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# Nikolaĭ Alekseevich Chernoplekov (on his seventieth birthday)

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Nikolaĭ Alekseevich Chernoplekov, Corresponding Member of the Russian Academy of Sciences, was 70 on 6 March 2000. N A Chernoplekov is the director of the Institute of Superconductivity and Solid-State Physics, Russian Research Centre 'Kurchatov Institute', a leading authority in experimental solid-state physics and technical superconductivity.

N A Chernoplekov published his first scientific works on the thermal properties of highly-anisotropic and glassy materials when an undergraduate student at the Physicochemical Department of the D I Mendeleev Moscow Chemical and Engineering Institute. At that time, the inquisitive student developed a great interest in the real shape of thermal excitation spectra in such complex systems. This interest was primarily excited by the conflicting results of numerous attempts to reconstruct the spectra from the temperature dependences of heat capacity. However, the requirements of the academic curriculum obliged N A Chernoplekov to choose for his diploma work the installation and commissioning of a 20 MeV betatron to be further used for research on the activation of various substances. On graduation, N A Chernoplekov remained with the institute to be employed as the head of the betatron laboratory. Nevertheless, he retained his early interest in direct experimental examination of the linkage between the structure and excitation spectra of solids.

Crucial for his further scientific carrier was a paper by G Placzek published in *Physical Review* in 1954, which suggested a direct relationship between neutron scattering spectra and phonon spectra of crystals.

In 1956, N A Chernoplekov started his post-graduate studies at the Chair of Physics, D I Mendeleev Moscow Chemical and Engineering Institute, and insisted on being affiliated with the Laboratory of Measuring Instruments (LIPAN No. 2), USSR Academy of Sciences, now the Russian Research Centre 'Kurchatov Institute'. This move was dictated by Chernoplekov's intention to use neutron beams produced in the nuclear reactor for the measurement of phonon spectra in crystals.

During that period, N A Chernoplekov combined basic research with applied studies designed to develop an original technique of using cold neutrons for the introscopy of fuel elements of a special reactor to control the distribution of fissioning nuclei.

A study performed jointly by N A Chernoplekov and M G Zemlyanov led to the development, for the first time in this country, of methods intended for the experimental investigation of excitations in substances, based on incoherent and coherent neutron scattering.

This work was extended to the creation of a few generations of neutron time-of-flight spectrometers and one of the world's first fully automated three-crystal spectrometers for measuring phonon dispersion. The cold neutron flux was increased using a specially constructed cryogenic source of these particles installed in the vicinity of the reactor core boundary.

Nikolaĭ Alekseevich Chernoplekov

In the early 1960s, these developments allowed the phonon spectra of several metals for the first time to be measured without preliminary model studies. N A Chernoplekov contributed to the solution of this problem by making an original suggestion of the so-called zero-matrix (vanishing of the neutron coherent-scattering amplitude after a change in isotope composition of the sample).

The investigations of N A Chernoplekov and his coworkers into the structure and dynamics of a large class of metal hydrides and deuterides are widely known. They have demonstrated specific transitions resulting from the consecutive ordering in the sublattice of light atoms and described phase structures. Those pioneering studies gave a powerful incentive for further research in this field both in Russia and other countries.

Successful development of the theoretical physics of nonideal crystals in this country was seriously hampered for a

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long time by the absence of relevant experimental data on their energy spectra. Further progress in this field was greatly promoted by the results obtained by N A Chernoplekov. His studies of real crystal dynamics for the first time gave direct evidence of quasi-local levels in crystals doped with heavy atoms and local levels in crystals doped with light atoms.

Subsequent studies by N A Chernoplekov using methods of both neutron and low-temperature physics involved many such systems and brought about detailed information about common regular features of the changes induced in phonon and electron subsystems of metals after the introduction of impurity atoms. In fact, these works gave birth to a new line of research on disordered systems. Later, N A Chernoplekov extended them to the relationship between real phonon and electronic spectra of diluted transition-metal solutions and the temperatures of their transition to the superconducting state. He obtained original results concerning the amorphization effects of metal alloys on the transition temperature.

After the discovery of high-temperature superconductivity, N A Chernoplekov concentrated on excitation spectra, the thermodynamic and kinetic properties of superconducting ceramic materials and, recently, of monocrystalline specimens. One of the important results obtained in this area is the discovery of the space anisotropy of the upper critical field.

In the last 30 years, N A Chernoplekov has been combining purely basic research in the field of metal and superconductor physics with applied heavy-current superconductivity studies designed to promote developments in electrophysics and electroenergetics. He made an outstanding contribution to the fuller understanding of electrodynamic and thermophysical properties of technical superconductors and superconductor-based composites both in short samples and magnetic coils. Thereby, he greatly promoted the development of the physical principles of creating superconducting wires and cables and made recommendations for their industrial fabrication.

N A Chernoplekov was directly engaged in the development of technology for manufacturing helium-temperature superconductors and the organization of their commercial production for high-quality superconducting wires and cables to be used in many branches of industrial engineering.

The creation of large superconducting magnetic systems is one more area of research on technical superconductivity in which N A Chernoplekov and his collaborators obtained important results. As a rule, each system proposed by the researchers was a unique one because it required the resolution of many complicated physical, electrotechnical and engineering problems. The most characteristic examples include the construction of the first combined generator of stationary magnetic fields providing a magnetic-flux density of 26 T, the world's first tokamak with a superconducting magnetic system (Tokamak-7), and presently the largest magnetic system for tokamak facilities based on an Nb – Pb superconductor.

Taken together, these works have won this country a viable place in the international arena in the field of heavy-current superconductivity. N A Chernoplekov is equally active in research on technical superconductivity that can be attained under liq. $N_2$. He implements the results of physical studies in the development of an overwhelmingly more sophisticated technology based on the use of high-temperature superconducting materials and in the expansion of the sphere of practical application of superconductivity taking advantage of the new possibilities provided by these materials.

In 1976 and 1986, N A Chernoplekov was awarded State Prizes of the USSR for his achievements in basic and applied research.

N A Chernoplekov is a professor at the Moscow Engineering and Physics Institute where he annually reads a course of lectures on topical problems of superconductivity and solid-state physics. Many of his students have completed and defended candidate and doctorate theses under his tutelage and have become reputed specialists in their areas of research.

N A Chernoplekov has published 3 monographs and over 120 scientific papers.

A man of broad scientific interests, N A Chernoplekov is at the same time a brilliant organizer of science. He successfully governs the work of a large body of physicists and engineers and devotes much of his time and attention to the coordination of on-going research in this country, especially that concerning superconductivity. He is one of the founders of the Russian school of neutron studies of matter and the leader of the school of applied superconductivity.

For many years, N A Chernoplekov has been the chairman of the Scientific Council of the RRC 'Kurchatov Institute', the chairman of the Interdepartmental Council on Superconductivity and one of the sections of the Scientific Council for the Ministry of Atomic Energy.

N A Chernoplekov is an invariably good-natured, enthusiastic, and cooperative person.

Friends, colleagues, and disciples congratulate Nikolaĭ Alekseevich on this jubilee occasion and wish him new achievements and success in his scientific work, good health and happiness.

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