Physics – Uspekhi **40** (3) 323 – 324 (1997)

PERSONALIA PACS number: **01.60.+q**

Igor' Il'ich Sobel'man (on his seventieth birthday)

On 26th January 1997, Professor Igor' Il'ich Sobel'man, a Corresponding Member of the Russian Academy of Sciences and a prominent scientist who has made valuable contributions to optics and spectroscopy, quantum electronics and atomic physics, celebrated his seventieth birthday.

Professor Sobel'man was born in Moscow in the family of an engineer. During World War II, he worked as a machine-tool operator at a defense plant in the city of Perm', and in 1944 he entered the N É Bauman Higher Technical College, Moscow (known as MVTU for short in Russian). When the decision was made to set up the Technical Physics Department of the Moscow State University (later the Moscow Institute for Physics and Technology, or MIPT), he was admitted, on the basis of merit, to what they called the senior course within Academician G S Landsberg's department, with the research base at the P N Lebedev Physics Institute of the USSR Academy of Sciences (better known as FIAN in Russian).

Since then, for a half-century now, Professor Sobel'man's career as a scientist and an educator has been inseparably linked with FIAN where he is Director of the Optics Division, and with MIPT where he is the leading professor of the Quantum Radiophysics Department. Even his early scientific results won Professor Sobel'man wide renown. He formulated the then new, and now generally accepted non-stationary approach to the theory of spectral lines broadening and shift. With this theory, it became now possible to express line widths and shifts as the elements of a scattering matrix.

Further developments of the theory formed the core of its numerous applications in the physics of plasmas and nonlinear laser spectroscopy. Professor Sobel'man's theory was instrumental in tackling the problem of the broadening of highly excited (Rydberg) atomic states, allowing for the coherence of transitions between degenerate states, and in explaining the corresponding observations in radio astronomy. Under his guidance, a range of pioneering experiments were staged at FIAN to investigate Rydberg states in the laboratory environment, and through them new verifications of the theory were obtained.

Proceeding from his quantum mechanical theory of spectral line broadening and shift, Professor Sobel'man came up with and substantiated a possible solution to the inverse problem of collision theory — the study of scattering matrix parameters by spectroscopic techniques. He proved possible to determine the scattering cross-section of slow electrons from the broadening and shift of atomic spectral lines in vapors or gases, and the velocities of inelastic collisions of electrons with atoms and ions from the Stark linewidth in plasmas.

Igor' Il'ich Sobel'man

When tackling specific tasks of atomic spectroscopy, Professor Sobel'man and his coworkers devised a number of asymptotic methods in the theory of collisions, which have since found application in both the theory of line broadening and shift and the theory of electromagnetic wave propagation in inhomogeneous media. One of the theory's results was a solution to the collision problem with a particle redistribution, subject to the law of flux conservation, known as the Hermitian formulation of the charge-reversal problem. The conclusions of Professor Sobel'man's theory have proved a reliable tool in calculating spectral line profiles and are actively used in the diagnostics of laboratory and astrophysical plasmas.

In his works on quantum electronics, Professor Sobel'man proposed and substantiated a number of techniques for the design of powerful lasers and laser beam converters able to compress light beams without an increase in their divergence. With his active participation, these ideas were materialized in experiments.

Uspekhi Fizicheskikh Nauk **167** (3) 343 – 344 (1997)
Translated by B V Kuznetsov

Well before the advent of the ruby laser, Professor Sobel'man (together with S G Rautian) proposed and substantiated the idea of optical pumping for luminescent media, which later came to be used in practice. Professor Sobel'man's theoretical predictions and subsequent studies on photodissociation lasers stimulated research on this major problem of science and technology. In consequence, and with Professor Sobel'man's active participation, the photodissociation laser was developed, which along with the neodymium-doped glass laser is at present among the most powerful pulse lasers. Both in and outside Russia, work is under way on various uses for such lasers, including controlled thermonuclear fusion.

Professor Sobel'man formulated a theory that explains the shape and stability of nonlinear laser power resonances and has developed its applications in nonlinear laser spectroscopy and laser frequency standards. He proposed and developed a number of techniques which use multiple-charge ions to bring about population inversion in laser materials in the far UV and soft X-ray regions of the spectrum. Professor Sobel'man's team was the first in the world to carry out experiments revealing line amplification in neon-like media. Follow-up work on these ideas is now under way at many laboratories worldwide.

It is characteristic of Professor Sobel'man to invoke methods of atomic spectroscopy in dealing with tasks of fundamental physics. Under his guidance, precision optical experiments were made to measure the effect associated with the nonpreservation of parity in bismuth atoms, predicted by the theory of weak electromagnetic interaction; a Faraday spectroscopic technique was devised to exactly determine the atomic constants by experiment; and an optical-pumping method was developed to polarize the nuclear spin of the ^{3}He isotope in a dense gas.

As head of FIAN's Optics Division, Professor Sobel'man has put much effort to support and promote the most promising areas of research. In particular, it is under his direct scientific guidance that studies on board spacecraft are going on into the X-ray astronomy of the Sun and the ozone layer of the Earth.

Professor Sobel'man has built up a school of specialists well known in and outside Russia, concerned with nuclear spectroscopy and its applications in the physics of laboratory and astrophysical plasma. Today, his disciples and colleagues, who have taken part in many of the studies listed above, are actively promoting research in these and new promising areas of science. Professor Sobel'man is well known for his monographs released in Russian and in English by several international publishers. From the first (1963), his books have become classical aids for specialists at almost all scientific centers connected with optics, spectroscopy, atomic physics, astrophysics, quantum electronics, and plasma physics. Professor Sobel'man has delivered lectures to more than 500 MIPT students of whom many have become major specialists and still have warm feelings for their teacher.

As chairman of the Russian Academy of Sciences' Scientific Council for Spectroscopy, Professor Sobel'man is responsible for the coordination and promotion of basic research in this field in Russia.

For many years, Professor Sobel'man sat on the Editorial Board of the journal *Pis'ma v Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki* (*JETP Lett.* in English translation), and is now a member of the editorial boards of international journals and collected volumes, and a member of the scientific committees of international conferences, both traditional and new. In this capacity, Professor Sobel'man is doing much to support Russian scientists at the international level, to promote broader scientific contacts, and to make Russia's advances in science known to the world.

Professor Sobel'man's multifaceted activity has won him two Orders of Merit, the State Prize of the USSR, the election to the Russian Academy of Sciences as a Corresponding Member, and the profound respect of the team he is heading now, of the entire P N Lebedev Physics Institute, and of many other scientific organizations. We wish Professor Sobel'man good health and further success from the bottom of our hearts.

N G Basov, A M Bonch-Bruevich, A A Boyarchuk, V L Ginzburg, N S Kardashev, Yu V Kopaev, O N Krokhin, V V Osiko, P P Pashinin, A M Prokhorov, V P Silin, I A Shcherbakov