Physics – Uspekhi **49** (6) 657 – 658 (2006)

PERSONALIA

PACS number: **01.60.+q**

In memory of Igor' Il'ich Sobel'man

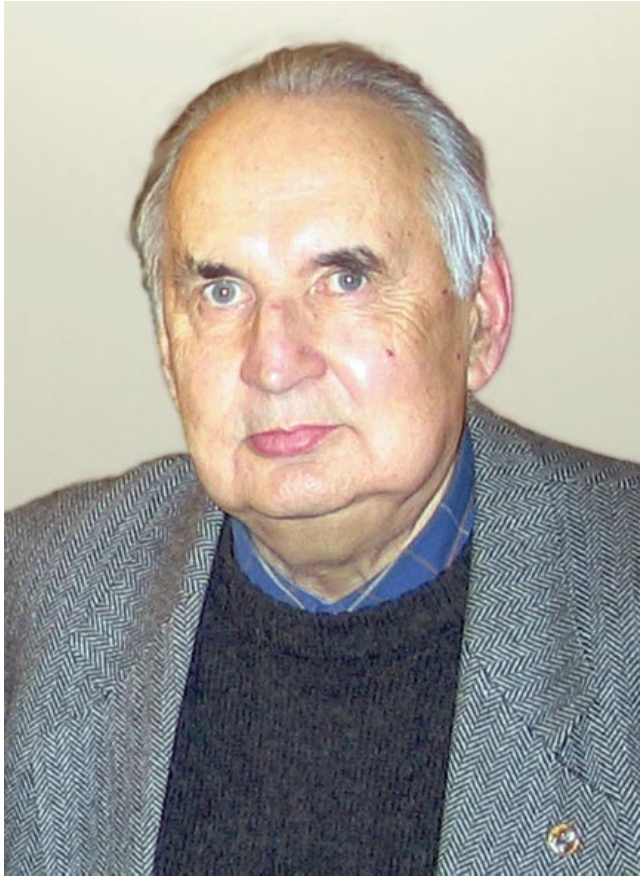
DOI: 10.1070/PU2006v049n06ABEH006000

Igor' Il'ich Sobel'man — an outstanding scientist, Director of the Optics Division of the P N Lebedev Physics Institute of the Russian Academy of Sciences (RAS), RAS Corresponding Member, Professor of the Moscow Institute of Physics and Technology, a State Prize Laureate — died suddenly on 23 November 2005. For many years he was Chairman of the RAS Scientific Council on the Problem 'Spectroscopy of Atoms and Molecules' and a member of the editorial boards of several domestic and international journals.

The main areas of Sobel'man's scientific activity covered optics, atomic and laser spectroscopy, quantum electronics, and the theory of atomic collisions with applications to plasma physics and astrophysics. He was distinguished by the breadth of scientific interests, physical intuition, the aspiration to solve major physical problems, and the infrequently occurring capacity to clearly formulate the heart of the problem. Sobel'man's salient feature was the ability to apply and validly evolve theoretical approaches from different areas of physics to the solution of topical problems in optics, spectroscopy and laser physics, and to combine them with the potentialities of experiments.

Igor' Il'ich Sobel'man was born on 26 January 1927 in Moscow into the family of an engineer. During the war years, from 1941 to 1943, he was evacuated to Perm', where he finished the eighth class of a secondary school in 1942. From April 1942 he started working as a metalworker at a defence plant, and subsequently worked at the workshops of the Bauman Institute in Moscow, while at the same time going to evening school. In 1944, he joined the N E Bauman Moscow Higher Technical School, where he studied successfully for three years, preparing to become a specialist in optical instrument making. On passing selection examinations and attending an interview, in 1947 Sobel'man entered the second course in the Physicotechnical Department of Moscow State University, which he graduated from with distinction in 1952 in the Chair of Optics among the first-ever graduates of the Moscow Institute of Physics and Technology (MIPhT).

Even during his first years at MIPhT Sobel'man found himself in the P N Lebedev Physics Institute, in the Optics Laboratory supervised by G S Landsberg. Apart from the commencement of his scientific work and specialized lecture courses at the Physics Institute, he actively attended scientific seminars, these being not only seminars in the Laboratories of Optics and Spectroscopy, but also the All-Institute Seminar, the seminar of the Theoretical Department supervised by I E Tamm, and L D Landau's theoretical physics seminar at the Institute for Physical Problems. In the Physics Institute, under the supervision of Landsberg and S L Mandel'shtam, Sobel'man formed his scientific interests and avenues of activity for many years to come. Upon graduation from the Physicotechnical Department of Moscow State University in 1952, Sobel'man was assigned to work at TsNII-58, where he worked until October 1956. In 1955, he defended his Thesis for Candidate of Physicomathematical Sciences, and in 1956 he was elected assistant professor of the Chair of Optics of MIPhT, where he worked up to his move to the Physics Institute in 1962.



Igor' Il'ich Sobel'man
(26.01.1927 – 23.11.2005)

At the Physics Institute, Sobel'man held the positions of Senior Researcher in the Optics Laboratory (1962 – 1965), Head of Division in the Quantum Radiophysics Laboratory (1965 – 1984), Head of the Spectroscopy Laboratory (1984 – 1989), and from 1989 up to his death Director of the Division of Optics, which he founded. His remarkable scientific and pedagogical talent was amply revealed at the Physics Institute, where he created a scientific school of his own and had a strong impact on the development of the outlook on science of many staff members of the Physics Institute.

Sobel'man's first scientific works were published in 1953 – 1954 and were concerned with the theory of width of Rayleigh and Raman scattering lines in gases and the theory of line

Uspekhi Fizicheskikh Nauk **176** (6) 681 – 682 (2006)
Translated by E N Ragozin

broadening arising from the quadrupole Stark effect, as well as the problem of relationship between statistical and impact broadening mechanisms.

In the 1950s and 1960s, he carried out an extensive series of works aimed at constructing a consistent quantum-mechanical theory of spectral line broadening. The year of 1963 saw the publication of his monograph *Vvedenie v Teoriyu Atomnykh Spektrov* (translated into English as *Atomic Spectra and Radiative Transitions*), which has subsequently been republished several times and to this day is a handbook on atomic spectroscopy in our country and abroad. In 1964, Sobel'man defended his doctoral dissertation entitled "Spectral line broadening and the theory of atomic collisions". His works in this area long ago became classics and the results he obtained have laid the foundation for the subsequent development of the theory, as well as for its numerous applications in plasma physics, radio astronomy, and astrophysics. Employing his line broadening theory, Sobel'man proposed and substantiated the spectroscopic method for the investigation of atomic collisions. He showed that under certain conditions spectral line narrowing, rather than broadening, is bound to occur with an increase in gas density and elucidated the interference nature of this effect. This permitted explaining the observations of atomic hydrogen radio lines in the interstellar medium and was a valuable contribution to the development of a new efficient method of investigation of the structure of nebulae. Furthermore, this underlay the prediction of Raman line narrowing in gases with increasing pressure.

Igor' Il'ich Sobel'man made a substantial contribution to the development of quantum electronics. Even prior to the advent of the first ruby laser, he proposed and substantiated the method of optical pumping of luminescent media, came up with the idea of a photodissociation laser, and showed the feasibility of producing population inversion in gases by way of quasiresonant excitation transfer. Sobel'man's theoretical investigations gave impetus to research aimed at the production of a photodissociation laser, which now is one of the highest-power pulsed lasers. Sobel'man advanced and theoretically substantiated the idea of harnessing the processes of stimulated light scattering for the development of radically new optical systems — light beam converters. These converters were produced and exhibited a high efficiency — more than a thousandfold increase in laser radiation brightness was attained for a total energy conversion efficiency of about 50%.

In the early 1970s, Sobel'man advanced and explored the idea of producing lasers in the far-ultraviolet and soft X-ray spectral ranges utilizing radiative transitions in multiply charged ions. He proposed a number of sways of creating population inversion of the levels of multiply charged ions in laser-produced plasmas, including those reliant on charge exchange processes and selective photoexcitation. He also performed a series of investigations into the effects of nonlinear interaction of laser radiation with resonant atoms and molecules and developed the quantum kinetic equation method for the description of nonlinear power resonances. This work underlies the modern theory of laser frequency standards and enjoys wide use in nonlinear laser spectroscopy.

Several efficient techniques of laser physics were developed under the guidance of Sobel'man in precision optical experiments: research was pursued to verify the parity nonconservation effect in atomic physics, predicted by electroweak theory, the Faraday spectroscopy technique was developed, and a method of ^{3}He nuclear spin polarization in a dense gas was elaborated. From 1984 to the last days of his life Sobel'man directed much effort towards promoting space research in X-ray solar astronomy. He was one of the directors of the scientific program of Russian spacecrafts intended for solar research — the circumterrestrial CORONAS satellites. With the aid of a complex of X-ray telescopes and spectrometers from the Physics Institute, which were aboard the CORONAS-F satellite, it has been possible to obtain unique results on the structure, dynamics, and spectroscopy of the solar corona. Side by side with this, an extensive program of ecological monitoring of the Earth's upper atmosphere has been implemented. In recent years, Sobel'man had addressed with enthusiasm the problem of time-reversal symmetry violation in atomic physics. He came up with a new method in the quest of the electric dipole moment of atomic xenon, emerging due to this effect.

Sobel'man made a substantial contribution to the teaching of specialists in the field of quantum radiophysics, optics, and spectroscopy. For many years, he brilliantly delivered lectures in physical optics and atomic spectroscopy at the Chair of Optics of MIPhT, affiliated with the Physics Institute. He wrote several monographs on theoretical spectroscopy and the physics of atomic collisions, which gained wide recognition, as well as a series of review papers on topical problems of the theory of radiative processes, published in the *Physics – Uspekhi* journal. His scientific and pedagogical activity had a profound impact on the formation of several generations of scientists in the field of atomic physics, optics, and spectroscopy in our country.

Sobel'man was not only a brilliant scientist but an engaging personality as well. He possessed a deep and broad erudition and a good sense of humor, and the decisions he arrived at were inevitably wise and rational. Igor' Il'ich Sobel'man's passing is an irreplaceable loss to all of his friends and colleagues.

T L Andreeva, I L Beigman, L A Vainshtein,
V L Ginzburg, I A Zhitnik, O N Krokhin,
V S Lebedev, M A Mazing, A V Masalov,
G A Mesyats, S G Rautian, V N Sorokin