Petr Petrovich Feofilov (Obituary)

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Soviet physics has sustained a heavy loss. On 24 April 1980, one of the most illustrious of the Soviet Union's scientific optics specialist, corresponding Member of the USSR Academy of Sciences Petr Petrovich Feofilov, died at the age of 65.

Most of Feofilov's 40-year scientific career was devoted to the optics and spectroscopy of the condensed state. His pioneering research in this field formed the basis for a number of new scientific trends and made him a world-recognized authority.

Feofilov's entire scientific biography is associated with the State Optical Institute, with which he became affiliated in 1939 after his graduation from the Leningrad Industrial (Polytechnic) Institute. He began a study of the polarized luminescence of molecular solutions under the direction of his teacher, S. I. Vavilov. Here a simple and heuristic model of a dye molecule was constructed, consisting of absorbing and emitting oscillators oriented in a certain way with respect to the skeleton of the molecule. Feofilov was the first to point out that polarization spectra are no less important than absorption and luminescence spectra and cannot be ignored in solution of analytic problems. Later, Feofilov extended methods for determination of the multipolarity of elementary radiators to organic crystals, where they gave origin to new and highly effective techniques for the study of defects in crystals (including impurities). Observation of the polarized luminescence of cubic crystals and its dependence on azimuth enabled Feofilov to develop the concept of the latent optical anisotropy of cubic crystals with defects. These studies laid the foundation for a new and original approach in crystal optics and had a strong influence on the development of crystal-spectroscopy in the Soviet Union and abroad.

A technology for growing artificial single crystals of optical fluorite and its crystal-chemical analogs was developed with Feofilov's active involvement. For the first time, a coordinated (growth, crystal chemistry, spectroscopy) approach to the growing of optical crystals was elaborated; it is now the standard in all solid-state optics laboratories.

Feofilov's work on crystals doped with unfilled-shell ions was extremely important. He was the first to discuss the multiplicity of activator centers, the crystal-chemical conditions of activation, the role of the charge

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state of the activator ion, and the charge-transfer effect in photoexcitation of two-activator systems. The readiness of doped-crystal physics to accept the ideas of quantum electronics was due in no small measure to Feofilov's efforts. For example, the creation of the first solid-state lasers with four-level lasing schemes (which were based on fluorite with samarium and uranium) was based directly on the results of Feofilov's spectroscopic and luminescence studies.

In the years that followed, Feofilov assumed a leading role in the spectroscopy of doped crystals. With his coworkers, he prepared and investigated a large number of crystals of various classes with rare-earth-ion doping. In recent years, his attention was drawn to crystals with high rare-earth-ion contents as promising media for compact lasers and crystals with color centers, which have been used to build tunable IR lasers.

Feofilov authored a theory of the Zeeman effect in cubic impurity crystals and performed the first experiments in this area. Further development of these studies in Feofilov's laboratory led to the design of several techniques for measuring magnetic circular dichroism and the magnetooptical rotation of the

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polarization plane. These techniques have been used to investigate allowed interconfigurational transitions in impurity rare-earth ions, to observe giant spin memory in certain impurity crystals, and to study double radiooptical resonances in crystals with impurity ions and color centers.

Feofilov's laboratory has given much attention to study of the vibronic interactions and dynamics of impurity crystals.

Feofilov and his colleagues originated and successfully advanced a new and original trend: the study of cooperative processes in condensed media. This led to the prediction and experimental observation of a whole series of phenomena that arise on interaction of a population of rare-earth ions with light. Phosphors that efficiently transform infrared to visible light were developed on the basis of these phenomena. The cooperative-luminescence work was of not only applied, but also conceptual significance, the latter in recognition of the role of collective interactions in photochemical, photophysical, and biological processes.

Feofilov had a typically broad and profound approach to scientific phenomena, the ability to generalize them, and a drive to practical realization of the results of scientific research.

He was also a prominent scientific organizer. He was an initiator and organizer of the All-Union Symposia on the Spectroscopy of Doped Crystals, which are highly important for the development and coordination of research in the field. His contribution to the advancement of these studies was truly invaluable.

Feofilov served as a member of the Scientific Councils on Spectroscopy and Radiation Physics of the USSR Academy of Sciences and as Deputy Chairman of the Scientific Council on Luminescence and its Applications in the National Economy, and worked productively in all of these Councils. With his broad-mindedness, enormous personal experience, and inexhaustible benevolence and patience, Feofilov enjoyed high authority among specialists in solid-state spectroscopy and physics and the affection of everyone who associated with him.

Feofilov combined his extensive research activity with prolific writing. His monograph "Polyarizovannaya Lyuminestsentsiya Atomov, Molekul, i Kristallov" (The Polarization Luminescence of Atoms, Molecules, and Crystals) has been a ready reference for several generations of scientists. He translated a number of books on optics from foreign languages. He was Deputy Editor-in-Chief of the journal "Optika i Spektroskopiya" (Optics and Spectroscopy) from its inception, and its Chief Editor after 1979. He was a member of the editorial councils of the international journals "Physica Status Solidi" and "Optics Communications."

Feofilov was awarded two USSR State Prizes (in 1949 and 1975) and the USSR Academy of Sciences' Mendeleev Prize (1949). He was awarded a Vavilov Gold Medal in 1970.

Feofilov left a monumental scientific legacy. His works are of fundamental importance for the development of the spectroscopy of crystals and of quantum electronics.

The glowing memory of Petr Petrovich Feofilov will remain forever in the hearts of all who knew him.

Translated by R.W. Bowers