

## Yuri Tsolakovich Oganessian (on his 90th birthday)

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April 14, 2023 was the 90th birthday of Yuri Tsolakovich Oganessian, a world-famous scientist, professor, academician of the Russian Academy of Sciences (RAS), and research supervisor at the Flerov Laboratory of Nuclear Reactions of the Joint Institute for Nuclear Research (JINR).

Yu Ts Oganessian was born on April 14, 1933 in Rostov-on-Don. On finishing secondary school in Erevan with a silver medal in 1950 and while waiting for his interview on physics and mathematics in order to enter the Moscow Mechanical Institute (now the Moscow Engineering Physics Institute — MEPhI), Yuri lived in Moscow for ten days at the Yaroslavsky railway station. Having graduated from MEPhI in 1956, he worked at the Measuring Instrument Laboratory No. 2 of the USSR Academy of Sciences (now the Kurchatov Institute). In 1958, along with G N Flerov's sector, he was transferred to JINR in Dubna, where he has been working for already two thirds of a century: junior researcher, senior researcher, head of the sector, head of the department, deputy director of the Flerov Laboratory of Nuclear Reactions (FLNR), director of the Laboratory (1989–1997), and research supervisor of FLNR JINR.

In 1962, Yuri Tsolakovich (Yu Ts) defended his candidate thesis, “Gamma-Ray Radiation of High-Spin Nuclei in Reactions with Heavy Ions,” in 1970, he defended his doctoral thesis, “Fission of Excited Nuclei and Possibilities of Fusion of New Isotopes,” since 1980, he has been a professor, since 1990, a corresponding member of the USSR Academy of Sciences, and since 2003, a full member of RAS (Division of Physical Sciences).

Academician Yu Ts Oganessian is a legend of world science, a world-famous scientist in the field of experimental physics of the atomic nucleus, studies of nuclear reactions, fusion, and examination of the properties of new elements of the Mendeleev Periodic Table of chemical elements, the physics and technology of charged particle accelerators, and the use of accelerated heavy ions in related areas of science and engineering. Together with academician G N Flerov, he is founder of the modern scientific, technical, and experimental base for the development of the new branch of nuclear physics — heavy ion physics.

Yu Ts Oganessian is the author of fundamental studies of the mechanisms of interaction of complex nuclei. One of the fundamental problems of natural science is related to determining the boundaries of existence of atomic nuclei and the synthesis of new chemical elements. Yu Ts's pioneering investigations of interaction mechanisms of complex nuclei, the creation under his guidance of high-power heavy ion accelerators, and the development of original methods for investigating rare processes of nuclear transformations have yielded excellent results. Worthy of note among them is an experimental proof of the effect of the structure of nuclear



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matter on collective large-amplitude nuclear motion such as fusion and fission.

Yu Ts Oganessian has carried out fundamental work on the synthesis of new elements in heavy ion beams. In the 1960s–1970s, he and his colleagues were the first to perform experiments on the synthesis of elements with  $Z = 104–108$ . He made a decisive contribution to the analysis of the mechanism of their origin and the properties of their radioactive decay. Yu Ts discovered a new class of reactions — the cold fusion of massive nuclei — which have been used for over 40 years in world practice for the synthesis and study of the properties of transactinide elements with atomic numbers from 107 to 113. To investigate the heaviest nuclei, Yu Ts Oganessian chose the fusion reactions of neutron-enriched actinide isotopes with accelerated ions of the rarest calcium-48 isotope. For the first time in world practice, intense beams of this exotic material were obtained in Dubna, which made it possible to completely fill in the 7th period of the Mendeleev Periodic Table. In 1999–2010, a group of scientists led by Yu Ts at JINR synthesized the heaviest elements with atomic numbers 113 (2003), 114 (2000), 115 (2003), 116 (2000), 117 (2010), and 118 (2002). In recognition of Yu Ts Oganessian's contribution to the synthesis and studies of the properties of the heaviest elements, the International Union of Pure and Applied

Chemistry assigned the name ‘oganeson’ to the 118th element. Yu Ts Oganessian is the second scientist whose name was immortalized in the Mendeleev Periodic Table *inter vivos*.

The discovery of a whole family of superheavy elements completes the long history of great efforts by major laboratories in the USA, Germany, Japan, France, and Switzerland in search of the hypothetical “Island of Stability” in the unknown region of the heaviest (superheavy) elements predicted by the microscopic nuclear theory in the late 1960s.

The synthesis of 52 new isotopes of the heaviest elements expanded the region of existence of nuclei up to a mass of 294. The number of elements in the Mendeleev Periodic Table increased to 118. The increase in the atomic number and mass of the heaviest stable nucleus, lead-208, by more than 40% demonstrated the amazing vitality of atomic nuclei. Owing to the internal structure of nuclear matter, the heaviest nucleus shows a fission barrier, which makes the existence of superheavy elements possible. The fundamental consequences of the modern microscopic nuclear theory were for the first time experimentally confirmed.

Now, scientists from Dubna intend to get the 119th and 120th elements—the first elements of the eighth period of the Mendeleev Periodic Table. Yu Ts Oganessian’s ideas were embedded in the development and launch in Dubna of a new acceleration complex referred to as the Factory of Superheavy Elements (SHE). The complex was created within six years, and at the present time the SHE Factory surpasses by about 15 times the units of the previous generation in its capability of obtaining the heaviest atoms.

Along with the fundamental scientific problems of modern nuclear physics and technology, Yu Ts Oganessian has focused significant attention on applied studies. With his active participation, FLNR has conducted investigations of the interaction between heavy ions and various materials: polymers, metals, and single crystals, and methods for obtaining new materials used in related sciences, and new technologies have been developed. Another avenue is obtaining radioactive isotopes for medical purposes.

Based on Yu Ts Oganessian’s ideas, new nuclear-physics and chemical laboratories are being created at international research centers in other countries and programs are being worked out for a wide range of work on the investigation of nuclei at the boundaries of stability. In addition to high scientific significance, which raises all research to a new level, this strengthens the leadership and international relations of Russian science.

Yu Ts is a key participant in several large scientific projects. For example, he played a very important role in the successful holding in 2019 of the International Year of Periodic Table of Chemical Elements devoted to the 150th anniversary of the discovery of the periodic law by D I Mendeleev. The international schools, meetings, and conferences regularly held under Yu Ts Oganessian’s guidance in Russia and other countries have become widely popular and highly recognized.

Eleven doctors and over 20 candidates of sciences both from Russia and from JINR member states are among Yu Ts Oganessian’s disciples. Yu Ts is the head of the Department of Nuclear Physics of Dubna State University (the base department of JINR).

Yu Ts is the author and co-author of over 500 scientific publications, is a member of the editorial boards of the

journals *Physics of Elementary Particles and Atomic Nucleus*, *Nuclear Physics*, and *Europhysics News*, for many years was a member of the editorial council of the journals *Journal of Physics G*, *Nuclear Physics News International*, *Il Nuovo Cimento*, *Particles and Nuclei*, and *Particle Accelerators*, was chair of the RAS academic council Relativistic Nuclear Physics and Heavy Ion Physics, and was chair of the JINR dissertation council. Yu Ts was also a member of the academic councils of GANIL (France, 1991–1995), RIKEN (Japan), GSI (Germany, 1998–2002), and FAIR (Germany 2011–2014), and a member of the program-consulting committee of GANIL and RIKEN.

Yu Ts Oganessian is a member of many foreign scientific societies, among which is the American Physical Society and the European Physical Society (EPS), and a member of the EPS bureau for nuclear physics (1989–1996). Yu Ts is a foreign member of the Serbian Academy of Sciences and Arts, the National Academy of Sciences of the Armenian Republic, and the Polish Academy of Learning in Krakow. He is an honorary member of the Royal Chemical Society of Great Britain, a professor at Konan University in Kobe (Japan), an honorary professor at Goethe University Frankfurt (Germany, 2002) and the University of Messina (Italy), an honorary doctor of Erevan State University, an honorary doctor of Maria Curie-Skłodowska University (Poland), an invited scientist and professor of Oak Ridge National Laboratory (USA), and an invited scientist and professor of the Institute for Advanced Study in Texas, USA.

Yu Ts Oganessian is an honorary professor at Lomonosov Moscow State University, an honorary doctor at the National Research Center Kurchatov Institute, an honorary professor at MPhI, an honorary doctor at the DI Mendeleev University of Chemical Technology of Russia, and an honorary citizen of the town of Dubna and the Moscow region.

Yu Ts Oganessian has received many prizes and awards for his merits. He was awarded the orders “For services to the Fatherland” IV, III, and II degrees, the “Badge of Honor,” the Red Banner of Labor, Friendship of Peoples, and Order of Honor.

Yu Ts is a laureate of USSR and RF State Prizes and the Lenin Komsomol Prize, received the honorary diploma of the RF Government, M V Lomonosov Great Gold Medal of RAS, I V Kurchatov gold medal of the USSR Academy of Sciences, and L N Nikolaev gold medal. He also received the G N Flerov Prize, I V Kurchatov Prize of the USSR Academy of Sciences, Demidov Prize, first UNESCO-Russia Mendeleev International Prize, scientific Sber Prize, and main prize of MAIK Nauka/Interperiodika (2001).

Numerous are Yu Ts’s awards from the Republic of Armenia: the Gold Medal of the National Academy of Sciences of Armenia, the Order of Honor of Armenia, and the Order of St. Mesrop Mashtots, and a stamp with the image of the world-renowned nuclear physicist Yuri Oganessian has been issued in Armenia.

Among Yu Ts’s other foreign awards are the A von Humboldt Prize (Germany), L Meitner Prize (European Physical Society), Order of Friendship (Mongolia), Order of Friendship II degree (DPRK), and officer’s cross of the Order of Merit of the Republic of Poland.

In memory of his wife, the violinist Irina Levonovna Oganessian, Yuri Tsolakovich initiated in 2011 the ILOganessian competition of violinists and cellists and instituted the

prize for laureates of this competition. The competition soon became all-Russian.

On April 14, 2023 (on the day of academician Oganessian's 90th birthday), the institution of the annual Oganesson Prize was announced. The prize was aimed at encouraging scientists and specialists to achieve in theoretical and experimental research in physics, chemistry, biology, and applied problems. In addition, the prize will be given to science journalists and science popularizers. The first Oganesson Prize laureates will be announced in 2023.

Yuri Tsolakovich enjoys the deepest respect of his colleagues both at his native laboratory and at JINR, as well as around the world. Among his main qualities are purposefulness and dedication to science, and the ability to see a scientific problem and unite people to solve it. Academician Oganessian continues to work actively on the development of the FLNR research program, first and foremost at the Factory of Superheavy Elements—one of the main JINR projects.

We heartily wish Yuri Tsolakovich Oganessian good health, brilliant new ideas, and scientific results on his 90th birthday!

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