Nikolai Nikolaevich Sobolev (on his sixtieth birthday)

L. M. Biberman, A. M. Prokhorov, V. A. Fabrikant, and R. V. Khokhlov

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March 29, 1974 was the sixtieth birthday of Doctor of Physico-mathematical Sciences Prof. Nikolaĭ Nikolaevich Sobolev, one of our country's leading scientists in the fields of quantum electronics, optics and spectroscopy.

Sobolev has worked for more than 36 years in the P. N. Lebedev Physics Institute of the USSR Academy of Sciences. Here he moved up through the ranks from laboratory assistant to chief of the laboratory for low-temperature plasma optics, and here he worked on the series of brilliant research projects that won him world-wide fame. These studies were typified by a broad and coordinated approach to solution of the problems posed, profundity and thoroughness, and immediate pertinence to crucial problems in the development of modern technology.

From 1945 to 1955, Sobolev was participating actively in the solution of certain physical problems related to the development of jet aviation in the USSR. During these years, he developed the physical bases for the optical pyrometry of hot gases and flames and proposed new pyrometric methods suitable for study of jet engines, made the first measurements of the flame temperatures of liquid rocket engines, and conducted other research. The pyrometry methods proposed by Sobolev have been highly productive and were subsequently put to routine use; to this day they remain the best methods for flame pyrometry. During these years, in connection with research for new types of rocket fuels, Sobolev headed extensive research studies of the vibrational spectra of various substances.

The development of space technology required careful analysis and practical recognition of radiative heat exchange between space vehicles reentering the atmosphere and the shock waves that form ahead of them. This analysis requires information on the emission spectra of air and other gases. On short notice, Sobolev supervised the construction in his laboratory of large experimental installations of a new type (shock tubes) and set up research on the spectra of diatomic molecules found in the atmospheres of the earth and planets. In the course of these studies, during the period from 1955 through 1966, methods were developed for calculating the states of complex gas mixtures behind shock waves, an original method was developed for measuring the gas temperatures behind the incident and reflected waves, and procedures were devised for determining charged-particle concentrations from the broadening of the hydrogen lines and from the continuous spectrum. The result was the acquisition of reliable data on the strengths of electronic transitions in many diatomic molecules. These data were used in radiative heat-exchange calculations.

The work of Sobolev and his students on spectral line broadening, measurement of the cross sections of various elementary processes in plasma and transition probabilities in atoms and ions, as well as their studies and diagnoses of nonequilibrium plasmas, made a substantial contribution to theoretical and applied plasma spectroscopy. This extremely complex and time-consuming project, which has a bearing on study of the fundamental properties of the low-temperature plasma, has been pursued systematically by Sobolev throughout his entire scientific career. It must be stressed that advances in precisely this work have in many respects been responsible for rapid and successful completion of all of his other studies.

In 1966—1973, Sobolev made an important contribution to the development of quantum electronics. The scope of his work in this field is extremely broad, ranging from profound scientific investigations of processes occurring in the plasma of gas lasers, which led to understanding of the mechanism by which inversions are formed in the most interesting of them, to the development of prototypes of devices for their adaptation to industrial production. Thus, the results of a major theoretical and experimental research project on the ionic argon laser were establishment of the basic physical processes occurring in the plasma of this laser, determination of its parameters, and, in general terms, the answer to the question as to the mechanism by which the inverted population forms. Successful completion of these studies then made it possible to develop recommendations for introduction of the ionic argon laser into production.

In 1966, Sobolev advanced a hypothesis that explains the formation of vibrational-level inversion in the most powerful CO_2 gas laser. Detailed laboratory experimental studies of the CO_2 laser fully confirmed this hypothesis, and the mechanism proposed by Sobolev for forma-

tion of the inverted population is now generally recognized.

Thorough understanding of the working mechanism of the CO_2 electrical-discharge laser made possible a quick laboratory solution of the important problem of building a gas-dynamic CO_2 laser with the aid of a shock tube and studying its performance.

In recent years, Sobolev has headed experimental studies of the CO laser's plasma parameters and made kinetic calculations of its vibrational-level populations. These studies showed that the mechanism of inversion formation in the CO laser is qualitatively different from that in the CO_2 laser, involving first of all a relaxation process of anharmonic oscillators. The outcome of these studies was the construction of a sealed CO laser with high output-radiation power. This laser has now been turned over to the industry for production.

Finally, methods for the selection and stabilization of ionic and molecular lasers have also been elaborated under Sobolev's direction, and the possibilities for their use both for scientific research and for solution of various practical problems have been studied.

Sobolev's scientific activity has been inseparable from his tight schedule of organizational and teaching work. For a number of years, he was Deputy Director and Scientific Secretary of the Academy of Sciences Physics Institute; he was several times elected a member of the Institute's Party Committee. He is a member of the editorial staffs of Soviet and international journals, a board member of the Commission on Spectroscopy, and a member of various scientific and coordination councils. Professor Sobolev has over the years lectured to students at the Moscow Power Engineering Institute, Moscow State University, and the Moscow Engineering Physics Institute. Twelve candidate's dissertations have been prepared and successfully defended under his supervision.

In sum, Sobolev's many years of intensive scientific, organizational and teaching activity have made an outstanding contribution to the development of such divisions of modern physics as quantum radiophysics, spectroscopy, and the physics of low-temperature plasma.

Sobolev is in the full flower of his creative forces. He is full of creative ideas and plans for the future.

We wish him many happy returns and further creative successes in his work.

Translated by R. W. Bowers