

Yuriĭ Aleksandrovich Izyumov (on his seventieth birthday)

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Yuriĭ Aleksandrovich Izyumov, well-known physics theorist, corresponding member of the Russian Academy of Sciences, will celebrate his 70th anniversary on May 28, 2003.

Izyumov's entire life is connected with the Urals, where he was born, where he graduated from Ural State University, and where he entered the postgraduate program at the Theoretical Physics Chair and graduated from it. In 1959 he started his work at the Institute of Metal Physics (IFM) of the Ural Division of the Russian Academy of Sciences. For many years he has been the Head of the Department of Mathematical and Theoretical Physics that he himself had created there. In 1960 Yu A Izyumov presented and defended his PhD thesis, written under the supervision of S V Vonsovskii; in 1967 he defended his DSc thesis.

Yu A Izyumov began his independent research at IFM by developing the theory of scattering of slow neutrons in magnetically ordered crystals. These problems became important in connection with active progress in the work on research-oriented atomic reactors where neutron beams were applied to studying the condensed matter. Yu A Izyumov quickly found his place in this new area and already in 1966 published (together with R P Ozerov) a monograph, *Magnetic Neutron Scattering*, which was a pioneering monograph in the world in this field and was a must-have book on the desktops of experimenters in this country and abroad.

Yu A Izyumov contributed importantly to the progress in magnetic neutron diffraction analysis (neutronography). He developed a theory of scattering of polarized neutrons by complex magnetic structures, introduced into magnetic neutronography the theory of symmetry (the formalism of the theory of space group representations), and obtained the exact solution to the problem of neutron diffraction on a soliton lattice. Using his approach, a fundamental handbook on magnetic structures with symmetry analysis of each structure was published in Poland. In 1986, Izyumov, among a group of authors, received the USSR State Prize for this work. This field of work also led to a number of publications on the theory of phase transitions in magnetically ordered crystals. Yu A Izyumov suggested the idea of exchange multiplets and developed it in relation to phase transitions in magnets. This work was summarized in his monograph *Phase Transitions and Crystal Symmetry*, printed both in the USSR and in the West.

The main thrust of Izyumov's research was the quantum theory of magnetism. As early as the 1960s, he constructed an exhaustive theory of magnetically ordered crystals with impurities and predicted a quasilocal state in the magnetic spectrum of crystals with a weakly bound impurity. The exact solution of the problem of two impurity atoms with an



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antiferromagnetic bond, placed in a ferromagnetic matrix, made it possible to interpret anomalous physical properties of alloys with mixed exchange interactions.

Yuriĭ Aleksandrovich applied considerable and successful effort to developing the mathematical apparatus of the theory of magnetic systems. Even at the beginning of the 1960s he developed a convenient version of the diagram technique for spin operators and extended it later to operators that are used to describe strongly correlated electron systems (the so-called *X*-operators). The spin and *X*-operators manifest complicated commutation relations as compared to conventional Fermi- and Bose-operators; this leads to special difficulties in the mathematical description of spin and strongly correlated systems.

In recent years, Yu A Izyumov has suggested a method of the generating functional to describe such systems, enabling the generation of equations of motion for temperature Green's functions in variational derivatives with respect to the fluctuating fields. In the framework of this approach, he formulated the generalized random phase approximation. This allowed him to solve, for the first time, the problem of

fluctuations of longitudinal components of spin in an isotropic ferromagnet, to construct the magnetic phase diagram for strongly correlated models of metal, and to demonstrate the possibility of forming a superconducting state with high transition temperatures.

The problem of the coexistence of superconductivity and ferromagnetism was analyzed in detail in the monograph written by S V Vonsovskii, Yu A Izyumov, and É Z Kurmaev: *Sverkhprovodimost' Perekhodnykh Metallov, Ikh Splavov i Soedinenii* [Superconductivity of Transition Metals, Their Alloys and Compounds] (1977), which is well-known both in this country and in the West. In recent years Yu A Izyumov has returned to this problem and, together with his colleagues from Kazan', has developed a detailed theory of F/S-systems composed of ferromagnetic and superconductor layers.

From the very first years of his individual research, Yu A Izyumov has strived to summarize the material in the area in which he is working at any given moment. In 40 years of research, he has published thirteen monographic reviews in *Physics Uspekhi* on various aspects of solid state physics. Yu A Izyumov has written eleven monographs, most of which have been translated into English. They are proof of the broad span of his interests in physics. At the same time, Yuriĭ Aleksandrovich has not locked himself in his research ivory tower, but has carried on intense pedagogical and science-managing work. For 25 years he has been a Professor at Ural University, and six of his numerous students have become Doctors of Science. Yu A Izyumov is a member of the Presidium of the Ural Division of the Russian Academy of Sciences and he chairs the Joint Academic Council of Physico-Technical Sciences. He is a member of several scientific councils and editorial boards of a number of national and international journals.

Colleagues and friends wish Yuriĭ Aleksandrovich Izyumov happy birthday and wish him health and many more years of success in his multifaceted activities.

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