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Preface: Stars and interstellar medium

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Abstract This issue presents proceedings of the "Stars and Interstellar Medium" section of the All-Russian Astronomical Conference VAK-2017. Sixteen papers (selected from about 70 talks) cover different problems related to stars, pulsars, interstellar gas and dust, and star formation. The preface briefly reviews these papers.

Key words: stars: binaries — ISM: general — ISM: clouds

The All-Russian Astronomical Conference VAK-2017 was held on 2017 September 17–22. It was a large scientific event, with hundreds of participants from many scientific institutes around Russia and quite a noticeable representation from other countries.

The scientific program included 13 invited discourses covering general problems of science in Russia, current and future space experiments, and the most interesting results in astronomy and astrophysics obtained during recent years. There were seven sections: Methods and instruments; Astrometry and celestial mechanics; Solar system and exoplanet systems; The Sun and heliosphere; Stars and interstellar medium; Extragalactic astronomy, high-energy astrophysics and cosmology; Astronomical education, history of astronomy and popular science. Transactions of the conference were partially published in Russian in the Journal of the Crimean Astrophysical Observatory (Vol. 114, No. 1, 2018).

The current issue of Research in Astronomy and Astrophysics (RAA) is based on transactions of the largest section of the conference, Stars and interstellar medium. Unlike cosmology or extragalactic astronomy, the subject of this section is not the most popular topic in current days. Nevertheless, this aspect of astronomy and astrophysics represents one of the deepest roots in our science; remember that the word "astronomy" is derived from Greek for "star." The subject of stars covers an extremely wide variety of objects exhibiting a wide range of properties. Understandings of their origin, formation, interaction and related studies of the interstellar medium are also of outmost importance.

About 70 talks were presented at the section "Stars and interstellar medium" during the conference week. Sixteen of them were selected for publication in RAA.

Traditionally, sections devoted to stars at Russian astronomical conferences contain many presentations on variable stars and pulsars. The topic of pulsars unites optical and radio astronomers. However, all the three purely pulsar papers in the current issue are by radio astronomers from Pushchino (Moscow Region) Observatory of the Astro Space Center, P.N. Lebedev Physical Institute. Two of them are based on observations with the Large Phased Array (LPA) telescope in Pushchino. Kazantsev and Potapov (2018) searched for giant pulses from observations of radio pulsars performed in 2011–2017. Malofeev and Tyulbashev (2018) successfully used the technique of power spectra in order to search for radio pulsars in the data from round-the-clock monitoring of the sky with the same telescope. The third paper (Malov and Timirkeeva 2018) deals with radio pulsars identified as gamma-ray sources. The authors present a list of 107 radio pulsars where gamma rays can be detected and of six gamma-ray pulsars with expected radio emission.

Pulsars are also a subject of the paper by Fadeev (2018) but here they are used to probe the interstellar medium on the way from the pulsar to the observer. The author (a team member of the "RadioAstron" space experiment) considers thin scattering screens as well as distributed matter that affects our estimates of distances to the scattering screens.

Tatarnikova et al. (2018) studied the famous symbiotic Nova PU Vul (Kuwano-Honda object) using many years of optical and infrared photometry as well as spectroscopy. The star has a long orbital period (13.4 years), displayed two eclipses after its outburst in 1977, exhibits pulsations from its cool component and is shown to have now entered a phase typical for symbiotic stars in quiescence.

Eretnova & Dudorov (2018) study a sample of young T-Tauri type variable stars and use several grids of evolutionary models to estimate their masses and ages. The pre-main-sequence status of the program objects is confirmed. T Tauri stars were also the subject of theoretical study by Khaibrakhmanov et al. (2018). They investigated dynamics of magnetic flux tubes in their accretion disks and found that such tubes can contribute to variations observed for T Tauri stars in the infrared wavelength range.

Ryspaeva & Kholtygin (2018) consider X-ray observations of a sample of O stars from the archive of the *XMM-Newton* space observatory. They compare two mechanisms suggested to explain this X-ray emission, the so-called Pollock's paradigm (Pollock 2007) and the magnetically confined wind model (MCWM). The conclusion is that observations contradict Pollock's paradigm and do not completely agree with the MCWM.

Belova & Bychkov (2018) studied physical conditions in the atmosphere of a cool star, in particular, cooling of partially ionized hydrogen gas behind a shock wave. They show that ionization from excited states should be taken into account when calculating the radiative cooling behind the shock.

Antipin et al. (2018) report their discovery of 275 new variable stars from digitized plates of the Sternberg Astronomical Institute's 40-cm astrograph taken in 1976–1994. The field centered at the star 104 Her was studied. The stars' classification performed using traditional methods was compared to automated classification, based on the same brightness measurements and using the Random Forest algorithm. The results seem promising.

Photographic astrometry is discussed by Shakht et al. (2018). They use plates taken with the Pulkovo 65-cm ($F = 10.4$ m) refractor in 1958–2006. In this paper, the authors consider two visual binaries, for which Pulkovo observations made it possible to derive accurate orbits and component masses, and two astrometric binaries, where they were able to estimate masses of their unseen components.

Star formation regions are the subject of several papers. Zinchenko et al. (2018) studied the general structure of the known high-mass star-forming region S255IR from radio observations they had acquired in 2016 with ALMA. They find a more complex structure than what was believed earlier, with several centers of star formation activity. Ryabukhina et al. (2018) investigate the filamentary dark cloud G192.76+00.10 in the star forming complex S254–S258 from observations with three radio telescopes performed in 2015–2016. Gas accretion possibly occurs along the filaments. Among the other results, six dense clumps with masses from 30 to 160 solar masses were identified in the CS(2–1) emission. Pirogov (2018) observed the high-mass star-forming regions S140 and S199 with three radio telescopes in 2010–2017. According to his estimate, each of the regions contains millions of randomly moving small thermal fragments. For fragments in S140, physical parameters were evaluated.

Topchieva et al. (2018) estimated total fluxes in eight infrared bands (from 8 to 500 μm) for 99 HII regions in our Galaxy. They show that the fraction of polycyclic aromatic hydrocarbons (PAHs) for most of them is much lower than the average galactic level, implicating PAH destruction in HII regions. The criteria usually applied in order to distinguish between HII regions and planetary nebulae sometimes fail in the case of spatially resolved objects.

Finally, this issue contains a review of studies performed by one of the most famous Soviet astronomers and astrophysicists, G. A. Shajn (1892–1956), who worked at Pulkovo Observatory, Simeiz Observatory, and Crimean Astrophysical Observatory in Nauchny. Bondar' (2018) describes his work related to diffuse matter and cosmogony of stellar systems. Shajn's results continue to seem very modern and inspire new work.

Summarizing, the section Stars and interstellar medium, only a small part of its talks of which are published in this RAA issue, provided an impressive picture

of Russia-based research in this important field of astronomical studies.

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