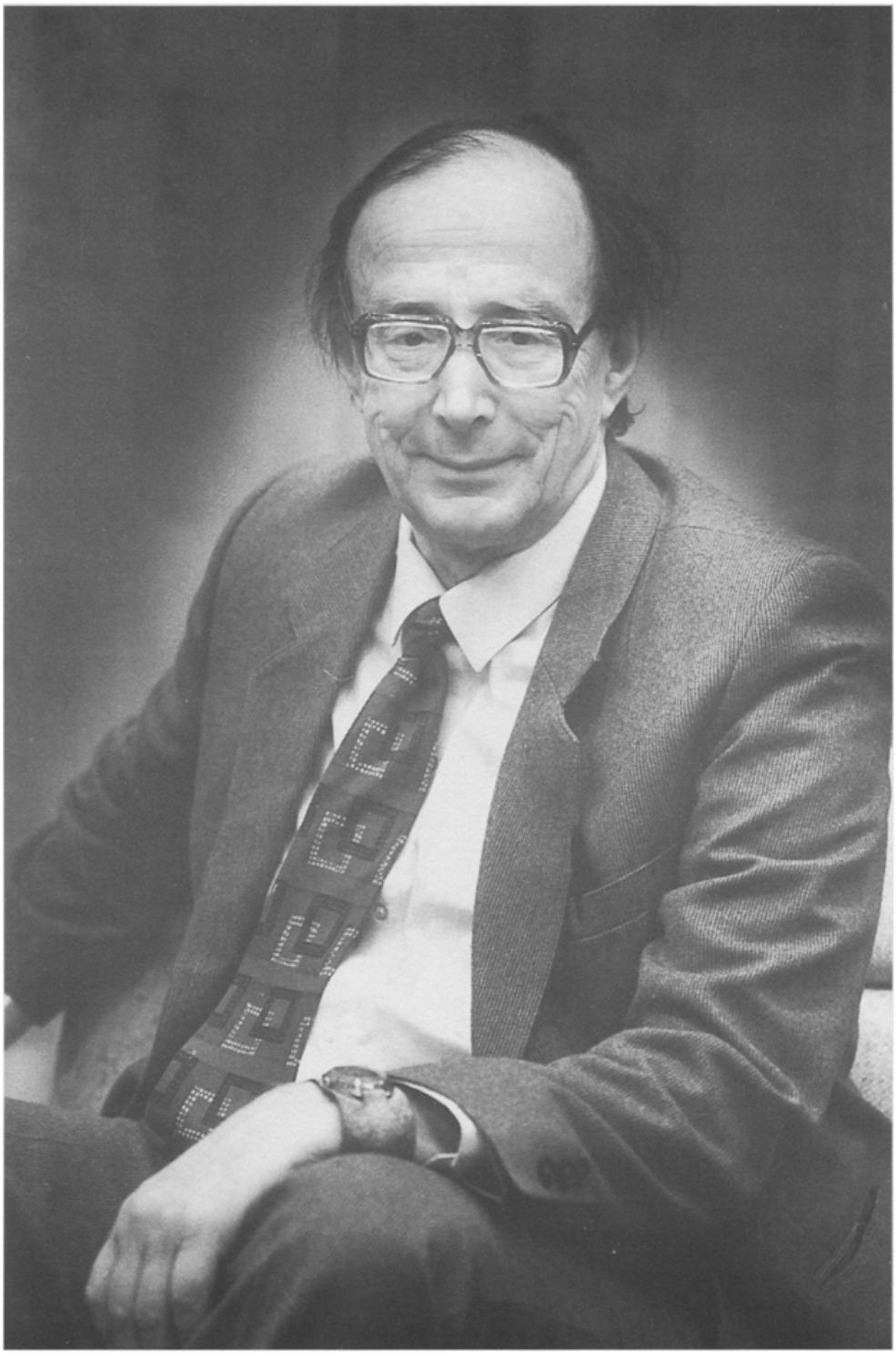

Victor Isaakovich Ogievetsky (1928–1996)

Preface

Victor Isaakovich Ogievetsky (1928–1996)

This volume is dedicated to the memory of Professor V.I. Ogievetsky, a leading Russian theorist who made many significant contributions to theoretical elementary particle physics. The volume contains both reprints of selected papers of V.I. Ogievetsky and contributions by his friends and collaborators including the talks of the participants of the Memorial International Seminar "Supersymmetries and Quantum Symmetries" held at the Joint Institute for Nuclear Research (Dubna, Russia) 22–26 July 1997.

A short outline of V.I. Ogievetsky's scientific biography may be useful for the readers of this volume. He was born in Dnepropetrovsk on August 6, 1928 into the family of I.E. Ogievetsky, Professor of Mathematics, and started his scientific activity as a theoretician in 1950 when he became a school-teacher in Dnepropetrovsk upon graduating from Dnepropetrovsk State University. His first studies were on the problem of the penetration of gamma-rays through matter. He received his PhD degree in Physics and Mathematics at the Lebedev Physical Institute in 1954. On the recommendation of Academician I.E. Tamm, in 1955 he was admitted to the V.I. Veksler laboratory at Dubna in the group of M.A. Markov where he actively began research on elementary particle physics and quantum field theory. He moved to the Joint Institute for Nuclear Research at Dubna in 1956 at the time of its foundation and worked there for 40 years in the Laboratory of Theoretical Physics of JINR (now the Bogoliubov Laboratory of Theoretical Physics).

From the beginning of his career Victor Ogievetsky was attracted to the study of symmetries in elementary particle physics. The universality of the gauge principle and its applicability not only to quantum electrodynamics, but also to other types of interactions, were not fully understood at that time, but V.I. Ogievetsky quickly realized both the potential applicability and the beauty of gauge theories. The criterion of beauty always played an important role in all his scientific works. In a close collaboration with I.V. Polubarinov, he carried out a series of studies on the field-theoretical interpretation of gauge theories and gravity theory, works which have greatly influenced the development of this major modern direction of elementary particle theory.

The role of spin of interacting fields in gauge theories was emphasised and it was realised that gauge invariance in quantum electrodynamics and non-Abelian gauge theories is a device to ensure the consistency of interactions of spin-1 fields with each other and with the conserved vector currents of matter. In a similar way, Einstein's theory of gravity was interpreted as a gauge theory of an interacting spin-2 field coupled to a conserved tensor current. In the course of these researches, V.I. Ogievetsky and I.V. Polubarinov made discoveries whose applications became clear only years later. In 1965, they introduced the 'notoph', an antisymmetric tensor gauge field which describes helicity 0 and so is complementary to the photon describing helicities ± 1. This object was later rediscovered in the context of string theories and turned out to be a necessary ingredient in many supersymmetric field theories. Another pioneering contribution made in 1964 was the idea to regard spinors in general relativity as objects with a nonlinear (in the metric) transformation law under the diffeomorphism group. This result anticipated the theory of nonlinear realizations developed later by C. Callan, C. Coleman, D.V. Volkov, S. Weinberg, J. Wess and B. Zumino. After defending his doctor's thesis based on these results in 1966, V.I. Ogievetsky carried on with intensive work on symmetry methods in quantum field theory. In the late 1960s, he became especially interested in the above-mentioned topic of nonlinear realizations and the closely related concept of spontaneous symmetry breaking, mainly in applications to space-time symmetries including the Poincaré group as a subgroup. One of his striking results in this domain (obtained in collaboration with A. Borisov) was the interpretation of gravity as a joint nonlinear realization of two spontaneously broken finite-parameter symmetries, conformal and affine, which in their closure yield the general covariance group. The latter observation is now known as the Ogievetsky theorem (1973). According to this ideology, the graviton can be viewed not only as a gauge field but also as an analogue of the Goldstone field appearing in the nonlinear realization of an internal symmetry. Later it was proved that other gauge fields admit such a two-fold interpretation as well. This deep analogy of gravity and gauge theories with sigma models turned out to be extremely fruitful in further studies, in particular in topological field theories and in the theory of embeddings of strings and superstrings.

In the next stage of his scientific career V.I. Ogievetsky turned to supersymmetry. He was very enthusiastic about this idea from the moment the first papers on the subject appeared. This was to a great extent due to the fact that in the 1960s he and I.V. Polubarinov were actually on the verge of discovering supersymmetry when asking themselves what the theory of a conserved spin 3/2 current could describe. From the beginning V.I. Ogievetsky was preoccupied by the beauty of the idea of superspace, an extension of ordinary Minkowski space by anticommuting coordinates. One of the first reviews on supersymmetry and superfield techniques was published by V.I. Ogievetsky and L. Mezincescu in Usp.Fiz.Nauk in 1975. It is unrivalled in the lucidity and completeness of its exposition and still serves as

an excellent introduction to this subject. In that period V.I. Ogievetsky organized a group of followers at Dubna who were inspired by the beauty of his geometric ideas. The geometric superfield formulation of supergravity as a supersymmetric extension of gravity theory (together with E. Sokatchev) was the main achievement of this period. This formulation is based on the superfield extension of the idea of coupling to a conserved current, this time to the supercurrent that unifies the energy–momentum tensor, the source of the graviton, with the spin 3/2 current, the source of the gravitino, a superpartner of the graviton. The consistent realization of this idea resulted in the construction of linearised superfield supergravity (in 1977) and then in the discovery of the fundamental gauge group of supergravity as the group of general coordinate transformations in a complex chiral superspace. The profound connections of supergravity with the theory of complex manifolds were thus revealed. Later on, the problem emerged of how to generalise the superfield theory of a simple ($N = 1$) supersymmetry to a more complicated extended supersymmetry that includes a non-trivial group of internal symmetries. The breakthrough came about in 1984 when the Dubna group headed by V.I. Ogievetsky (A. Galperin, E. Ivanov, S. Kalitzin, E. Sokatchev) invented the concept of harmonic superspace that involves parameters of the internal-symmetry group as coordinates. The method of harmonic superspace is at present commonly recognised as a powerful geometric approach to extended supersymmetries and supersymmetric integrable systems; it is closely related to the Penrose twistor method. During his last years, up to his untimely death, Victor Isaakovich remained faithful to subjects related to supersymmetry, and in particular to applications and generalisations of the harmonic superspace approach. In his last year he was especially interested in self-dual supersymmetric theories including self-dual supergravity and had been working on some promising ideas (these last researches were performed together with Ch. Devchand). Unfortunately, his final illness overtook him suddenly and prevented him from carrying through this programme to its conclusion.

V.I. Ogievetsky was awarded the I.E. Tamm Gold Medal of the Academy of Sciences of the USSR in 1986 and the von Humboldt Foundation award (Germany) in 1992. He was four times winner of the 1st JINR annual competition prize. V.I. Ogievetsky was a member of the editorial board of the journal Yadernaya Fizika [Sov.J.Nucl.Phys.], participated in many conferences on group-theoretical methods in physics and quantum gravity, was a permanent chairman of the organizing committee of regular international workshops on supersymmetries and quantum symmetries he had founded at Dubna. He was a member of the governing board of the International Centre for Fundamental Physics founded by the P.N. Lebedev Physical Institute and NORDITA in Moscow.

Dubna, Munich
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E.A. Ivanov, J.Wess

List of Main Publications of V.I. Ogievetsky

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