

PERSONALIA PACS number: **01.60.+q**

Sergei Mikhailovich Stishov (on his 80th birthday)

DOI: https://doi.org/10.3367/UFNe.2017.11.038243

Professor Sergei Mikhailovich Stishov, the outstanding Russian physicist, Full Member of the Russian Academy of Sciences (RAS), member of the Bureau of the Physical Sciences Division of RAS, and Doctor of Physical and Mathematical Sciences celebrated his 80th birthday on 12 December 2017.

Sergei Mikhailovich Stishov is a world-renowned specialist in the field of high-pressure physics and technology, condensed matter physics, and the physics of phase transitions. He exhibits undiminished interest in physical problems, great erudition, a remarkable mastership of experiment, and deep physical intuition.

S M Stishov was born on 12 December 1937 in Moscow and, having finished secondary school in 1955, entered the Faculty of Geology of Lomonosov Moscow State University (MSU).

As a student, he began his active scientific work and published a number of papers on the nature of color centers in different minerals. After graduating from MSU with honors, S M Stishov entered the graduate program, where his interest in the internal structure of Earth and planets stimulated the origin of experimental activity in high-pressure physics. The name Stishov became well known when, in 1961, he obtained and examined a new dense modification of Earth silicon, which was soon found in an Arizona meteorite crater and called 'stishovite' after him. With the results of this work, S M Stishov defended his Candidate's thesis.

Further, for many years S M Stishov's scientific activity was connected with the Institute of Crystallography RAS, where he progressed from a Junior Researcher to Head of a large laboratory. For over 20 years, from 1993 to 2016, Sergei Mikhailovich Stishov was Director of the Institute of High Pressure Physics (IHPP) RAS, where he is a scientific supervisor to this day.

The work done by S M Stishov in the field of phase transitions and high-pressure physics received wide international recognition, first and foremost due to the study of a superdense modification of Earth's silicon and investigations into melting transitions. S M Stishov showed experimentally that the transition of silicon to sixfold coordination at high pressures makes it possible to create a consistent model of Earth's lower mantle. Thus, S M Stishov was the first to obtain experimental proof of the decisive role of phase transitions in the formation of the structure of Earth and the planets.

In the early 1960s, S M Stishov discovered and examined temperature peaks in the melting curves of a number of substances under pressure. This work initiated the study of 'phase transformations' in liquids, a problem now being intensely developed. Investigating the equations of state and melting of simple substances, S M Stishov revealed universal behavior of thermodynamic quantities under melting. It was shown that under melting the relative jump of volume and the jump of entropy tend to finite values in the limit of superhigh compression. This fact was decisive in concluding that repulsive forces are dominant in melting–crystallization phenomena.

Sergei Mikhailovich Stishov

From the study of simple isotropic liquids, S M Stishov moved to examining liquid crystals, where he discovered a new type of polycritical point. Later on, S M Stishov and colleagues also performed a series of precision experiments on investigation of tricritical phenomena in crystal ferroelectrics.

S M Stishov, in fact, developed the experimental static megabar pressures technique using diamond anvil chambers in our country, and a number of outstanding scientific results were obtained. In particular, the equation of state of deuterium up to 300 kbar was analyzed for the first time, and the phenomenon of 'chemical degeneracy' under megabar pressure was revealed. Under the guidance of S M Stishov, pioneering studies of the equations of state and the Raman spectra of superhard materials — diamond, boron cubic nitride, and silicon carbide — were carried out. The data

Uspekhi Fizicheskikh Nauk **187** (12) 1403 – 1404 (2017)
DOI: https://doi.org/10.3367/UFNr.2017.11.038243
Translated by M V Tsaplina

obtained allowed S M Stishov to propose in 1987 a new scale of pressures in the megabar range. It is only in the last 5–7 years that this scale has been 'rediscovered' in several scientific groups and has become conventional. Special emphasis should be placed on the 1990–1991 discovery and study by S M Stishov's group of graphite's transformation into a new transparent modification of carbon under room-temperature compression. In the last 3–5 years, this carbon state has also been intensely 'rediscovered' in many experimental laboratories.

Unfading interest in different fields of physics and new results appearing in condensed state physics have stimulated S M Stishov to radically change the direction of his studies every 5–10 years to be in the forefront of a new area. A deep insight into physics typically promotes great success in work in the new area owing to his erudition, exceptional ability to work, persistency, and the outstanding talent of an experimentalist. Most of the high-pressure setups designed by him have had no analogues elsewhere in the world.

When S M Stishov was already Director of IHPP RAS, he carried out pioneering experimental studies of isotopic quantum effects in compressed substances. He then obtained a number of interesting results when investigating the topology of a phase diagram of a substance and its relation to the character of interparticle interactions.

For the last 15 years, S M Stishov has been carrying out intense studies of quantum phase transitions in systems with strong electron correlations. A number of brilliant results have been obtained, in particular, a first-order quantum magnetic phase transition in ferromagnetic semimetal CoS_2 was discovered and investigated, and precision measurements of a wide spectrum of physical properties of the helicoidal itinerant MnSi magnet cast light on the enigmatic behavior of this compound and made S M Stishov one of the leaders in this area of condensed state physics. It should be stressed that this work was done with the very active personal participation of Sergei Mikhailovich at all stages, beginning with the statement of the problem and designing the setups to writing the papers.

In the last two decades, which have not been easy for Russian science, the Institute has not only held out, but even ensured the recognition of the international and Russian scientific communities. Much work that has had great resonance was implemented under the guidance of S M Stishov, in the first place the discovery and study of a superconducting diamond. As IHPP RAS attainments, one should also note the study of phase transitions in liquids and glasses, the study of quantum phase transitions, growing large single crystals of high-pressure phases, the realization of the experimental model of inorganic oil synthesis, and the synthesis of nanodiamonds doped with impurities — one-photon emitters. The work done at IHPP RAS over the last two decades has habitually been included in the basic achievements of RAS.

S M Stishov's work has won wide international recognition. For his achievements, he was decorated with the 2005 Bridgman Prize — the main international award in high-pressure physics. Sergei Mikhailovich has received many times the most prestigious positions of invited professor in different centers and universities. In 2014, S M Stishov was awarded the P L Kapitza Gold Medal of RAS for a series of experimental studies in high-pressure physics.

Sergei Mikhailovich successfully combines scientific work with scientific-organizational activity. He is a member of the Bureau of the Physical Sciences Division of RAS, a Scientific Supervisor of the Institute of High Pressure Physics of RAS, and a member of the editorial board of *High Pressure Research*; for 17 years he was Head of the Chair *Condensed State Physics in Extreme Conditions* of the Moscow Institute of Physics and Technology. For 15 years S M Stishov has been the organizer of the popular annual Russian conference *Strongly Correlated Electron Systems and Quantum Critical Phenomena*. The Program of the RAS Presidium on 'Condensed Matter Physics and the New Generation of Materials' was formed on the initiative of S M Stishov and under his guidance.

At all levels, S M Stishov has actively defended RAS positions and the values of fundamental science. Sergei Mikhailovich is a natural leader and is exceedingly consistent in the achievement of goals. S M Stishov has a clearly pronounced feeling of responsibility, a high capacity for work, and an exceptional exactingness to himself and his colleagues. These qualities are combined with straightforwardness of judgment, disgust for hypocrisy and dishonesty in all spheres of life, and a sense of humor and self-irony.

Friends and colleagues heartily send Sergei Mikhailovich Stishov best wishes on his glorious jubilee and wish him good health, happiness, and new achievements in science.

A F Andreev, N Ashcroft, V V Brazhkin,
R Jeanloz, Yu M Kagan, O N Krokhin,
V A Matveev, V I Ritus, I Silvera,
R A Suris, V B Timofeev, R Hemley