

Among them we find three Academicians (G T Zatsepin, G B Khristiansen, A E Chudakov), and 45 DSc and 225 PhD scientists.

S N Vernov successfully combined productive research with science administration in his capacities of Deputy Academician-Secretary of the Nuclear Physics Division of the USSR Academy of Sciences, Chair of the Scientific Council on the Cosmic Rays integrated program, Chair of the Nuclear Physics Section of the Scientific and Technical Council of the USSR Ministry of Higher and Medium Special Education, member of the editorial boards of the journals *Nuclear Physics*, *Proceedings of the Academy of Sciences: Physics Series*, *Geomagnetism and Aeronomy*, *Vestnik of Moscow State University* (Physics Series), and member of a number of learned and scientific councils.

The characterization of S N Vernov would be incomplete if we failed to mention his massive activities in popularizing science as such, and the achievements of scientists of Moscow State University in particular. His lectures and popular science articles appeared in many central newspapers and popular science magazines.

Sergei Nikolaevich Vernov was a cheerful and charming man. His innate kindness and responsiveness and his desire to help in times of difficulties earned him general respect and love. As luck would have it, I lived near him for several years in the main MSU building: his apartment was on the fifth floor, mine was on the fourth. Great friendship bound me to his first deputy at RINP, Professor I B Teplov, with whom we often discussed the problems of the Institute, and Sergei Nikolaevich's opinion was always offered on any subject in these discussions. On the other hand, Sergei Nikolaevich would never make a decision on an important issue without first working out a version taking into account I B Teplov's point of view.

Sergei Nikolaevich Vernov died on 26 September 1982 and was buried in Novodevichy Cemetery.

To perpetuate the memory of S N Vernov, a plaque has been mounted at the entrance to the RINP building at Vorobiev Gory, where he worked from 1953 to 1982, the auditorium 5–18 of the Department of Physics became the S N Vernov auditorium, outstanding students of the MSU Department of Physics are awarded the Vernov scholarship, and the S N Vernov contest for best research paper by a young scientist is regularly conducted at MSU RINP. One of the streets in Dubna in the Moscow region and a street in the town of Sestroretsk in the Leningrad region, where S N Vernov was born, bear his name.

Moscow State University is a leading research center in the country, contributing in important ways to progress in fundamental science and to strengthening of most needed scientific university education. Sergei Nikolaevich Vernov belongs to the constellation of scientists who are the pride of MSU. His path through science and life offers a brilliant example for the new generations of young researchers ready to do good for their Fatherland.

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S N Vernov centenary talk

V I Trukhin

The date 11 July 2010 marks the 100th anniversary of the birth of Academician Sergei Nikolaevich Vernov, the scientist of world renown, one of the founders of the Research Institute for Nuclear Physics (RINP) [now renamed as D V Skobeltsyn Institute of Nuclear Physics (SINP)] of MSU and of the Nuclear Physics Division (NPD) of the MSU Department of Physics.

Let us look at the brief history of the creation of the Research Institute of Nuclear Physics (RINP) and NPD. In 1940, a chair, Atomic Nucleus and Radioactivity, was set up in the Department of Physics of MSU on the initiative of Academician S I Vavilov and Corresponding Member D V Skobeltsyn. It was headed by D V Skobeltsyn, while S N Vernov and I M Frank became chair professors. In 1943, S N Vernov change his principal position to professorship in the Department of Physics of MSU, namely D V Skobeltsyn's chair, so that Vernov's pedagogical activities and his research were connected with Moscow State University until the last days of his life.

In 1940 and in 1943–1945, S N Vernov gave lecture courses on cosmic ray physics for students of the Atomic Nucleus and Radioactivity chair, and since 1944 he headed the chair's laboratory of the atomic nucleus—the first laboratory of nuclear physics at MSU. It was in this laboratory that S N Vernov launched his study of cosmic rays in the stratosphere, while Professor L V Groshev and Assistant Professor V S Shpinel were the first in the USSR to begin work on the study of the structure of atomic nuclei by β - and γ -spectroscopy. Students of the chair began to take active part in this research work.

In 1946, a Special Resolution of the USSR Council of People's Commissars created at MSU, on the basis of the chair and the chair laboratory, a Scientific and Research Center for training specialists for the Soviet Atomic project—the Institute of the Atomic Nucleus—mentioned in declassified documents as MSU NIFI-2; in 1956, this was changed to the current title MSU RINP (SINP). For two years, from 1946 till 1948, all the main organizational work of the institute and the chair (renamed Structure of Matter) became the responsibility of S N Vernov as deputy Director of the institute because Director of the Institute D V Skobeltsyn was sent to the USA as the USSR representative in the UN.

In this period, D V Skobeltsyn and S N Vernov tackled the task of creating an institute operating as large-scale university type nuclear physics center for conducting fundamental nuclear physics research and training of young researchers.

Work for the Soviet Atomic project demanded a sharp increase in the number of graduates specializing in nuclear physics. In December 1948, the USSR Council of Ministers

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issued a resolution on the training of higher education professionals for conducting this work. To implement this resolution, the Division of the Structure of Matter, now the Nuclear Physics Division, was founded at the beginning of 1949 on the basis of the Structure of Matter chair of the MSU Department of Physics. The division comprised five chairs: Physics of the Atomic Nucleus, Accelerators, Neutron Physics and Radioactive Radiation, Nuclear Spectroscopy, and Cosmic Rays.

Academician D V Skobel'syn became the first Head of the Division. In 1960, he transferred this position to Sergei Nikolaevich Vernov, who occupied it for twenty years, acting at the same time as Head of the Chair of Cosmic Rays and Space Physics. During these decades, the structure of the division was changing, and new chairs were formed.

On the initiative of D V Skobel'syn, S N Vernov, and the first Director of the Joint Institute for Nuclear Research (JINR) D I Blokhintsev, a branch of MSU RINP with two chairs was organized in Dubna, so the training of the students of these chairs used the facilities of the JINR.

S N Vernov led the way to organizing an efficient educational process at the Nuclear Physics Division, including the work of the Chair of Cosmic Rays and Space Physics. Initially, Sergei Nikolaevich was the lecturer of the main course, Introduction to the Physics of Cosmic Rays, but then passed it on to other teachers. He never ceased to supervise postgraduates working in MSU RINP laboratories.

Students highly valued meetings with Sergei Nikolaevich, at which he discussed the problems of education, science, and their future. Addressing his students, S N Vernov would say: “Forget your free time on Sundays, your free weekday evenings. If you wish to become true scientists, your time must be wholly devoted to science when working, thinking, reading.”

The first graduate students of the Chair of Cosmic Rays were future professors L I Sarycheva, I V Rakobolskaya, S A Slavatinskii, and G B Khristiansen. When it was created, the Chair had few staff, which consisted mostly of moonlighting teachers but with time and S N Vernov's effort the number of teachers kept increasing and the scientific interests of the staff grew wider.

Each year the Chair accepts 10 to 15 third-year students and typically has from five to 10 postgraduates. Diploma and PhD theses are mostly prepared in scientific laboratories of MSU RINP and in the laboratories of the P N Lebedev Physical Institute and the Institute for Nuclear Research of the RAS. More than 20 all-department and special courses are presented to students in the Chair, and specialists are trained in the astrophysics of cosmic rays and in space physics.

Sergei Nikolaevich Vernov regarded the practical work of students in research teams as extremely important. Even long before their graduation date, students ought to take part in work on the most pressing problems and apply modern methods. The more initiative a student shows, the earlier he/she should be exposed to modern science and hardware and should meet those who create this science; it is therefore of key importance to involve the leading specialists of research institutes in teaching university courses. Sergei Nikolaevich Vernov wrote: “Teaching allows leading professionals to throw a closer look at their domain as if from outside, to check the completeness of their knowledge and the credibility of the findings.” He believed that experts ought to pass on their knowledge to others and to learn from their students. Sergei Nikolaevich himself never hesitated to learn from his students: he learned computerized methods of data proces-

sing, admired the results, then wrote in his notes: “Computers should permeate the entire process of education.”

Sergei Nikolaevich had a wonderful ability to quickly notice new phenomena in science and introduce new subjects into teaching courses for students at the Chair and in the Nuclear Physics Division. For instance, the creation of first artificial Earth satellites and the discovery of Earth's radiation belts resulted in organizing a whole range of new lecture courses dealing with issues in space physics at the Chair, and was reflected in its title: Chair of Cosmic Rays and Space Physics.

A new area of research — space materials science — started taking shape at the Chair owing to S N Vernov's initiative. The Chair began to train students in this field and worked in close contact with the appropriate division of MSU RINP. S N Vernov also initiated the founding of this new specialization for students at the Moscow Institute of Electronic Engineering, where he gave lectures on space materials science.

Also on S N Vernov's initiative, research on high-energy physics at accelerators and on the physics of ultrahigh energies in cosmic rays intensified and this immediately stimulated adding new special courses to the curricula and to starting the training of students in these new fields. Another new feature was launching at the Chair a special course on neutrino astrophysics in response to new advances in this sphere. Sergei Nikolaevich wrote: “We need to be able to train experts, and fast, in areas which simply did not exist in the past.” In fact, almost all research teams of the physics institutes now working in the field of cosmic rays and neutrino astrophysics are former graduates of the Chair of Cosmic Rays and Space Physics.

In parallel with training specialists in narrow problems, Sergei Nikolaevich Vernov also regarded it as necessary and very important to think ahead about training researchers with a very broad span of skills and interests. He himself was a person of this ilk. The MSU Department of Physics highly values everything accomplished by S N Vernov in expanding higher education in cosmic ray physics and space physics along the latest directions.

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Coming of age and development of space physics at Moscow State University. Radiation in space: the legacy of S N Vernov

M I Panasyuk

1. Introduction

This paper presents a brief retrospective review of the main results of a research in the field of space physics obtained at the Lomonosov Moscow State University (MSU) in the

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