs are studied.

The simulations show that MFTs rise periodically with velocities up to 5-15 km s^{-1} and periods of 0.5-10 yr determined by the toroidal magnetic field generation time. The external magnetic field causes MFT oscillations near the disc surface. These magnetic oscillations have periods from several days to months. The magnetic oscillations decay over a few periods. We simulate MFT dynamics in accretion discs in the Chameleon I cluster. The simulations demonstrate that MFT oscillations can produce observed IR-variability of T Tauri stars. The work is supported by the Russian Foundation for Basic Research (project no. 18-02-01067).

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Evolution of a viscous protoplanetary disc with convectively unstable regions

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The role of convection in the accretion gas-dust disc around a young star is studied. The evolution of a Keplerian disc is modeled using the Pringle equation, which describes the variation of surface gas density with time under the action of turbulent viscosity. At the same time, the distribution of volume density and temperature in the polar direction is calculated assuming that the disc is in hydrostatic equilibrium.

When calculating the vertical structure of the disc, the heating of the disc by stellar and interstellar radiation, as well as viscous heating are taken into account. The main factor controlling the evolution of the disc in our model is the dependence of the viscosity coefficient on the radius. We account for the background viscosity which provides continuous accretion of gas and for convective viscosity which is triggered in the inner part of the disc. The global disc evolution and disc morphology within this approach are presented. We show that an episodic accretion is established in the disc with two sequent stages: the inner region of the disc (R 1 AU) is slowly (~ 2000 yrs) filled with a gas, and then quickly (~ 100 yrs) discharged. These results may be useful in explaining the activity of young stellar objects like FU Orionis and EX Lupus.

Perturbations in the disks and their hydrodynamical simulations

(Invited talk)

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Observations of protoplanetary disks with high angular resolution using an large ground and space telescopes showed that large-scale structures are often visible on their images. The existence of such structures indicates strong perturbations of the matter of protoplanetary disks. The latter can be associated with a formation of planetary systems. The review will present a series of results devoted to the impact of an invisible companion on the matter distribution and illumination condition of the circumstellar disk. The hydrodynamical simulations shows the large-scale inhomogenities of matter can be produced by periodic perturbations of the protoplanetary disk by the protoplanet. Such structures can effect on the circumstellar extinction and propagation of the star radiation to an observer. Streams of matter, density waves and vortexes may arise in the disk and affect the photometric properties of protoplanetary disks. For instance, it can produce the variable circumstellar extinction, which is typical for UX Ori type stars. UX Ori phenomenon may manifest in protoplanetary disks seen face-on, when the inner part of the disk is warped because of the inclination of the companion orbit to the disk plane. In this case the warp prevents the spread of stellar radiation in some direction. An observer will see motionless shadows on the disk image.

The second natural mechanism for protoplanetary disks is destructive collisions of large bodies (planetesimals and planetary embryos). We showed that the large impact also can produce noticible inhomogeneity on the disk images. The theory allows to explain the three types of observed substructures in protoplanetary disks: crescent-like azimuthal asymmetries, tightly wrapped spiral arms and rings as different phases of one process.

Warps in transition disks

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Warps or inclination changes as a function of radius have often been invoked to explain protoplanetary disk observations. Well characterised examples can inform on the origin of such warps, on their role in disk evolution, and may allow for new probes of physical conditions. In transition disks, the separation of the inner and outer disks by a radial gap allows firm constraints on warp geometry. There are now 5 examples of sharply warped transition disks, in which the outer disk is directly exposed to stellar light. Some shadows also correspond to a temperature decrement, but others do not. After a brief description of the known warped systems, I will propose a simplified model for cooling in shadowed outer disks. This model accounts for the wide variety of thermal decrements, and may provide a diagnostic of the outer disk mass.

Accretion bursts and their effect on the pre-main-sequence stellar evolution

(Invited talk)

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The formation process of stars is accompanied by energetic events known as FU Orionis-type eruptions (FUors), during which the stellar luminosity increases by factors from tens to hundreds. These energetic events are likely associated with an increased rate of mass accretion on the star, which is caused by various disk instabilities or external disk perturbations. I will review several mechanisms for FU Orionis-type accretion bursts and the consequences that the bursts can have on the pre-main-sequence evolution of low-mass stars.

Measuring accretion rates of Herbig Ae/Be stars

(Invited talk)

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Mass accretion rates cannot be measured directly, for which an underlying physical model is needed to infer their values from the observations. In this talk I will review our current knowledge about the mass accretion rates in Herbig Ae/Be stars, as derived from different observational probes and the magnetospheric accretion (MA) scenario. I will summarize the main observational evidences supporting that although such a scenario could actually work for most Herbig Ae/Be stars, several Herbig Bes show properties incompatible with MA and require a different accretion paradigm.

He I 10830 line as an indicator of UX Ori accretion

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We investigate the formation of the HeI 10830 Å line in the spectra of UX Ori stars. The analysis of observations presented by Cauley & Johns-Krull (2014) shows that all UX Ori stars have the inverse P Cyg profiles, indicating that the He I 10830 A line originates in magnetospheric accretion flows. Given the results of previous studies (Kwan & Fischer 2011), we suggest that X-ray photoionization is needed for ionization of helium and producing the HeI 10830 line opacity.

We find that if the X-Ray emission is formed in the region behind the shock front that arises when accretion funnel hits the star, then the line profile is very weak. This means that X-ray emission is formed not only in the accretion spots, but also beyond them. Using a method similar to that used in Fischer et al. 2008, we obtain a HeI 10830 line profile close to that observed in the spectrum of BF Ori.

The helium line at 5876 angstrem in the spectrum of the Herbig Ae/Be star HD37806 as an indicator of magnetospheric accretion

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We present results of the spectroscopic study of the Ae/Be Herbig star HD37806 near the HeI 5876 line carried out using spectrographs of high resolution at the Crimean astrophysical observatory and the OAN SPM in Mexico. 19 spectra obtained during November 8-12, 2012 and 8 spectra obtained on February 18, 2010 were analyzed. We have revealed that this line demonstrates a short-term variability with a characteristic time of hours in form of of standing intensity waves in the region of the red absorption component. Using model calculations we prove that such variability can be observed only if the local accretion flows are rotating rigidly with the magnetic field of the star inside the magnetosphere.

Additionally, on the date February 18, 2010 this absorption component became strongly extended up to +420 km s^{-1}. This can be also possible only if the magnetospheric character of accretion takes place.

A review and update on the dipper systems

(Invited talk)

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The so-called "dipper" objects are young (≤ 10 Myr) T Tauri stars hosting protoplanetary disks with optical light curves that exhibit very deep (> 10%) and moderate-duration (0.5-2 day) dimming events that can appear either quasi-periodically (i.e., at regular intervals, but with varying shapes and depths) or aperiodically (i.e.,B stochastically and with varying shapes and depths). The dips are thought to be caused by large dusty structures passing through the inner (≤ 1AU) disk regions and transiting our line-of-sight to the host star, however the driving physical mechanisms and their relation to our understanding of planet formation remain unclear. In this talk, I will review what we know about these enigmatic objects, highlighting the latest results that have leveraged the recently launched TESS mission as well as synergies with ground-based observatories like ALMA.

Simultaneous photometric and spectral analysis of a new outburst of V1686 Cyg

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We present an analysis of the optical observations of Herbig AeBe star V1686 Cyg, which is associated with a small isolated star-forming region around HAeBe star BD+40 4124. V1686 Cyg is demonstrating photometric variability up to 3 magnitudes amplitude. We present results of its photometric and spectroscopic observations in optical range. We observed this star as a part of our project of young eruptive stars investigation. Observations were held on 2.6m telescope of Byurakan Observatory from 2015 to 2017. For this period we obtained V1686 Cyg direct images and 14 medium- and low-resolution spectra. In the course of observations we noticed that this star underwent a new outburst. After data reduction we found that the full rise and decline of V1686 Cyg brightness with almost 3 magnitudes range lasted about 2 months. We were able to trace the changes of the stellar spectrum during the outburst.

An enigma of the Herbig Ae/Be magnetic stars evolution

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Magnetic-field measurements for Herbig Ae/Be stars are analyzed. The distributions of rms magnetic fields B and magnetic fluxes F for Herbig stars with measured magnetic fields are determined. The B and F distributions can be approximated by log-normal functions with the means $\log B = 2.0$ and $\log G = 25.5$ and with widths $\log \Delta B = 0.3$ dex and $\log \Delta F = 0.4$ dex respectively. The obtained distribution widths appeared to be close to the typical values for main-sequence (MS) AB-type stars, whereas the mean logarithms of magnetic fields and magnetic fluxes proved to be significantly (up to one order of magnitude) lower than the corresponding values for MS stars (2.5 and 26.4 respectively). The causes of these differences and the evolution of magnetic fields of intermediate-mass pre-MS stars are discussed. An analysis of the magnetic-field measurements for UX Ori showed that their magnetic properties do not differ from those for all sample of Herbig Ae/Be stars.

The history of KH 15D (V582 Mon) and the status of observations and new interpretations

(Invited talk)

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Just over twenty years ago the variable star, V582 Mon, was re-discovered by Kearns and Herbst and henceforth has also been known as KH 15D. In this talk, I will review the history of this intriguing system, and what it represents: an opportunity to study a pre-main sequence (PMS) binary system still embedded in an accretion disk. The steady precession of the occulting circumbinary (CB) ring has allowed us to derive the stellar properties of both stars, and presents us with the opportunity to refine and expand current models of the system. This should lead to a strong test of PMS models. I will review the most recent observations and results, and discuss some new interpretations of "old" data.

The inner astronomical units of protoplanetary disks

(Invited talk)

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A first step towards understanding planetary formation is the characterization of the structure and evolution of protoplanetary discs. Although the large scale disc is understood in some detail, very little is known about the inner 5 au (i.e. within a radius corresponding to Jupiter's orbit) in which the main physical processes take place: accretion, ejection and planetary formation. Only recently, IR interferometers have been able to perform the first statistical study of the dust in the inner disk. In this talk, I will review recent optical interferometric results concerning the structure of the inner disk as probed through dust and gas tracers.

ALMA studies of young eruptive stars

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It is now believed that stars acquire most of their mass in short episodes of accretion outbursts. This episodic accretion picture has replaced the traditional steady state accretion model and is changing our understanding on how stars gain their mass (and the origin of the IMF), binary formation, planet formation, the luminosity spread in young clusters, disk chemistry and snowline migration. Despite its relevance, the physical mechanisms responsible for episodic accretion remain poorly understood. In this work I discuss recent observational results aimed at constraining the physical properties of outbursting sources to help understand what drives this important phase of star formation.

Resolving the FU Ori system with ALMA: co-planar twin disks

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FUors are low-mass pre-main sequence stars that undergo dramatic brightness outbursts. These outbursts are thought to be linked to – currently not well understood – episodic accretion events in which stars gain a significant portion of their mass. The archetypical FUor system, FU Orionis, is composed of two young stars with a projected separation of 0.5". Gas and dust emission have been detected around both components in previous radio observations. The individual dust emitting regions have not been resolved until now.B In this talk I will describe new 225 GHz (1.3 mm) ALMA observations of the FU Ori binary where both dusty circumstellar environments are resolved at 40 mas resolution.B In combination with ^{12}CO gas line kinematics, we are able to determine the disks geometries and update accretion models for FU Ori.B

Circumstellar material around main-sequence stars: looking for exocomets and related phenomena

(Invited talk)

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In this talk the results of a large high-resolution spectroscopic survey, carried out by our team, aimed at detecting and monitoring the presence of exocomets around main-sequence stars, will be presented.

Over 2000 spectra of more than 100 AFG-type stars have been obtained. Gas absorption features compatible with a circumstellar (CS) origin are found in ~25% of the stars of the sample, and variable absorptions in 18 objects, some of them being new detections. We will present the results of particular stars, e.g. ϕ Leo, which shows conspicuous variations, and HR 10, an object that has been considered and studied so far as a single star, and whose CS variability has been interpreted as originated by beta-Pic like events, when actually it is a binary with two individual CS envelopes; this raises the interesting point that there is a chance that other stars that exhibit variability attributed to FEB phenomena might actually be binaries.

Magnetospheric model of the gas accretion onto RZ Psc star

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We present the magnetorspheric model of the gas accretion onto UX Ori type stars RZ Psz. The signatures of the gas accretion onto this very weak line T Tauri star have been recently observed in the H-alpha line by Punzi et al. (2018) during the "flare" of accretion activity of RZ Psc. Quite large velocities ($\sim 500 - 600$ km/s) in the red absorption component of H-alpha line suggest the large magnetosphere (about 10 stellar radii). Together with the small mass accretion rate ($\sim 10^{-10} - 10^{-9}$ solar masses per year) it implies densities in the magnetosphere about $10^{10} - 10^{11}$ atoms per cm^3. With such small densities and large velocities we have to take into account the movement of the accreted gas along the magnetic field lines when calculating the ionization state and level populations of the hydrogen atoms. The resulting theoretical line profile explains well the red absorption component of the H-alpha line, but fails to reproduce the central part of emission. We assume that the additional narrow emission component is formed in the accretion spot on the stellar surface.

Posters

Photometric activity of the EXORs type stars in the near infrared wavelengths

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A study of the relationship between the observed IR characteristics of EXors type variables and the mechanisms operating during their typical evolutionary phase pre-main sequence is presented. The results were obtained mainly from observations in the near infrared region of the spectrum on the telescope AZT-24 in Italy in conjunction with astronomers of the Roman Astronomical Observatory. Based on the data received during long monitoring program EXORCISM and literary data, the analysis of the photometric and spectral variability of a number of objects, confirming the assumption of the role of disk accretion as the main mechanism of the variability of EXors.

BP Psc: young UXOR at the extremely high galactic latitude?

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The star BP Psc is located far above the Galactic plane at the latitude $b = -57°$. BP Psc possesses strong circumstellar activity resembled those of young T Tauri stars. However its evolutionary status was unclear. In our poster we report the discovery of the UX Ori type photopolarimetric activity of BP Psc. The re-analysis of its high resolution optical spectra gives additional evidences in favour of the T Tauri star scenario.

This research was supported by the grant RFBR No.18-32-00501.

Photometric activity of the UX Ori type stars in the young cluster IC 348

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We present results of the multi-year photometric (VRI) monitoring of six T Tauri stars in the young cluster IC 348. All targets demonstrate the UXOr type activity. Three of them (V712 Per, V716 Per, V909 Per) are the classical TTSs, three others (V695 Per, V715 Per, V719 Per) are the weak line TTSs. The light curves demonstrate the large diversity. In two cases we observed the combination of the UXOr type activity and periodic brightness variations similar to that observed in AA Tau by Bouvier et al. (1999). In one case we observed the very long (about 3 years) deep minimum with a sudden start and the same sudden end. The properties of the observed photometric activity and its origin are briefly discussed.

Long-term planetesimal dynamics in planetary chaotic zones

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Algorithms and a software package are described that have been developed for simulating the long-term dynamics of passively gravitating particles in planetary systems of single and binary stars. The algorithms are based on the BulirschвЂ“Stoer method for solving differential equations of the second order. The integration accuracy is controlled on the secular timescale. Using this package, we perform massive numerical experiments revealing the long-term dynamics of debris disks in planetary systems of single and binary stars. We concentrate on determining the mass parameter dependences of the radial sizes of planetary chaotic zones, as well as on the clearing timescales of these zones. The obtained massive numerical results are discussed and interpreted in the light of the existing analytical theories, based on resonance overlap criteria, as well as in comparison with previous numerical approaches to the problem. The work is supported by the Russian Foundation for Basic Research (project No. 17-02-00028).

The IR-photometric behaviour of the young stars VX Cas and V517 Cyg

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The long-term infrared photometry of the young stars VX Cas and V517 Cyg is investigated. The IR-data were obtained in Astrophysical Observatory Campo Imperatore (Italy) with Pulkovo telescope AZT-24 in J, H and K Johnson bands during 2003-2016. Additional optical photometry were used. Color behaviour of the choosen object is considered and discussed. Observed photometric activity seems to be connected with circumstellar extinction variations produced in the gas-dust disks surrounding these stars and seen almost edge-on.

Radiation and thermodynamic characteristics of hydrogen gas at the magnetospheric accretion

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The thermodynamic characteristics of Hydrogen gas near a state of complete thermalization, to which the gas approaches in the dense layers of the magnetospheres of young stars, is considered. In this state Balmer decrement becomes flatter: $H\alpha/H\beta/H\gamma = 1.3/1.0/0.8$ (see, for example, Muzerolle et al. 1998). It is less known, however, that on the way to this state a sharp strengthening of the H? can be observed in comparison with other lines of the Balmer series.

In this report we examine in detail the physical conditions under which such anomalous Balmer decrements arise.

The different between two type of telescope (Cassegrain & niutonis) in photometry

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In this paper we checking the different between two type of common telescopes (Cassegrain telescope and niutonis telescope) for photometry in astronomy. We take photo of CY Aqr star at city near Shiraz in Iran in one night we use two type of telescope with same situation in all things like tripod seeing the sky location CCD camera for photometry after that we use MaximDL software for analysis data and checking for the different them, the most important different between this two type of telescope in photometry was in saturation of stars.

Estimating and manufacturing a Corrector Blade, to Balance the Aberration Elimination Capability and enhancement picturing and photometery for an Amateur telescope

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Commercial amateur telescopes have optical insufficiencies besides their low picturing quality. All types of amateur telescope have usually no more than one specific performance capability. The major reason of that is the high manufacturing cost of an amateur telescopes with multiple capabilities and with high picturing quality. The aim of this research is to improve the quality and to reduce the cost of amateur instruments used by amateur astronomers. In this project, the computation of the correcting blade is presented to decrease the aberration and to investigate the possibility of making satisfying and rational pictures in amateur telescopes. In this case, the three correcting blades of Meniscus are designed. In the first and second phases of the project, the amount of Aberration caused by circular mirror has been decreased to minimum and it has been used in the second phase to manufacture the design. The body of Maksutov Cassegrain has been designed in a way that it can be converted to Newtonian telescope as well. So the quality of the system has been evaluated both in the presence of the correcting blade and without it. Therefore, the telescope would be capable of picturing and using a photometer optionally. The quality of images taken, the amount of remnant aberration, the insufficiency in each of two optical glasses and the performance of each system have been studied in practice and tested using of image processing.

Key Words: amateur telescope, correcting blade, aberration, processing picture, picturing, astrological, photometry

Thirty years of Herbig Ae/Be stars photopolarimetric monitoring in CrAO

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Photopolarimetric observations of Herbig Ae/Be stars and related objects started in Crimean Astrophysical Observatory (CrAO) more than 30 years ago. All observations has been done with the AZT-11 (1.25 m) telescope equipped with 5-channel UBVRI photometer-polarimeter. Simultaneous brightness and polarization in UBVRI bands has been monitored for 25 stars. Here we present a number of the most interesting observations.

Determination of accretion rates of Herbig Ae/Be stars

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We present INT/IDS spectra of 30 Herbig Ae/Be stars. The stellar parameters are determined using atmospheric models, the Gaia parallaxes and isochrones. The accretion rates are determined from Halpha line measurements and the relationship between accretion luminosity and line luminosity which comes from the magnetospheric accretion model. The sample is extended by combining with the sample of Fairlamb et al. (2015) whose results are updated using the Gaia distances. This is the largest spectroscopic sample of 78 objects with homogeneously determined stellar parameters and accretion rates. Moreover, accretion rates of an additional 85 objects in the Vioque et al. (2018) sample are determined for all objects of which equivalent widths are available. Our final sample contains 163 accretion rates. This sample size allows for a determination of the mass where the break in the relationship between low-mass and high-mass stars occurs. This suggests the process of accretion switch from magnetically controlled accretion in low-mass stars to another mechanism around $4M_{\odot}$.

Ammonia survey of cold high-mass clumps discovered with ATLASGAL

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The initial conditions of molecular clumps, in which high-mass stars form, are still largely unknown. In particular, progress requires to study objects in the early evolutionary stages, before ultracompact HII regions have formed and the newly formed high-mass (proto)stars emerge in the infrared. These phases are best searched for and detected by (sub)millimeter dust continuum and high-density molecular tracers. ATLASGAL, the first unbiased dust continuum survey of the whole inner Galactic plane at 870 micron, provides a global view of cold dust and star formation at submillimeter wavelengths. The sample discovered by ATLASGAL presents an important repository for the characterization of the statistical properties of these high-mass clumps.

I will focus on results that were derived from the large scale database of the coldest stages of massive star formation, especially the pre-stellar phase, provided by the continuum survey and follow-up observations. In particular, molecular line observations are a powerful tool that can be used to estimate distances and gas properties, which are key to determining the properties of star-forming regions. We therefore followed up 1200 dust clumps identified by ATLASGAL in the (1,1) to (3,3) inversion transitions of the high-density tracer ammonia, which is an excellent probe of massive clumps with low temperatures. I will show that the analysis of the so far largest ammonia sample of massive star-forming sources reveals a clear trend of increasing rotational temperatures and line widths found from the earliest to the later evolutionary stages.

We identified about 700 molecular cloud complexes consisting of about 3500 ATLASGAL sources based on spatial and kinematic information to provide an unbiased 3D view of these massive star-forming sites within our Galaxy. I will show a correlation that was found between the number of ATLASGAL sources as a function of galactocentric radius and the position of the spiral arms revealing a link between them. In particular, the assignment of distances allowed us to estimate clump masses and sizes, to evaluate their stability via their virial mass and to study the star formation activity within numerous molecular clouds.

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