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PERSONALIA

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In memory of Oleg Igorevich Sumbaev

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The physics community in this country and abroad has suffered a painful loss. Oleg Igorevich Sumbaev, corresponding member of the Russian Academy of Sciences (RAS), the first Director of the B P Konstantinov Leningrad (now Petersburg) Nuclear Physics Institute of the RAS in Gatchina, died on October 2, 2002. We have lost an outstanding personality and scientist, the founder and leader of the Petersburg school of crystal diffraction research.

Sumbaev's entire life in science was aimed at the future. The results of his work were very often so unusual that considerable courage and perseverance were needed to stand by them and win the recognition of the world physics community. His ideas, his incessant search, and the phenomena he discovered ultimately led to the creation of numerous novel fields of research in the most diverse branches of physics.

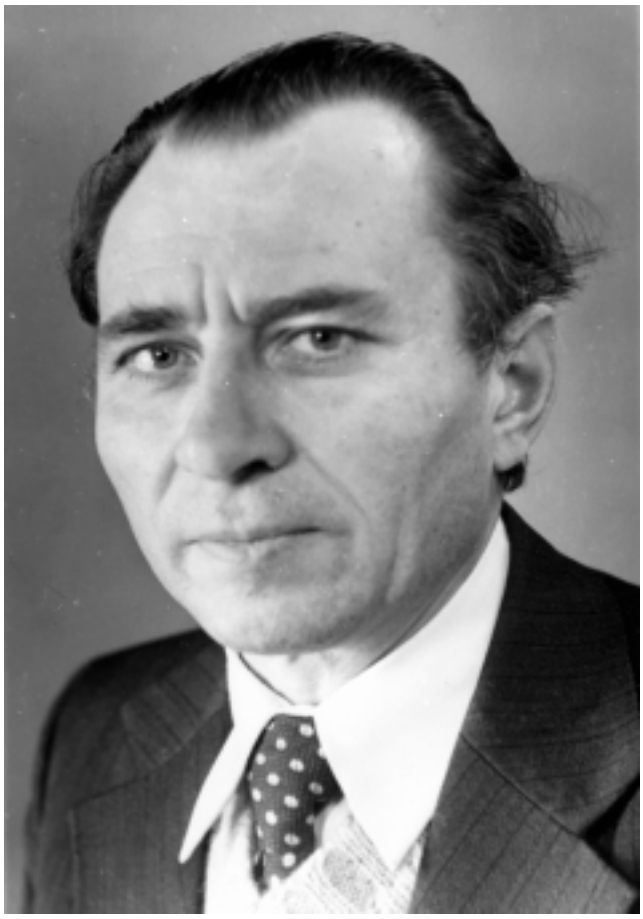
Oleg Igorevich Sumbaev was born on February 4, 1930 in Irkutsk. Having graduated from high school, he enrolled in the Leningrad Polytechnic Institute, from which he graduated in 1954, having majored in nuclear physics.

While still a student, he started working in 1953 at the USSR Metrology Institute where he presented his diploma project and joined the Laboratory of X-ray Physics. Here, under the guidance of the full member of the Academy P I Lukirsky (1894 – 1954), he started construction of a focusing crystal diffraction gamma spectrometer, the first in this country. This effort defined his interest in physics for life. The spectrometer was put into operation already in 1956.

The work "Creation of a two-meter crystal diffraction spectrometer and its application to studying γ-ray spectra" was the topic of his PhD thesis; Oleg Igorevich defended it brilliantly in 1957. The subject was further expanded in the book *Crystal Diffraction Gamma Spectrometers* published in 1963. Even now this monograph remains a must volume and textbook for many scientists in this field.

In 1957, on the invitation of Professor L I Rusinov, O I Sumbaev transferred to the affiliate of the Physico-Technical Institute (now Petersburg Nuclear Physics Institute, PNPI) in Gatchina where the construction of a new atomic reactor was started. The actual launch of the WWR-M reactor took place on December 29, 1959. New experimental results on the Mössbauer study of tungsten isotopes were already obtained with a spectrometer in 1961. This was one of the first projects implemented on the WWR-M reactor. The spectrometer, GSK-1, is still used successfully at the PNPI to study the electronic structure of the chemical bond in compounds of rare earth and transuranium elements by measuring energy shifts of X-ray lines.

In 1957, Oleg Igorevich discovered a new phenomenon which made him known to the entire world community of physicists: the so-called elastic quasi-mosaic structure of crystals (the Sumbaev effect). The profound understanding of the problem which allowed him to calculate precisely the properties of crystals has qualitatively changed the very approach to designing new focusing crystal diffraction instruments. A unique possibility was created to vary their resolution and luminosity by a factor of up to several hundred, and this in turn led to the development of spectrometers with optimal parameters for solving problems in various fields: from nuclear, atomic, and molecular physics, to the physics and chemistry of the condensed state of matter.



Oleg Igorevich Sumbaev
(04.02.1930 – 02.10.2002)

The results obtained allowed O I Sumbaev to design and build a four-meter GSK-2-spectrometer with record resolving power for studying γ-ray spectra in nuclear reactions caused by neutrons. This instrument is still used in experiments; after recent modernization, it has no competition in the world among focusing spectrometers.

Even in one of the first projects carried out with this spectrometer, results were obtained (in 1963) which are still puzzling and await explanation. This is the work on the γ-spectrum of the (n, γ) reaction on Rhodium, which revealed for the first time non-statisticity in the energy

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distribution of γ-lines; this behavior manifests itself in the clustering of energy levels. Furthermore, the distances between groups were found to be multiples of masses of elementary particles (and of differences between masses). Later, Sumbaev noticed that this phenomenon is similar to the effect of synchronization known quite well for systems of nonlinearly coupled oscillators. His calculations demonstrated a surprising agreement between the frequency distribution of such oscillators and the energy distributions of nuclear transitions; it must be mentioned that discussions on the nature and even on the reality of this phenomenon are still raging on.

New possibilities for crystal diffraction techniques also opened for studying X-ray spectra of heavy atoms. Oleg Igorevich experimentally discovered the effect of small energy shifts of atomic X-ray lines, which led to the discovery of a number of new phenomena, such as the electron collapse in atoms, and a typical dependence on the type of X-ray line of chemical shifts caused by removing an electron from an atom ('facsimile' of s-, p-, d-, and f-electrons). It was also proved that there exists an intermediate (non-integer) valence in chemical compounds. New methods were developed for studying chemical bonding and isomorphic phase transitions in matter, and also for measuring charge radii and magnetic moments of atomic nuclei. On the force of the results of this research, Oleg Igorevich presented and defended his DSc thesis in 1966, became professor in 1975, and was elected corresponding member of the Academy of Sciences of the USSR in 1979. Beginning in 1962, Sumbaev had been an irreplaceable head of the Laboratory of X-ray and Gamma-Spectroscopy, which later branched into several independent groups and laboratories with their own research fields.

High-resolution X-ray and γ-spectrometers created on the basis of the theory of elastic quasi-mosaicity developed by Sumbaev are widely used in nuclear and meso-X-ray spectroscopy. High-aperture X-ray spectrometers are successfully applied in molecular physics and the physics of condensed states.

Oleg Igorevich Sumbaev was the founder and supervisor of the scientific school of diffraction research. His students and colleagues submitted and defended three DSc and 17 PhD theses.

Sumbaev pioneered the study of effects in the channeling of protons in bent crystals, which was new for the Institute. He predicted the phenomenon of volume capture and focusing of channeled protons, which were later experimentally confirmed and studied.

Crystal diffraction spectrometers were built in a number of research centers where the ideas and results of Sumbaev's work were applied: in Russia, USA, Switzerland, Germany, and France.

Crystal diffraction spectrometers created in Gatchina under O I Sumbaev and A I Smirnov's supervision were used to study hadronic atoms and to measure the masses of the K^--meson and Σ-hyperon in the Institute for High Energy Physics (Protvino, Moscow region); pionic atoms were studied at the Paul Sherer Institute (in Switzerland). These studies became possible through the creation of the meson-generating target by placing a sample directly into the proton accelerator beam, as this increased the yield of hadronic atoms by several orders of magnitude; the target was widely accepted and became known as the 'Gatchina target'.

O I Sumbaev was the Director of the B P Konstantinov Leningrad Nuclear Physics Institute of the Academy of Sciences of the USSR from the moment it was founded in 1971 until 1985. It was owing to his efforts and his unflinching insistence on impeccable moral standards in science and in relations between scientists that a creative atmosphere reigned in the Institute; this spirit remains its principal feature and has led to conditions that have stimulated fruitful world-class research.

O I Sumbaev's achievements were rewarded with the Orders of "Sign of Honor", "The Red Banner of Labor", "The October Revolution", and with the B P Konstantinov Academic Prize.

It would be difficult to find another person as profoundly and as altruistically devoted to physics as was Oleg Igorevich Sumbaev.

Zh I Alferov, D A Varshalovich, A A Vorob'ev, K A Konoplev, V M Lobashev, E P Mazets, V A Nazarenko, G A Petrov, Yu V Petrov, A P Serebrov, A N Skrinskiĭ, V V Fedorov