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In memory of Sergeĭ Vasil'evich Vonsovskiĭ

The Russian and international science communities have suffered a sad loss: professor Sergeĭ Vasil'evich Vonsovskiĭ, a Member of the Russian Academy of Sciences, passed away on August 11, 1998 at the age of 87. He was a brilliant scientist and science administrator, and his contribution to modern solid-state physics was outstanding.

Sergeĭ Vasil'evich Vonsovskiĭ was born on September 2, 1910 in Tashkent (now Uzbekistan), the son of a school teacher. He graduated from Leningrad State University in 1932 and went to work the same year at the newly organized Ural Physics and Technical Institute in Sverdlovsk (now the Institute of Metal Physics of the Ural Branch of the Russian Academy of Sciences). He became one of the creators of this institute and tied his fate to that of the Ural region.

In the thirties he worked on the many-electron problem in the theory of metals and dielectrics. Together with his teacher S P Shubin (1908 – 1938) he suggested the polar model of metals, which made it possible to describe the dualism of localized and collective states in transition metals and to obtain a criterion for the metal – dielectric phase transition. Thirty years later a well-known Hubbard model was proposed, which is a particular case of the Shubin – Vonsovskiĭ polar model.

One important result which was directly connected to these works of Shubin and Vonsovskiĭ on the polar model lay in the explanation of the fractional nature of magnetic moments (in Bohr magnetons as natural units) in ferromagnetic metals, such as iron. A fractional moment arises as a result of competition between interelectron interactions at one site and hopping of electrons to the neighbouring sites. The possibility of existence of dielectrics with continuous energy spectrum was predicted on a polar-model basis. Such zero-gap states were later discovered in experimental work.

The expression for the parameter of the so-called 'kinetic exchange interaction' was first written in Vonsovskiĭ's papers in 1936. This idea was later developed in a considerable number of papers both in the USSR and abroad.

In 1946, Sergeĭ Vonsovskiĭ proposed the $s-d$ exchange model of metals. This model postulated the separation of electrons into localized (d) and collectivized (s). The conjecture made it possible to achieve significant progress in deriving specific physical results. Localized electrons are mostly responsible for magnetic properties of metals while collectivized electrons are responsible for electrical, optical and superconducting properties. The most important range of problems that was discussed and analyzed by Sergeĭ Vonsovskiĭ and his disciples was the effect of magnetism on the kinetic properties of metals and alloys.

The formulation of the effect of a 'magnetic' subsystem of a transition metal on collectivized electrons proved extremely fruitful. Even the first publications by Vonsovskiĭ on the $s-d$ exchange model discussed the problem of the magnetic contribution to the electric resistance of ferromagnetic metals. Later the application of the $s-d$ exchange model allowed a solution of the problem of the electric resistance of diluted magnetic alloys.

Sergeĭ Vasil'evich Vonsovskiĭ
(02.09.1910 – 11.08.1998)

Sergeĭ Vasil'evich Vonsovskiĭ and his disciples paid considerable attention to the problem of coexistence and mutual influence of magnetism and superconductivity. In terms of the $s-d$ exchange model Vonsovskiĭ investigated the aspect of suppression of superconductivity in ferromagnetic metals via the paramagnetic effect and via the electron – spin waves interaction. He was also able to show that the interaction via spin waves can result in superconductivity with triplet Cooper pairs. The importance of this work is characterized, for example, by the fact that the magnetic mechanism (the attraction of electrons via spin fluctuations exchange) is now considered by most physicists as the most probable cause of high-temperature superconductivity in copper oxide compounds. The problems formulated by Sergeĭ Vonsovskiĭ still remain at the focus of attention of solid state physicists.

Vonsovskiĭ's spread of interests was very wide: from the quantum theory of metals and alloys to the technical magnetization curve and magnetic defectoscopy. He was able to develop the theory of magnetic anisotropy and magnetostriction of ferromagnets. During the World War II, Vonsovskiĭ together with Ya S Shur organized the nondestructive quality control of shells at one of the Ural munitions factories.

Vonsovskiĭ was a recognized head of the Ural school of physicists. Among his disciples we find Members of the

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Russian Academy of Sciences, and dozens of Doctors and Candidates of Sciences. He has written several monographs of encyclopedic nature which are well known both in Russia and abroad: "Ferromagnetism", "Current Studies on Magnetism", "Magnetism", "Magnetism of Microscopic Particles", "Superconductivity of Transition Metals, their Alloys and Compounds", "Quantum Solid-State Physics" and others.

Sergeĭ Vasil'evich Vonsovskiĭ was an active science organizer. He was long a member of the Presidium of the USSR Academy of Sciences, a member of the Scientific Council Bureau of the Academy of Sciences of the USSR on the integrated problem "Solid-State Physics" and chaired a scientific council on the problem "Physics of Magnetic Phenomena". He was one of the organizers of the Ural Research Centre of the Academy of Sciences of the USSR and the first chairman of the Presidium. Vonsovskiĭ guided the Centre for 15 years. On his initiative, the journal "*Metal Physics and Materials Science*" was established, and he remained its Editor-in-Chief for more than forty years.

Sergeĭ Vonsovskiĭ had a long teaching career. He began in the Industrial Institute (currently known as the Ural State Technical University — the Ural Polytechnical Institute) and continued in Ural State University. He took an active part in creating Ekaterinburg Humanitarian University and became its first rector.

Vonsovskiĭ was in regular communication with the international community in magnetic research. He was for many years a member of the magnetism Commission at the International Union of Pure and Applied Physics where he represented the USSR, and also a member of the editorial board of the international journal *JMMM*. He was a foreign member of a number of academies abroad.

From 1963 to 1971, S V Vonsovskiĭ was a deputy of the Supreme Soviet of the Russian Federation. As the chairman of the science committee of the Supreme Soviet of the Russian Federation, he paid much attention to the strategy of scientific and technological advancement of Russia.

Vonsovskiĭ's achievements earned high merit. He was a Hero of Socialist Labour, twice received the State Prize of the USSR, obtained the Vavilov Gold Medal of the USSR AS and the Demidov Prize and numerous other orders and distinctions. Sergeĭ Vonsovskiĭ was given the rank of honorary citizen of the city of Ekaterinburg.

We will remember Sergeĭ Vasil'evich Vonsovskiĭ as an outstanding scientist, a respected and energetic leader, a kind teacher, and a modest and wonderful man, deeply devoted to science. Not with words, but with his very own behaviour, he taught the wisdom of life, serenity and humanity to all around him.

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