## PERSONALIA

## Anatolii Mikhailovich Cherepashchuk (on his 80th birthday)

July 7, 2020 was the 80th birthday of the outstanding Russian astronomer, full member of the Russian Academy of Sciences (RAS), and research supervisor at the Sternberg State Astronomical Institute (SAI) of Lomonosov Moscow State University (MSU), Anatolii Mikhailovich Cherepashchuk.

Cherepashchuk was born in the town of Syzran in the Kuibyshev (now Samara) region on July 7, 1940. His mother worked as a nurse's aid in the Syzran Division of Acute Care and his father was an officer (lieutenant in the artillery corps). He died in the war in 1941.

Anatolii Mikhailovich traveled an illustrious path from a schoolboy from Syzran fascinated with astronomy to a professor, director (from 1986 to 2018), and then a research supervisor at a first-rate astronomical institute (SAI MSU).

In the course of over half a century of active scientific work, he obtained world-renowned results in the study of stellar physics, the physics of stellar systems, relativistic objects, and active galactic nuclei, as well as in solving inverse astrophysical problems.

Cherepashchuk carried out studies of close binary stellar systems at the late stages of evolution containing Wolf–Rayet (WR) stars, white dwarfs, neutron stars, and black holes as their components. He developed effective methods for interpreting observations of these systems, applying complicated, physically grounded models and using modern methods to solve ill-posed problems. He predicted X-ray emission from collisions of supersonic stellar winds in massive close binary systems, which was later confirmed by satellite observations. He determined the evolutionary status of WR stars and revealed the evolutionary relations of WR stars, neutron stars, and black holes.

At the dawn of X-ray astronomy in 1972–1973, Cherepashchuk and colleagues carried out fundamental studies of optical manifestations of X-ray binary systems and proposed the now widely used method for estimating the inclination of the orbit of an X-ray binary system from the observed opticalstar ellipsoidal form. This method underlay the determination of neutron star and black hole masses. Together with V M Lyutyi and R A Sunyaev, Cherepashchuk suggested one of the first estimates of the black hole mass in the Cygnus X-1 system. He also discovered optical eclipses in a unique object—"the enigma of the century"—SS433 and showed that this object with moving emission lines in the spectrum is a massive X-ray binary system at the late stage of evolution with a precessing supercritical accretion disc around a probable black hole. Cherepashchuk's studies of the object SS433 resulted in identifying a new class of galactic objects, microquasars.

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Anatolii Mikhailovich Cherepashchuk

Cherepashchuk worked out effective methods for calculating light curves, line profiles, and radial velocity curves of tidally deformed stars with a complex temperature distribution over the surface in X-ray binary systems. He obtained reliable estimates of neutron star and black hole masses in these systems.

In 1971, Cherepashchuk (together with Lyutyi) discovered the effect of time delay of intensity variation of wide emission-line components in the spectra of galactic nuclei relative to variability of their continuum. The measurement of this delay time allows estimating the distance from the central supermassive black hole to the surrounding gas clouds. The search for the reverberation effect was included in the program of the Hubble Space Telescope. The investigation of line variability and the search for reverberation effects have now formed a new area in the study of the structure of active galactic nuclei and determination of supermassive black hole masses. This method has been used to determine the masses of thousands of black holes in galactic nuclei within the range of  $10^6 - 10^{10}$  solar masses. The masses of several dozen black holes and neutron stars in binary systems

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were also measured. This led to the development of a new direction in relativistic astrophysics, black hole demography used in studying the birth and growth of black holes as well as their relation to classical objects in the Universe (stars, galaxies, etc.). Cherepashchuk and A V Zasov revealed correlations between central supermassive black hole masses and the characteristics of parent galaxies. In connection with the recent discovery of gravitational waves from binary black hole coalescences, studies of black holes acquired a firm observational basis. Cherepashchuk emphasized that the final proof of the existence of the event horizon in black holes can be obtained via gravitational-wave observations of quasinormal black hole oscillation modes due to merging.

Cherepashchuk and his students were the first in this country to measure the angular diameters of stars from observations of their lunar occultation with an angular resolution of nearly one millisecond. He proposed the method of searching for exotic forms of matter (single black holes, wormholes, etc.) by analyzing light curves observed in microlensing of distant background stars by compact dark bodies of the halo of our Galaxy. He also calculated (together with M B Bogdanov and M V Sazhin) chromatic and polarization effects observed in microlensing of nonzero-size stars.

Constructed during 2005–2015 on the initiative of Cherepashchuk and under his guidance was the Caucasus mountain observatory of SAI MSU with a 2.5 m telescope situated near the town of Kislovodsk at an altitude of 2100 meters above sea level. As director of SAI, Cherepashchuk managed to preserve the Crimean Astronomical Station of SAI MSU and breathe new life into its development.

Professor Cherepashchuk is heavily engaged in teaching. Since 1972, he has delivered a special course on close binary stellar systems at MSU. Twenty-eight candidate (PhD) and 6 doctoral theses have been defended under his guidance. He has published over 500 scientific papers and nearly 20 monographs (some of them with co-authors). Together with mathematicians, he has published three monographs on solving inverse astrophysical problems. Among Cherepashchuk's latest monographs worthy of mentioning is the twovolume Close binary stars (Moscow: Fizmatlit, 2013) and also a collective monograph (where Cherepashchuk is the compiler, editor, and author of one chapter) Multimessenger astronomy (Fryazino: Vek-2, 2019). Widely known are his brilliant scientific reviews (published in Physics-Uspekhi) on observational manifestations of astrophysical black holes in close binary systems and galactic nuclei.

Cherepashchuk successfully combines scientific work with extensive scientific organizational and popularization activities. For 32 years, he was director of SAI MSU. Now, he is a member of the Bureau of the Division of Physical Sciences of RAS, chairman of the Scientific Council on Astronomy of RAS, a member of the International Astronomical Union, an associate member of the Royal Astronomical Society, and, from 2000 to 2005, vice president of the European Astronomical Society. As vice chairman of the Academic Council of Moscow Planetarium, he actively promoted the rebirth of this largest Russian center for disseminating scientific knowledge to the public. After many years of reconstruction, the renewed Planetarium was opened on June 12, 2011, Russia Day.

For many years, Cherepashchuk has been editor-in-chief of the *Astronomicheskii Zhurnal (Astronomy Reports)* and a member of the editorial boards of several Russian and international scientific journals. He is a member of editorial boards of a number of popular-science journals (*Priroda* [*Nature*], Zemlya i vselennaya [Earth and the Universe], and others). Since 2015, is a member of the editorial council of *Physics*-Uspekhi.

Cherepashchuk was chairman of the expert commission on awarding the Bredikhin RAS Prize in astronomy and is now head of the expert commission on awarding the Shklovskii RAS Prize in astrophysics.

The activity of Anatolii Mikhailovich concerning the dissemination of astronomical knowledge is widely known. He is an active fighter against pseudo-science and bellicose ignorance. His popular books in astronomy became bestsellers and have been reprinted several times.

For his contribution to the development of science and training astronomers, Cherepashchuk has received state awards: the Order of Friendship (1999), the Order of Honor (2005), and the Order of Alexander Nevsky (2020). For outstanding scientific results, he was repeatedly awarded with high prizes. In 2008, he was decorated with the State Prize of the Russian Federation in the field of science and technology. In 2013, he received the RF Government Prize in education. He is a laureate of the Belopolsky Prize of the RAS (2002) and a laureate of Lomonosov Prizes of MSU for scientific research (1988) and pedagogical activity (2001). For a series of studies on inverse problems of the theory of eclipsing binary stars, Cherepashchuk was awarded the 1974 Lenin Komsomol Prize. In 1997, the minor planet 4307 of the solar system was named after Cherepashchuk.

Cherepashchuk is one of the most active organizers of and participants in the activities of the RAS Scientific Council on astronomy. Being head of the team, he can stimulate its activity through his own example, willingly taking upon himself the task of solving key problems and at the same time remaining cheerful, inventive, well-disposed, and optimistic.

We heartily give our best to Anatolii Mikhailovich Cherepashchuk on his splendid jubilee and hope he has new creative achievements in his active scientific and organizational work. We wish him, his family, and his relatives good health and success.

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