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In memory of Sergeĭ Ivanovich Nikol'skiĭ

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Sergeĭ Ivanovich Nikol'skiĭ, one of the outstanding Russian researchers of primary cosmic rays and of their interaction with matter at superhigh energies, and a Corresponding Member of the Russian Academy of Sciences, died on September 18 after a prolonged and painful illness.

S I Nikol'skiĭ was born on July 5, 1923 in Livna, Orlov Region. He graduated from high school in 1941 and was conscripted to the Red Army in October of the same year. After initial military training, he took part in military operations on the Western Front. Grievously wounded, he spent a long time in hospitals, where surgeons had to amputate his right arm. After his hospitalization, he had to relearn writing using his left hand, while a leg wound forced him to relearn walking.

In 1943, against all odds, he enrolled as a student in the Physics Department of M V Lomonosov Moscow State University, from which he graduated in 1948. His further life in physics was mainly based at the P N Lebedev Physics Institute of the Academy of Sciences (FIAN). In 1947, he did his senior year student research paper at the Pamir Mountain Research Station of FIAN. He wintered there in severe high-altitude conditions that completely cut the station off from the outside world.

In 1948, S I Nikol'skiĭ started his postgraduate course at FIAN, and having defended his PhD thesis in 1952, joined the research staff of FIAN and stayed there until his last days. In 1952 – 1959 he took part in annual expeditions to Pamir, where he headed a large group of FIAN researchers and students who studied extensive air showers.

After it had been decided to transfer the Pamir station to the Tyan-Shan Mountains because of the distance to the base in the town of Osh and of insufficient power supply (the Pamir area had not yet been connected to the power grid), Sergeĭ Ivanovich traveled to Alma-Ata in the winter of 1959 and walked up into the mountains to select the new location for the research station.

At the Pamir and Tyan-Shan Research Stations, S I Nikol'skiĭ led in the creation of large-scale complex facilities for studying extensive air showers in order to investigate primary cosmic rays of superhigh energies ($10^{14} - 10^{17}$ eV) and their interaction with atomic nuclei in air and in other media by monitoring the components of extensive air showers. At that time and in that environment, fulfilling successful research goals would have been impossible were it not for the friendly, warm and creative team atmosphere that Sergeĭ Ivanovich was so able to generate owing to the respect he enjoyed, his charm and his good-natured attitude to people; his subordinates responded likewise.

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Translated by V I Kisin

Sergeĭ Ivanovich Nikol'skiĭ
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The Tyan-Shan detector array that they had built nearly 40 year ago is still unique in the amount and variety of information obtained by simultaneous recording of various components of extensive air showers. The array included a multichannel set of scintillation and gas discharge counters that measured the flux of the electron-photon component. This data allowed the team to measure the energy of primary particles and to study the processes of their interactions in air. The underground areas contained detectors for muon component flux, as well as spark chambers and an ionization calorimeter for studying the characteristics of the creation of muons and of their interaction with matter.

In order to monitor the energy processes in nuclear interactions of high-energy particles in the central core of air showers, the large calorimeter was placed at the central part of the array; it contained ionization chambers alternating with layers of lead absorbent. When measurements were started, this calorimeter pioneered the use of moving X-ray films. The data on each event were output to a computer and the data from all recording channels were written on magnetic tape; at that time this was a novelty. In later years FIAN's

Tyan-Shan complex array incorporated a large area X-ray emulsion camera and a neutron monitor of the Kazakh Institute of the Ionosphere which supplied interesting new results on extensive air showers.

At the Tyan-Shan station, Sergeĭ Ivanovich also supervised the construction of a large gamma telescope for studying the sources of cosmic rays by monitoring Cherenkov emission of showers in the atmosphere. This telescope served to study numerous galactic sources and to discover new metagalactic sources of gamma quanta.

In 1963, S I Nikol'skiĭ was one of the physicists who initiated the creation, in the Yakutiya region, of a giant array for studying extensive air showers of the highest energies ($10^{17} - 10^{20}$ eV), one of the first of its kind in the world. He headed the Russian Academy of Sciences Commission on designing the Yakutsk array and in 1973 headed the State Commission which certified this array for operations; he later participated in designing experiments and conducting data analyses. The results obtained in these experiments are known worldwide.

Together with physicists of the Yerevan Physics Institute, Sergeĭ Ivanovich proposed the idea of building an array for studying extensive air showers in Armenia, in the Aragatz Mountain. He took part in the design stage of this project and then led a group of colleagues from FIAN who worked on building the system, using it in experiments and analyzing the data.

S I Nikol'skiĭ was a champion of the idea of extensive cooperation between scientists from various countries. Scientists from research institutes in Bulgaria, Hungary, Poland and Czechoslovakia worked together at the Tyan-Shan station. Four gamma telescopes were built in India using the FIAN designs and plans exist for conducting joint gamma-astronomy investigations there.

Sergeĭ Ivanovich also taught at M V Lomonosov Moscow State University and at Moscow Engineering Physics Institute, where he was a professor until his last days. His numerous followers — former students and postgraduates — now carry on active research work at FIAN and Yakutia and at high-altitude stations in Pamir, Tyan-Shan, Aragatz. In 1970, he became a Doctor of Science in physics and mathematics and in 1984 was elected a Corresponding Member of the Academy of Sciences of the USSR. His work was rewarded with government awards and decorations and the Lenin Prize; he also received the International Prize of the Bulgarian Academy of Sciences.

For many years, S I Nikol'skiĭ was one of the organizers of Soviet and Russian science, as director of the Pamir and Tyan-Shan Research Stations, Head of laboratory, Secretary of the Communist Party Committee of FIAN and Director of the Multi-branch Division 'V' of FIAN during a particularly difficult time for the institute, and then Director of the Division of Nuclear Physics and Astrophysics of FIAN.

S I Nikol'skiĭ was a world authority on cosmic rays. His name is inseparable from the study of the energy spectrum and the nuclear composition of primary cosmic rays; in this field he was the first to apply calorimetric techniques to all components of extensive showers. The 'Nikol'skiĭ spectrum' and 'Nikol'skiĭ composition' are known to scientists everywhere. S I Nikol'skiĭ paid careful attention to the study of new phenomena of nuclear processes whose existence was inferred from the experimental data obtained at the Tyan-Shan research array. Recently Sergeĭ Ivanovich analyzed processes of multiple creation of hadrons at energies of $10^{15} - 10^{20}$ eV using the entire set of experimental data accumulated during the preceeding years.

S I Nikol'skiĭ was a very modest and responsive person but he was also a courageous and purposeful man. Despite a punishing wound obtained in the Second World War, which constantly caused him pain, despite the tragic death of his adult daughter, he remained devoted to science and became an outstanding physicist and manager of research efforts.

The memory of Sergeĭ Ivanovich, a wonderful human being and scientist, will live in the memory of those who new him.

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