

In memory of Igor' Mendelevich Beterov

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Professor Igor' Mendelevich Beterov, Doctor of Physico-mathematical Sciences, died unexpectedly on 4 September 1999. Professor Beterov headed the Department of Quantum Electronics at the Institute of Semiconductor Physics, Siberian Branch of the Russian Academy of Sciences, and was widely known for his work on nonlinear laser spectroscopy, atomic beam spectroscopy, and the physics of Rydberg atoms. The results of his studies have been and continue to be extensively used in this country and abroad.

I M Beterov was born to the family of a serviceman on 7 June 1942 in the city of Ordzhonikidze (now renamed as Vladikavkaz), the capital of North Ossetian Autonomous Soviet Socialist Republic. His childhood and youth was spent in different towns because the family was transferred from one locality to another as his father's commanders saw fit. On finishing school in Novosibirsk as a gold medal winner (1959), Igor' Beterov immediately entered Novosibirsk State University (NSU) which, that year, admitted its first students. In June 1964, he graduated with honours from the Department of Natural Sciences (now the Physics Department) and went to work for the Institute of Semiconductor Physics, Siberian Branch of the Russian Academy of Sciences. Having started his 35-year scientific career as a senior laboratory assistant, I M Beterov eventually rose to a leading position as head of the ISP Department of Quantum Electronics. During the last 18 years of his life, I M Beterov successfully combined his scientific work with teaching at institutions of higher education, which he regarded as a very important area of activity. From 1981, I M Beterov was professor at the Chairs of Quantum Optics and General Physics, Physics Department, NSU. Later, he received a professorship at the Chair of Optical Information Technologies, Department of Radio-technics, Electronics and Physics, Novosibirsk State Technological University (formerly NETI). In the last few years, he became a professor at the State Academy of Economics and Management. During his scientific and educational career, I M Beterov made a substantial contribution to training qualified specialists in quantum electronics.

I M Beterov will remain in the memory of his colleagues as a thoughtful and skillful experimentalist. Having satisfied himself that the atomic beam technique, although very complicated, ensured a highest accuracy of spectroscopic measurements, Beterov pioneered its application to scientific research in this country. Using this approach, he developed a series of original methods and successfully employed them in studies on photoionization spectroscopy, nonlinear polarization spectroscopy, infrared and microwave spectroscopy of highly excited (Rydberg) atoms. Professor I M Beterov was a pioneering researcher on three-level atomic systems which have recently become one of the major object of laser spectroscopy. The results of these investigations were



Igor' Mendelevich Beterov
(07.06.1942 – 04.09.1999)

summarized in a monograph entitled *Trekhurovnevye Gazo-vye Sistemy i Ikh Vzaimodeistvie s Izlucheniem* (Novosibirsk: Nauka, 1972) written jointly with V P Chebotaev and also published by Pergamon Press¹. Other works of I M Beterov devoted to tunable lasers, examination of surface phenomena using laser radiation, and multiphoton processes in atomic gases are equally well known. The elegant experimental methods developed and effectively employed by I M Beterov in his research brought about new interesting data which earned him one of the highest citation indices in the Russian-speaking world of experimental physicists.

This is especially true of the studies pertaining to microwave spectroscopy of sodium Rydberg atoms, which I M Beterov initiated in the late 1980s and completed in the early 1990s. During this work, he observed for the first time the two-photon dynamic Stark effect which consists in the

¹ Beterov I M, Chebotaev V P *Three-Level Systems and Their Interaction with Radiation* (Progress in Quantum Electronics, Vol. 3) (Oxford: Pergamon Press, 1973) 106 pp.

splitting of atomic energy levels caused by the application of radiation in the millimeter range that induces two-photon transitions.

Concomitantly, I M Beterov and his co-workers were the first to discover the so-called ‘double Stark resonance’ in Rydberg atoms, a phenomenon which accounts for the markedly increased probability of two-photon transitions upon imposition of a static electric field on an atom, due to the convergence of virtual and real intermediate transition levels. This, in turn, allowed the probability of transition to be controlled and, besides, facilitated absolute gauging of the electric field strength. In subsequent experiments, I M Beterov and his co-workers managed to control the motion itself of Rydberg atoms in a beam by changing the parameters of high power electromagnetic radiation. Exquisite experimental techniques enabled I M Beterov and his colleagues to accurately measure various physical parameters of atoms and processes in which they are involved, such as the static and dynamic polarizabilities of Rydberg atomic states, photoionization and chemoionization cross-sections, high-order multiphoton transition spectra, etc.

I M Beterov was a thoughtful investigator who brought to perfection the art of scientific experimentation and was reputed for his particular skill in applying and modifying relevant theoretical models for the analysis of physical phenomena under discussion. This faculty enabled him to convert seemingly abstract theoretical models into really observable phenomena as was the case with a study on photoelectron spectrum asymmetry resulting from the ionization of sodium atoms from the 4^2S state. The experimental evidence provided by this study which was carried out jointly with the group of B Ya Zel’dovich led to the discovery of an interesting fundamental phenomenon apparent as the interference between sodium atom one- and two-photon photoionization channels.

I M Beterov was known to his colleagues as the organizer of several S I Vavilov conferences in Akademgorodok (‘Academic Town’) near Novosibirsk and international conferences on quantum electronics and related subjects. He was an ISOE member and a full member of D S Rozhdestvenskiĭ Optical Society.

Also, he was a dedicated educator giving much time to pedagogic work. His broad scientific outlook was especially well apparent in a series of lecture courses including “Physics of gas lasers”, “Nonlinear laser spectroscopy”, “Laser spectroscopy”, “Concepts of contemporary natural sciences”, and “Fundamentals of measurement theory”. Many papers published by I M Beterov in the *Sibirskii Fizicheskii Zhurnal* (Siberian Physical Journal) and in the *Sorosovskii Obrazovatel’nyi Zhurnal* (Soros Educational Journal) (for which he wrote as a Soros Professor) as well as his numerous lectures and reports at conferences and workshops showed him as a man of great learning. I M Beterov was the author of several textbooks and manuals on the physics of lasers, guidelines on optical techniques for high-school students, and other teaching aids. He considered pedagogic work at institutions of higher education to be a major prerequisite for the formation of public opinion in favor of deferential attention to science which has been seriously compromised by the current situation in this country. It is worthwhile to note that I M Beterov had a rare gift for explaining the most complicated scientific problems in plain and precise terms before a large audience of lay listeners. Unfortunately, it was not fated that I M Beterov should live

to celebrate the coming 40th anniversary of Novosibirsk State University of which he was one of the first graduate students. He was an enthusiastic organizer of the jubilee festivities and thought of being an active participant. He passed away in the prime of his creative activity, full of new plans and projects.

Seeing that a crisis of science could be a reality for Russia, after years of economic and social degradation, Igor’ Mendelevich was conscious of the necessity to oppose the spreading of pseudoscientific theories for which the way is paved by the current development of the situation. He sat in a special commission established by the Russian Academy of Sciences to combat this problem.

The versatile scientific and pedagogic activities of professor I M Beterov included (to list but a few major ones) heading the Department of Quantum Electronics and the Laboratory of Tunable Lasers and Laser Diagnostics, organizing and directing international workshops, conferences and competitions for research projects, and teaching at the three largest and most prestigious higher-learning institutions in Novosibirsk. He was completely devoted to serving science and the education of young investigators.

Those who knew I M Beterov during his life greatly appreciated his broadest scientific outlook, independent turn of mind, true culture and intelligence, personal kindness, decency, and modesty. We were all subject to the influence of this pure and upright character.

The premature death of Igor’ Mendelevich Beterov left unaccomplished many of his plans and intentions. He died soon after a series of experiments on diode laser spectroscopy of coherent effects in rubidium atoms had been initiated and thought about starting experiments on laser cooling of rubidium atoms in a magneto-optical trap. These studies will be continued by his colleagues and disciples. Their results together with the remainder of the rich scientific heritage left by professor I M Beterov will always remain in the history of physics and keep alive the remembrance of this outstanding scientist and remarkable man. The death of I M Beterov is a severe and irretrievable bereavement for his numerous colleagues and friends. The memory of his bright and creative personality will forever live in our hearts.

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