

### Personalia on the 60th Birthday of Sergei Pavlovich Kruchinin



This year, Sergei Pavlovich Kruchinin, a well-known theoretical physicist in the fields of nuclear physics, solid-state physics, superconductivity and nanophysics, a disciple of Academician A. S. Davydov of the National Academy of Sciences (NAS) of Ukraine, celebrates the 60th anniversary of his birthday.

S. P. Kruchinin is the *author* and *co-author* of more than 100 scientific works published in leading scientific journals. He has also published the book “Modern Aspects of Superconductivity: Theory of Superconductivity” and the textbook “Problems and

Solutions in Special Relativity and Electromagnetism,” both published with World Scientific (Singapore).

In 1979, he graduated from the Faculty of Physics of the T. G. Shevchenko State University of Kiev, Ukraine. From 1989 till now, S. P. Kruchinin is working as a *leading scientific researcher* at M. M. Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine and is a *Professor* of the Chair of Theoretical and Applied Physics of the National Aviation University (Kiev, Ukraine).

He defended the Candidate thesis “Interaction of collective and internal degrees of freedom in systems with a few number of nucleons” in 1986 and the Doctoral thesis “Thermodynamical effects in high-temperature superconductors” in 2002.

Kruchinin has published significant original works in the fields of nuclear physics and many-particle systems, solid-state physics, superconductivity, theory of nonlinear phenomena and nanophysics.

He explained the nature of resonances observed in photonuclear reactions and the interaction of collective and cluster degrees of freedom in light nuclei.

Together with Academician A. S. Davydov, S. P. Kruchinin proposed the bisoliton model of superconductivity and introduced the interlayer effects in the newest high-temperature superconductors. The investigation of the mechanisms of high-temperature superconductivity is one of the priority directions of studies to which S. P. Kruchinin gives much attention.

He proposed a continual model of the spin-fluctuation mechanism for high-temperature superconductors and calculated the thermodynamic properties of superconductors with *d*-pairing.

Kruchinin’s works on superconductivity were included in the above-mentioned monograph *Modern Aspects of Superconductivity: Theory of Superconductivity*

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(World Scientific, Singapore, 2010) which shows the contemporary status of the problems of high-temperature superconductivity.

In the last years, S. P. Kruchinin is working intensively on the theory of nanosystems and new materials. He has developed the theory of interaction of Gaussian quantum dots in magnetic fields and has calculated the spectrum and wavefunctions of such nanosystem. Moreover, the theory of interaction of magnetic dots on the surface of superconductors has been constructed. Also, it is shown that such systems can reveal the spin-orientational temperature-dependent phase transitions.

It is worth noting that S. P. Kruchinin has achievements in the theory of nanotransistors, quantum computers and thermoelectricity in tunneling nanostructures. His results in these directions are published in the recent years and recognized by the World Physics Community.

S. P. Kruchinin was an *organizer* of seven NATO workshops and three international conferences on actual problems of high-temperature superconductivity and nanosystems held at Ukraine. These conferences favored the development of international collaboration between Europe, the USA and Ukraine.

As an *editor*, he participated in the publication of seven books by the publishing house Springer (Germany), two scientific journals by the publishing house World Scientific and the scientific journal *Quantum Matter* (USA).

S. P. Kruchinin is a *member of the editorial boards* of the international journals *Quantum Matter* (USA), *Reviews in Theoretical Science* (USA) and *Progress in Nanotechnology and Nanomaterials* (USA).

He is a *full member* of the New York Academy of Sciences (USA) and the International Association of Mathematical Physics (France).

The scientific community and colleagues cordially congratulate S. P. Kruchinin on this significant occasion and wish him good health and many new creative achievements.

## PERSONALIA ON THE 55<sup>TH</sup> BIRTHDAY OF SERGEI PAVLOVICH KRUCHININ



In 2012, the famous physicist-theorist, Professor Sergei Pavlovich Kruchinin, Ph.D. in Physico-Mathematical Sciences, a leading scientific researcher of the N. N. Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine, Head of the Chair of Applied Physics at the National Aviation University, celebrates his 55<sup>th</sup>, birthday.

S. P. Kruchinin was born on February 6, 1957 in the town of Krasnyi Luch in the Lugansk region. In 1979, he graduated from the Physical Faculty of the T. G. Shevchenko Kiev State University and started his post-graduate course at the Chair of Theoretical Physics in Kiev under the guidance of Professor G. F. Filippov who developed the theory of nonaxial nuclei jointly with A. S. Davydov, Academician of the NAS of Ukraine. Having defended his Candidate degree thesis entitled *Coupling of Collective and Internal Degrees of Freedom in Few-Nucleon Systems* in 1986, Sergei Pavlovich was invited by A. S. Davydov to work in his group. Since that time, the scientific and scientific-organizational activities of Sergei Pavlovich have been closely connected with A. S. Davydov and the Institute for Theoretical Physics.

In 2002, S. P. Kruchinin defended his Ph.D. thesis entitled *Thermodynamical Effects in High-Temperature Superconductors* in the major of *Theoretical and Mathematical Physics*.

S. P. Kruchinin has published significant original works in the fields of nuclear physics and many-particle systems, solid-state physics, superconductivity, theory of nonlinear phenomena, nanophysics. He is the author and co-author of more than 80 scientific works which have been published in leading scientific journals. He has been using advanced mathematical methods to solve the posed problems.

In the article *On the Nature of Resonances Observed in Photonuclear Reactions* (*Nuclear Physics*, 1986, S. P. Kruchinin, jointly with G. F. Filippov), the coupling of collective and cluster degrees of freedom in light nuclei was studied, and the nature of resonances in photo-nuclear reactions observed in experiments was explained.

Since the time high-temperature superconductors were discovered, S. P. Kruchinin has intensively studied their physical properties. In particular, it is worth noting the work carried out jointly with A. S. Davydov *Interlayer Effects in the Newest High- $T_c$  Superconductors* (*Physica C*, 1991), where the theory of the non-monotonous dependence of the critical temperature of superconductivity on the number of cuprate layers in the elementary cell of high-temperature superconductors was developed. This work has remained up to date in connection with the search for new superconductors operating at room temperature.

The investigation of high-temperature superconductivity mechanisms is one of the priority directions of the studies to which Sergei Pavlovich has been paying much attention. In the work *Functional Integral of Antiferromagnetic Spin Fluctuations in High-Temperature Superconductors* (*Modern Phys. Letters B*, 1995), S. P. Kruchinin proposed a continual model of a spin-fluctuation mechanism for high-temperature superconductors and calculated the thermodynamic properties of superconductors with  $d$ -pairing.

The experimental discovery of superconductivity in magnesium diborides stimulated a new stage of studies for Sergei Pavlovich such as the development of a multiband model of superconductivity. In this field, one of the works by S. P. Kruchinin jointly with H. Nagao, namely *Multiband Superconductivity* in *Int. J. Mod. Phys.*, 2002, should be mentioned.

Kruchinin's works on superconductivity were included in the monograph *Modern aspects of Superconductivity: Theory of Superconductivity* (*World Scientific*, Singapore, 2010, jointly with H. Nagao) which shows the contemporary status of the problems of high-temperature superconductivity.

In the last years, S. P. Kruchinin has been working intensively in the theory of nanosystems and new materials. The important work performed jointly with N. N. Bogolyubov (jr.) Corresponding Member of the Russian Academy of Sciences, *Method of Intermediate Problems in the Theory of Gaussian Dots Placed in a Magnetic Field* (*Condensed Matter Physics*, 2006) should be noted, where the spectrum and eigenfunctions of a system of quantum dots with the Gauss interaction in a magnetic field were calculated. It was shown that such systems were of significant importance for nanotechnologies.

A number of works by S. P. Kruchinin are devoted to hybrid "superconductor-ferromagnetic" nanosystems. In the article *Interactions of Nanoscale Ferromagnetic Granules in a London Superconductor* (*Supercond. Sci. Technol.*, 2006, jointly with J. Annett), the interaction of ferromagnetic granules in a London superconductor is studied, and it is shown that such a system is characterized by temperature-dependent spin-orientation phase transitions.



It is also the works on the theory of nanotransistors, quantum computers, and composites with radioactive inclusions which were published in the last years that are worth noting.

S. P. Kruchinin has found much time to train scientific personnel. He is the Head of the Chair of Applied Physics at the National Aviation University (Kyiv). This chair was established by A. P. Shpak, Academician of the NAS of Ukraine in 2002. Its main scientific trends have been the physics of nanosystems and the physics of modern energy systems.

Sergei Pavlovich was the organizer of six international conferences on the current problems of high-temperature superconductivity and nanosystems which were held in the town of Yalta. These conferences promoted the development of international cooperation, including Russia and Ukraine. Five books in *Springer* and one book in *World Scientific* publishing houses were published under his guidance.

S. P. Kruchinin was the leader of many international projects supported by the Ministry of Education and Science of Ukraine, INTAS, CRDF (USA), Royal Society (Great Britain), DFG (Germany), JSPS (Japan), *etc.*

S. P. Kruchinin is Academician of the International Academy of Creation (Russia, 2007), member of the New York Academy of Sciences (USA, 1998), and member of the International Association of Mathematical Physics (France, 1996).

The scientific community and colleagues cordially congratulate Sergei Pavlovich on this significant occasion and wish him good health and many new creative achievements.



