Physics – Uspekhi **52** (7) 757 – 758 (2009)

PERSONALIA

PACS number: **01.60.+q**

Lev Borisovich Okun (on his 80th birthday)

DOI: 10.3367/UFNe.0179.2009071.0805

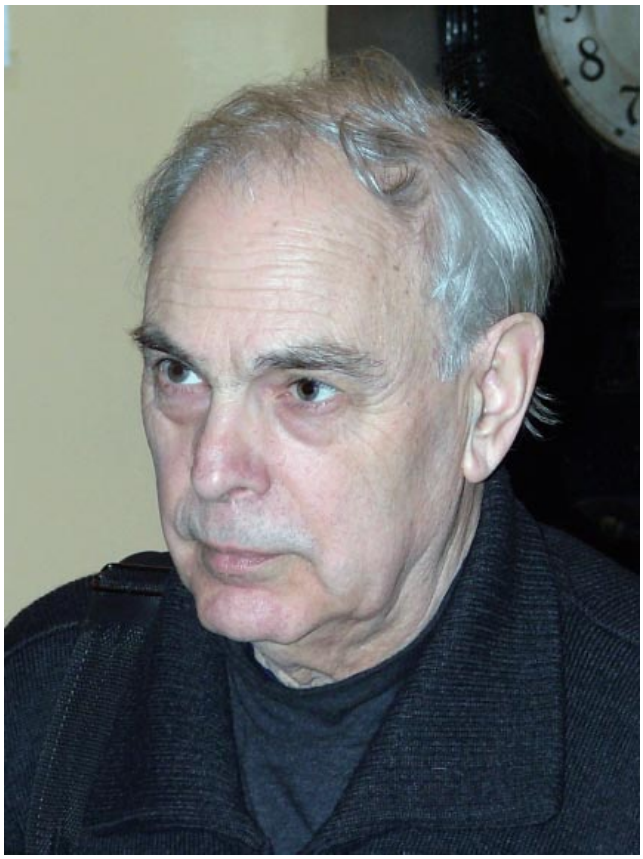
Lev Borisovich Okun, the outstanding physics theorist and Full Member of the Russian Academy of Sciences (RAS), celebrated his 80th birthday on July 7, 2009.

Lev Borisovich was born in the town of Sukhinichi in the Kaluga region. In 1953, he graduated from the Moscow Engineering Physics Institute (his diploma supervisors were A B Migdal and V I Kogan). Lev Borisovich's entire subsequent research is inseparable from the Institute for Theoretical and Experimental Physics (ITEP), where he started in 1954 as a postgraduate, later headed the Laboratory of Elementary Particle Theory for more than 30 years, and continues working as Chief Researcher.

In 1956, Lev Borisovich submitted and defended at the ITEP his CandSc thesis supervised by I Ya Pomeranchuk, and in 1963 his DSc thesis. In 1966, he was elected Corresponding Member of the USSR Academy of Sciences, and in 1990 became a Full Member. For many years Lev Borisovich taught at the Moscow Institute of Physics and Technology (MFTI) and received his professorship there in 1967.

Lev Borisovich is a world-renowned scientist. His rare gift of achieving total clarity, his profound intuition, and his knack for posing 'correct questions' have been influencing progress in the physics of elementary particles for more than 50 years now. Many new ideas and whole new fields of research date back to him, and his scope of interest in science covers practically all of elementary particle physics.

Weak interactions have been the favorite topic in Lev Borisovich's research ever since the beginning of his career. Already an early paper of 1957 (written together with B L Ioffe and A P Rudik) presented a fundamental conclusion that the violation of P-parity in β-decays also manifests the violation of C-parity. In the same year he and B M Pontecorvo gave an estimate of the mass difference between K_L and K_S mesons. In 1958, he suggested one of the first successful composite models of strongly interacting particles, the so-called Sakata–Okun model, in which all particles known at the time were constructed of three praparticles that predated quarks. In this model he described all weak decays of strongly interacting particles, which he suggested calling 'hadrons'. The Sakata–Okun model lies at the basis of Lev Borisovich's exceptionally good book *Weak Interaction of Elementary Particles* published in 1963. At the beginning of the 1970s, together with V N Gribov, A D Dolgov, and V I Zakharov, he studied the behavior of weak interactions at asymptotically high energies in the framework of the four-fermion theory. The new gauge theory of electroweak interactions was described in his book *Leptons and Quarks* published first in 1981 and revised in 1990. In the 1990s, a series of papers proposed a new method of taking account of loop radiative corrections to electroweak observables, in particular to the decay probabilities of the Z boson, and analyzed the results of precision measurements at the LEP I, LEP II, Tevatron, and SLC accelerators (with coauthors M I Vysotsky, V A Novikov, and A N Rozanov).



Lev Borisovich Okun

Another field that interests Lev Borisovich is that of strong interactions. Some of the results he obtained in this area also became classic. In a paper written in 1956, the Okun–Pomeranchuk theorem on the equality of interaction cross sections of particles of the same isomultiplet at asymptotically high energies was proved. In 1958, he predicted the existence of the η and η′ mesons in the framework of the composite model of hadrons. At the end of the 1970s he proposed the QCD sum rules for charmonium (together with A I Vainshtein, M B Voloshin, V I Zakharov, V A Novikov, and M A Shifman) and wrote the famous review paper "Charmonium and quantum chromodynamics".

Lev Borisovich was one of the first to realize that studying interactions of elementary particles at the early stages of the evolution of the Universe and cosmology in general can

Uspekhi Fizicheskikh Nauk **179** (7) 805 – 806 (2009)
DOI: 10.3367/UFNr.0179.2009071.0805
Translated by V I Kisin

provide unique information on fundamental physics. This 'intersection' of cosmology and elementary particle physics began with a paper that Lev Borisovich wrote in 1965 together with Ya B Zel'dovich and S B Pikel'ner. In this paper they calculated the concentration of primordial elementary particles (including that of fractionally charged quarks) in our Universe. A classical method of calculating the primordial concentrations of a host of exotic particles was developed.

An even earlier paper, written together with I Yu Kobzarev and I Ya Pomeranchuk in connection with the discovery of the violation of CP-parity, introduced the idea of a 'mirror world' which would interact with our world only through gravitation. Subsequently, this idea was discussed in hundreds of papers and nowadays the 'mirror world' is one of the main candidates for the role of dark matter.

In his paper written in 1974 with I Yu Kobzarev and Ya B Zel'dovich, cosmology for the first time dealt with macroscopic objects representing classical solutions of equations for fundamental fields of matter. The paper studied the evolution of vacuum domain walls in the Universe, arising as a result of spontaneous violation of discrete symmetry and separating space regions with various phases. In a paper written in the same year in collaboration with M B Voloshin and I Yu Kobzarev, they constructed a theory of decay of metastable vacuum. Each of these papers marked the birth of a new avenue of research in elementary particle physics and cosmology.

Lev Borisovich devotes much energy to working on the editorial board of the journal *Uspekhi Fizicheskikh Nauk* (*UFN*). Immediately after the famous flare of the Supernova 1987 in the Large Magellanic Cloud from which a neutrino signal was detected, he became the principal initiator of publishing a detailed review of this event on the pages of *UFN*. Owing to his very important critical remarks and indefatigable persistence, this review paper (written by ITEP astrophysicists V S Imshennik and D K Nadezhin) did appear in print very rapidly — by the end of the following year, 1988. Incidentally, this was a pioneering publication in the world literature, even the version translated into English. (The next review, by American astrophysicists, was published approximately six months later.) Ever since then, Lev Borisovich has shown keen interest in the progress of neutrino astronomy, which was practically born with the recording and interpretation of the neutrino signal from SN1987A.

One of Lev Borisovich's favorite pursuits is to analyze the validity range of the fundamental principles of a theory. He has analyzed the accuracy of such principles as the masslessness of the photon, conservation of the electric charge, electric neutrality of atoms, Pauli's principle, and CPT invariance.

Scientific discussions with Lev Borisovich play an invaluable role for his colleagues. His implacable desire to achieve complete clarity in understanding may now and again wear out his interlocutor, but it is invariably very useful. Many a colleague is grateful to him for his critical remarks. A well-known example is his remark during A M Polyakov's talk in 1975 that the solution of the Yang–Mills equations found by the speaker is nothing other than the magnetic monopole.

Lev Borisovich has taught for nearly 50 years at the MFTI Chair of Elementary Particle Physics. His lectures on the weak interactions at FizTekh are legendary in the memory of his students. More than 20 CandSc degrees have been obtained by people he supervised. Lev Borisovich founded a powerful scientific school. Among his students we find such well-known theoreticians as E P Shabalin, V A Kolkunov, V I Zakharov, A D Dolgov, V B Kopeliovich, N N Nikolaev, V A Novikov, E B Bogomol'nyi, M B Voloshin, M I Vysotsky, A Yu Hodzhamiryan, A Yu Morozov, N A Nekrasov, and others. His lectures are always a feature at the ITEP Winter Physics Schools.

Lev Borisovich is an outstanding popularizer of physics. He has written two brilliant books for the general public: α, β, $\gamma, \ldots Z$ and *Elementary Particle Physics* — published and frequently reprinted in numerous countries. In recent years Lev Borisovich has bravely and indefatigably led a campaign against an archaic and partly erroneous presentation of the special and general theories of relativity which, alas, is firmly rooted in the world literature. The preliminary results of this struggle are described in several papers for *Uspekhi Fizicheskikh Nauk* (*Phys. Usp.*) and the *American Journal of Physics*, and also in the just published collected papers *Energy and Mass in Relativity Theory* (2009).

Lev Borisovich's social activities played a very important role in the successful survival of science in Russia and other CIS countries. He was one of the organizers of the International Science Foundation (Soros Fund) and the International association for the promotion of co-operation with scientists from the Newly Independent States of the former Soviet Union (INTAS).

The international science community has highly appreciated the scientific results obtained by Lev Borisovich Okun. He is a member of the European Academy of Sciences, honorary member of the New York Academy of Sciences, and fellow of the Institute of Physics (IOP, Great Britain). He was invited to present the concluding talks at the Rochester Conference (Madison, 1980), the Leptons and Photons Conference (Bonn, 1981), the Neutrino Conference (Boston, 1988), the International Europhysics Conference on High Energy Physics (Marseille 1993). He has given Honorary Lectures at Harvard (1989), at Berkeley (1990), at Carnegie Mellon University (1991), in Pisa (1993), in Vienna (1994), and at Brookhaven (1995). He was a member of the Scientific Policy Committees in CERN (Geneva, 1981–1986), SSC — the Laboratory of the Superconducting Supercollider (Dallas, 1989–1993), and DESY (Hamburg, 1992–1997). He was awarded the Matteucci Medal of the Italian Accademia dei XL, the Lee Page Prize (USA, 1989), the Karpinsky Prize (Germany, 1990), the Humboldt Prize (Germany, 1993), the Bruno Pontecorvo Prize (Dubna, 1996), the Special award of the Open Society Institute (1997), the L D Landau Gold Medal (2004), and the Pomeranchuk Prize (2008).

We wish Lev Borisovich all the best from the bottom of our hearts on behalf of numerous colleagues, disciples, and friends on this wonderful jubilee and wish him good health, new accomplishments in science, and an abundance of success.

M I Vysotsky, S S Gershtein, V I Zakharov,
V S Imshennik, A V Kaidalov, V I Kogan,
A Yu Morozov, V A Novikov, V A Rubakov,
Yu A Simonov, A N Skrinsky, N E Tyurin