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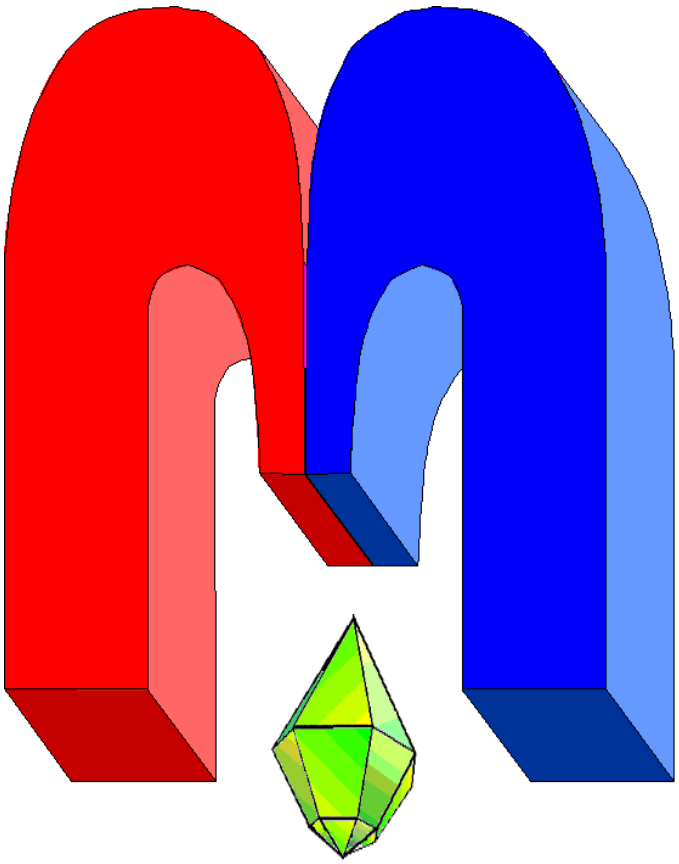

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* In Kazan University the Electron Paramagnetic Resonance (EPR) was discovered by Zavoisky E.K. in 1944.

Professor Kochelaev, Boris Ivanovich

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This note is dedicated to Professor B.I. Kochelaev on the occasion of his 85th anniversary

Kochelaev, Boris Ivanovich, Professor of Kazan Federal University (former Kazan State University – KSU), is the leading scientist in the field of spin dynamics in condensed matter, the bright representative of the Kazan Physical School founded by the corresponding-member of USSR Academy of Sciences S.A. Al'tshuler.

Born on April, 19, 1934 in the industrial settlement DirizhablStroi (now Dolgoprudny city in the Moscow region) Boris I. Kochelaev graduated with the silver medal from the secondary school in the city of Vyatskie Polyany (Kirov's region) and entered the Physical-Mathematical Faculty at Kazan State University in 1952.

Scientific activities of B.I. Kochelaev started in his student years under the supervision of Prof. S.A. Al'tshuler, who was the supervisor of his PhD thesis (PhD degree from Kharkov University, 1960). Two terms at Harvard University (1963-1964) under supervision of the future Nobel Laureate, Prof. Nicolaas Bloembergen, also had a great impact on the scientific interests of B.I. Kochelaev. In 1967, B.I. Kochelaev received his Doctoral (Habilitation) Degree from KSU. The whole Kochelaev's scientific life

is continuously connected with Kazan University and the Theoretical Physics Department. He was the head of this Department from 1973 to 2000.

Scientific work of B.I. Kochelaev in the sixties and seventies of the 20th century was focused on the studies of spin-phonon interactions in paramagnetic crystals. He proposed original theories of non-resonant absorption and resonant dispersion of hypersound in paramagnetic media, indirect spin-spin interactions between paramagnetic ions mediated by conduction electrons in semiconductors and by phonons in insulators, and the nuclear spin relaxation caused by the electron spin-spin interactions at ultra-low temperatures. He investigated the influence of a phonon spectrum on the Jahn-Teller effect, derived the theory of the coupled spin-phonon excitations, and determined the conditions for their appearance. Together with Linar K. Aminov, B.I. Kochelaev investigated interactions between paramagnetic centers via phonons, taking into account the retardation effects. This work had an essential influence on further development of the theories of interactions between the localized electrons mediated by static and dynamic lattice deformations. Further investigations of non-linear phenomena in paramagnets irradiated by radio-frequency fields, light, and hypersound resulted in the theory of kinetic processes in paramagnetic crystals based on the spin temperature concept. In the framework of this theory, it had become possible to explain experimentally observed phonon avalanche and super-scattering of light under the saturation at the wing of the EPR line. B.I. Kochelaev predicted the subsequently discovered effect of non-resonant sound absorption and its giant amplification by radio-frequency fields.

Together with his PhD students, B.I. Kochelaev proposed the theory of EPR and spin relaxation in conventional superconductors with paramagnetic impurities. It has been shown that spin dynamics and magnetic properties of doped superconductors are determined mainly by existence of the coupled spin excitations of the conducting and localized electrons as well as by the appearance of long-range correlations between paramagnetic impurities.

In recent years, scientific activities of B.I. Kochelaev are focused on one of the "hottest" topics of the condensed matter physics, namely, the physics of strongly correlated electron systems. He proposed to use paramagnetic probes inside CuO_2 planes to measure relaxation rates of magnetization in high-Tc superconductors. The idea put forward by B.I. Kochelaev has been successfully realized in the joint investigations with the group of Prof. B. Elschner at Darmstadt University. Further investigations based on the proposed method were performed in collaboration with the group of the Nobel Laureate Prof. K.A. Müller at Zürich University. This work led to understanding of the nature of very fast electron spin relaxation and development of the model explaining the observed phase separation into the nanoscale metal and insulator domains in CuO_2 planes. B.I. Kochelaev solved the long-standing problem of the "ESR-silent" superconducting cuprates and showed that it is caused by a very fast spin-lattice relaxation of the Cu-ions with the rate greatly enhanced by the exchange coupling between them.

These theoretical investigations are best described by the Nobel Laureate Prof. K.A. Müller in the paper titled "*The Impact of ESR (EPR) on the Understanding of the Cuprates and Their Superconductivity*" [EPR newsletter, **22**, No. 1, 5-6 (2012)]:

> *"Finally, it should be noted that this important advance was achieved by the experimental results at the universities of Darmstadt and Zürich on the one side and the deep theoretical insight of Boris Kochelaev at the Kazan State University explaining them on the other side."*

B.I. Kochelaev has proposed a new approach based on the idea of spin waves in the media with topological excitations (skyrmions) and described, within a unified framework, both

the static and dynamic parameters of layered magnets such as spin coherence length, magnetic susceptibility, etc. His collaborations with experimental group of Prof. A. Loidl and PD H.-A. Krug von Nidda at Augsburg University, and with the group of Dr. J. Sichelschmidt from Dresden were extremely fruitful. The electron spin kinetics in substances with colossal magnetoresistance was investigated by ESR methods, and ESR spectra of heavy-fermion compounds below the Kondo temperature were studied. It was shown that the absence of the "Slichter" peak established in some superconductors by ESR measurements and unexpected discovery of the ESR signal in the Kondo lattice with heavy fermions below the Kondo temperature are both the consequences of a formation of collective spin excitations of paramagnetic ions and conduction electrons.

B.I. Kochelaev's theoretical investigations of the EPR in solids are well known worldwide. Essentially all his theories and predictions have been confirmed experimentally. He has been invited to present plenary talks at numerous National and International conferences and scientific schools. His results were published in the high-impact journals such as Phys. Rev. Lett., Phys. Rev. B, Mod. Phys. Lett., etc.

For many years B.I. Kochelaev has served as the chairperson of the Scientific Council awarding PhD and Doctoral degrees at Kazan University. He was a member of the International Committee of the AMPERE Scientific Society. He was awarded the Orders of the Russian Federation and the State Award of the Republic of Tatarstan in the field of science and technology. B.I. Kochelaev is the Honorary Scientist of the Russian Federation and of the Republic of Tatarstan, as well as the Honorary Professor of Kazan University.

Professor Kochelaev has spearheaded the progress not only in the theory and applications of EPR, but also in theoretical physics in Kazan. For more than 50 years, B.I. Kochelaev is the leading lecturer at Kazan University, where he has developed lecture courses on quantum mechanics, quantum theory of solids, non-equilibrium thermodynamics, and quantum statistical physics. He has established his own scientific school. Thirty-three of his students obtained PhD degrees, 11 of his disciples earned Doctoral (Habilitation) degrees and became professors in Russia, Germany, and USA.

This short note is an attempt to demonstrate the evidence of recognition of B.I. Kochelaev's scientific achievements and superb human qualities, as well as the testimony of the deep respect from his colleagues.

Happy Birthday, dear Boris! And many fruitful years to you!