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# In memory of Nikita Alekseevich Sveshnikov

Nikita Alekseevich Sveshnikov, Associate Professor of the Department of Physics of Moscow State University, a brilliant scientist and pedagogue, untimely passed away on July 29, 1997 at the age of 44.

An alumnus of the Chair of quantum statistics at Moscow State University headed by N N Bogolyubov, Nikita Sveshnikov started his academic activity in his undergraduate years. In his diploma work, and then in his candidate's thesis prepared under the guidance of D V Shirkov, he investigated the problem of infrared divergences in quantum field theory. Such divergences have been known since the 1930s, and acquired special interest in connection with the problem of confinement of quarks in quantum chromodynamics.

Sveshnikov was the first to understand that a consistent application of the method of asymptotic dynamics, which exactly describes the processes of interaction of particles at asymptotically large times, to massless models of non-Abelian symmetry, may give rise to non-trivial restrictions on the spectrum of the theory. In a series of works of the late 1970s — early 1980s he demonstrated that the model's charge-symmetrical theory does not admit states with non-zero non-Abelian charges, and within the framework of perturbative quantum chromodynamics there are no asymptotic states corresponding to free quarks, which may be interpreted as indication of confinement.

In the years to follow, Nikita Alekseevich again and again turned to the problems of infrared divergences, asymptotic dynamics and confinement, and worked on them actively and productively to the last day of his life.

An important contribution by Sveshnikov to the quantum theory of gauge fields consisted in the recognition of the role of surface terms and delocalized observables (variables at infinity) in quantum gluodynamics in the Fock – Schwinger gauge, and in the development of elegant methods of functional integration designed for adequate inclusion of the contribution of the surface effects to the statistical sum, and for studying its dependence on the boundary conditions. This led to an explanation of the mechanism of the confinement – deconfinement phase transition in SU($N$) gluodynamics. He demonstrated that below a critical temperature only a zero value of color charge in any angular cone is statistically realizable. The latter is equivalent to the physical condition of 'non-escape' of color in any direction, and is the mathematical expression of the singlet nature of physical observables with respect to the subgroup of gauge transformations at infinity, which in turn ensures fulfillment of Wilson's confinement criterion. The numerical value of a string tension predicted by this model is close to that calculated by the Monte Carlo method.

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A natural consequence of these works are the results in the theory of jet reactions at high energies obtained in the mid-1990s; the linkage of the main class of observables with the energy – momentum tensor was discovered.

It ought to be observed that the supreme mathematical culture of Nikita Alekseevich enabled him to formulate consistent theories in fields previously dominated by semi-phenomenological approaches. His supreme mathematical culture was perhaps one of his strongest points — one is tempted to think of a genetic predisposition. Sometimes it might even seem that his physics was obscured by mathematics. Such an impression, however, is certainly wrong: the physics for him always came first.

The scope of academic interests of Nikita Alekseevich broadened with time, and his extensive erudition and superlative skill allowed him to work simultaneously on pivotal theoretical problems in different branches of physics, and not physics alone: for example, he studied the processes of

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propagation of information in distributed systems. In particular, he demonstrated that a population of neurons not communicating directly with one another may perform complicated data transfer functions by releasing a special substance into the common environment and reacting to its local variations of concentration. Also studied were other systems where the active units were large organic molecules which communicate through special 'messenger molecules' carrying information about the destination code.

Sadly, death interrupted the multifarious studies of Nikita Alekseevich. He left many unpublished or partly published results, finished papers and preliminary drafts which for years to come will be sent to press by his colleagues and students. Among his last works one should mention the original study of specific three-particle states which he called 'non-Pauli states'; the development of the theory of quantum bound states submerged in a continuum, and the classical analogs of such states: bound states without classical turnpoints; and the study of methods for construction of isospectral Hamiltonians.

For Nikita Alekseevich, his research work was inseparable from teaching. Educational work was all-important in his activities. It would not be an exaggeration to say that he put his heart and soul into his work with the students at the chair of quantum theory and high energy physics headed by A A Logunov, and at the nuclear physics division of the Department of Physics of Moscow State University, where he was deputy head for many years. He was willing and able to teach, and his pedagogical talent matured with the years. For the current generation of students of the Department of Physics he was one of the best-loved teachers. Everyone who had the privilege of knowing him will remember how rapidly he grew both as a teacher and as a researcher. This was perceived by his students: his number of graduates and postgraduates increased every year. For the past few years he gave a full-year special course on quantum field theory. His contribution to the organization of various topical courses, like the ''Quantum field theory for experimental physicists'', delivered by D V Shirkov, was invaluable. He had a rare gift to carry the weight of organizational duties with elegance and ease, and every job was invariably done in the most efficient and comprehensive manner.

For the past twelve years Nikita Alekseevich gave his time and efforts to a project related both to education and research, started initially as a self-appointed task. In 1985 the first annual ''School of young scientists of the R&D Institute for Nuclear Physics of Moscow State University'' was convened, devoted to quantum field theory and high energy physics. This school gradually grew into a major annual international conference, known in this country and worldwide as the QFTHEP School Seminar. From the first school onwards, Sveshnikov was a member of the organizing committee. His admirable presentations and the numerous discussions he organized will always be remembered as his contribution to the QFTHEP project. He played a most active role in the preparation of the 12th QFTHEP Seminar, which took place after his untimely demise in September 1997 in Samara and was dedicated to his memory.

In spite of his youthfulness, people constantly turned to Sveshnikov for advice and his opinion. Many benefited from his bright wit, knowledge, and — last but not least — his openness. He was a self-disciplined and modest person. He was a man of talents, the gift of communicability being one of the many. It is not by accident that he was one of the leading personalities in the social life of the Department of Physics at Moscow State University.

Nikita Alekseevich, our colleague and good friend, had a blessing of Nature. 'Talent' and 'charm' are words that characterize him best. It would be wrong to say that he departed this life — he will live in the memories of his friends, and he will live in his accomplishments, results, ideas and dreams.

His friends, colleagues and disciples will forever keep a grateful memory of this man of excellence.

*V G Kadyshevskiĭ, A A Logunov, V A Matveev,*
*V A Rubakov, V I Savrin, A A Slavnov, V I Trukhin,*
*O A Khrustalev, D V Shirkov*