

Al'bert Nikiforovich Tavkhelidze (on his seventieth birthday)

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December 16, 2000 was the 70th birthday of Albert Nikiforovich Tavkhelidze, prominent scientist and science manager, theoretical physicist of world-wide renown, President of the Academy of Sciences of Georgia and member of the Russian Academy of Sciences.

After graduating in 1953 from the Tbilisi State University, where he read in theoretical physics, A N Tavkhelidze was recommended by full members of the academy I N Vekua and N I Muskhelishvili for a post-graduate course at the V A Steklov Mathematical Institute of the USSR Academy of Sciences. Full member of the Academy N N Bogolyubov became his science advisor.

In 1956, N N Bogolyubov and A A Logunov invited A N Tavkhelidze to start working at the Laboratory of Theoretical Physics of the United Institute of Nuclear Studies, based at the International Physical Centre that had been opened in Dubna shortly beforehand. While working on fundamental physical problems, he became active as a science manager. He accepted A A Logunov's offer to take part in organising the Sector of Theoretical Physics at the Institute of High-Energy Physics in Protvino. In 1967, he worked together with N N Bogolyubov to establish the Institute of Theoretical Physics in Kiev (the institute has since been named after N N Bogolyubov). He contributed to the launching of the *Theoretical and Mathematical Physics* journal. Much of his time was devoted to training a new generation of physicists, organising and conducting a whole range of symposia, workshops and conferences.

In 1970, the Presidium of the USSR Academy of Sciences appointed A N Tavkhelidze to the post of director of the newly founded Institute of Nuclear Studies, Moscow. His task was to work out the structure of the new institute and to set the scientific dimensions of its activities. After discussion with prominent academics, with the final support of the full Academy member M A Markov, two main avenues of research were chosen for the institute: particle and nuclear physics, and neutrino astrophysics. The institute drew up plans for building the Moscow Meson Plant in Troitsk, and neutrino observatories equipped with appropriate neutrino telescopes, underground ones at the Baksan neutrino observatory in the Elbrus region and underwater ones at lake Baikal. At the Institute of Nuclear Studies, A N Tavkhelidze still carries out successful research in the capacity of its science manager and head of the Department of Theoretical Physics.

While working in Moscow, A N Tavkhelidze paid much attention to promoting physics research in Georgia. With the support of Academy member N I Muskhelishvili, the A M Razmadze Mathematical Institute opened a Department of Theoretical Physics while Tbilisi University established the Institute of High-Energy Physics. Since 1995, A N Tavkhelidze has headed the latter institute. In 1967, A N Tavkhelidze was elected corresponding member of the

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Georgian Academy of Sciences; in 1974, he became a full member. In 1986, recommended by the Georgian government and supported by the USSR Academy of Sciences, A N Tavkhelidze was elected President of the Georgian Academy of Sciences. In 1993 and 1998, he was re-elected to this post by general assemblies of the Georgian Academy of Sciences. The Academy's contribution to the scientific and intellectual life of Georgia has been fully acknowledged.

A N Tavkhelidze has authored over 200 science publications with a high citation index. Many of his co-authors who started as young researchers are now reputed world-wide as major scientists and science managers. The contribution made by A N Tavkhelidze has played a key part in the progress of several fields of modern theoretical physics. Let us name just a few of his scientific results.

Generalising N N Bogolyubov's method of dispersion correlations (DC) for inelastic processes and those with non-conserved numbers of particles in the quantum field theory (QFT), A N Tavkhelidze and A A Logunov were the first to

obtain the DC for amplitudes of photo-generation of pions on nucleons.

Working together with A A Logunov, A N Tavkhelidze suggested a three-dimensional version of the QFT, in which a system of two interacting particles is described by relativistic three-dimensional quasipotential equations known as the Logunov–Tavkhelidze equations. They are very useful for calculating super-fine corrections of the energy of hydrogen atoms, the bound state energies of quarks etc.

Working together with A A Logunov and L A Solov'yov, A N Tavkhelidze obtained finite-energy (FE) sum rules for amplitudes of meson-nucleon scattering. Using the new sum rules, the three scientists discovered global duality: the integral relations between the resonance component of amplitude and the Regge parameters. The properties of the global and local (Venetiano) duality became the basis for creating a string model of hadrons. Subsequently, with the collaboration of N V Krasnikov and K G Chetyrkin, the FE method was generalised for the case of quantum chromodynamics based on the asymptotic freedom which is a property of this theory. FE sum rules are a non-perturbative method which is widely used for calculations in quantum chromodynamics.

A N Tavkhelidze, B A Arbuzov and R N Faustov were among the first scientists to realise that the fermion mass could arise as a result of spontaneous symmetry violation in a two-dimensional model of QFT.

In 1965, A N Tavkhelidze, N N Bogolyubov and B V Struminsky, working independently from Nambu and Khan, suggested that quarks may have a new quantum number, subsequently named ‘colour’, that plays a key part in chromodynamics. Based on the quasi-independent quark model, the Matveev–Muradyan–Tavkhelidze formulas of quark count were discovered and registered in 1987; the new formulas predicted a power-law behavior for the elastic scattering amplitude and hadron form-factors on momentum at high energy and momentum transfer. The dynamic quark model of hadrons became the starting point in the search for a relativistic generalisation of $SU(6)$ symmetry of elementary particles and finally brought about the formulation of relativistic-covariant equations for bound systems of particles in the QFT (in collaboration with V G Kadyshevsky, R M Muradyan, Nguen Van Hieu, I T Todorov and R N Faustov).

A number of papers written by A N Tavkhelidze together with V A Matveev and R M Muradyan formulated the principle of self-similarity in high energy physics (1969), and, based on it, a consistent approach to describing phenomena of the scale-invariant behavior of deeply inelastic interaction between leptons and hadrons. Joint papers with N N Bogolyubov and V S Vladimirov (1972), gave rigorous justification of the existence, within the local QFT, of self-similar (scale-invariant) asymptotics of deeply inelastic processes and established the exact connection of the structural functions of these processes with the behavior of commutators of local currents in the vicinity of the light cone.

In the research that A N Tavkhelidze did jointly with V A Matveev, V A Rubakov, V F Tokarev and M E Shaposhnikov, they posed and solved the problem of instability of normal baryonic matter under extreme conditions of super-high densities, for the first time in the standard theory of electroweak interactions. A result of major importance yielded by this research was that intensive decay of normal matter can occur upon contact with a droplet of

super-dense fermion matter, generating high energy release. Recently, the possibility of such phenomena was actively discussed in connection with the launch of a new generation of colliders of relativistic nuclei, and with the search for ‘dark matter’ in the Universe. In 1977, A N Tavkhelidze, N V Krasnikov and V A Kuzmin, working within the ‘Grand Unification’ theory, suggested a gauge interaction model with super-weak CP-violation that both describes the CP-violation in rare and K-decays and explains the origin of the baryonic asymmetry of the Universe.

In acknowledgement of his major contribution to science, A N Tavkhelidze was elected corresponding member of the USSR Academy of Sciences in 1984, and a full member, in 1990.

A N Tavkhelidze won the USSR State Award in 1973 for publications on photo-generation of π -mesons on nucleons. The joint papers on a new quantum number colour — and the discovery of dynamic laws in quark structure of elementary particles and atomic nuclei — won the Lenin Award in 1988. In 1998, A N Tavkhelidze and a team of researchers from the Institute of Nuclear Research won the State Award of the Russian Federation ‘For creating the Baksan neutrino observatory and research in the field of neutrino astrophysics of elementary particles and cosmic rays’.

In 1996, the National Academy of Sciences of Ukraine awarded A N Tavkhelidze the N N Bogolyubov Prize. In 1998, the International Association of Academies of Sciences gave A N Tavkhelidze a Gold Medal for his major contribution to strengthening the international co-operation of scientists. A N Tavkhelidze has won many honorary Soviet and Russian awards and prizes. He is a member of several academies and of the Pugwash Peace Movement.

Everyone who is well acquainted with A N Tavkhelidze is aware of his commitment to science and his great strength of character. An extraordinarily hardworking man, he can bring people together to work for a joint purpose. He is a true friend and a very kind man.

Al’bert Nikiforovich’s colleagues at the Department of Nuclear Physics, at the Institute of Nuclear Studies and at the Joint Institute of Nuclear Research, his close associates and pupils wish him good health and happiness, and new major achievements for the benefit of science.

*N S Amaglobeli, A M Baldin, G T Zatsepin,
V G Kadyshevskii, V M Lobashev, N V Krasnikov,
V A Matveev, V A Rubakov, A N Sisakyan,
A A Slavnov, A E Chudakov, D V Shirkov*