

In memory of Mikhail Leonovich Ter-Mikaelyan

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Full Member of the Armenian Academy of Sciences Mikhail Leonovich Ter-Mikaelyan, outstanding scientist and science organizer, died on January 31, 2004, soon after the international conference devoted to his 80th birthday.

He was born in 1923 in Tbilisi, son of a well-known railway engineer, head of many large-scale construction projects in Russia, including what at the time was referred as the ‘project of the century’ — the Moscow–Vladivostok railway line. Ter-Mikaelyan inherited from his family the outlook of the intelligentsia and a mild and sensitive soul, as well as uncompromising honesty in all matters scientific. In 1948 he graduated from Yerevan State University where his science advisor was the then ArmSSR AS Academician V A Ambartsumyan. This was followed by postgraduate courses in Moscow at the Theoretical Department of the P N Lebedev Physics Institute of the USSR Academy of Sciences (FIAN), where E L Feinberg was his advisor. Ter-Mikaelyan submitted his thesis for Candidate of Physicomathematical Sciences to the Learned Council of FIAN as early as August 1952 (published and defended in 1953); the topic of the thesis was the electron bremsstrahlung radiation in crystals.

This brilliant theoretical work discovered a paradoxical effect that was to create a unified basis for the novel interpretation of the interaction between high-energy particles and matter. Ter-Mikaelyan showed that the radiation emission proceeds in an elongated region of space (the formation zone), whose longitudinal dimension (coherence length) increases indefinitely as particle energy grows and which coherently involves all atoms of the medium that are located in this zone, even though the particle wavelength decreases with increasing energy. However, it would seem logical that the formation zone could only grow smaller in the process (and tend to zero). In view of this contradiction, even some of our top theoreticians originally treated this result as nonsensical; on comprehension of the effect they later had to accept it and began to expand on it. Ter-Mikaelyan himself and others used this phenomenon as a basis for predicting numerous new effects that were invariably confirmed in experiments and proved useful. For instance, L D Landau and I Ya Pomeranchuk showed, less than a year after Ter-Mikaelyan’s talk at Landau’s seminar, how bremsstrahlung in an amorphous medium differs from that in crystals or from that with a single atom.

It was then found that the formation zone growing with energy is important not only for electrodynamic radiative processes in media but to an equal extent in high-energy physics in general, in hadron–nucleus interactions when the nucleus is treated as a material medium, and in chromodynamics. This is a very necessary element of high-energy physics. In recent years, international conferences on electro-



Mikhail Leonovich Ter-Mikaelyan
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magnetic processes at high energies have become an annual event, and M L Ter-Mikaelyan often opened them with an introductory review talk.

Having returned to Armenia, Ter-Mikaelyan started working at the Yerevan Physics Institute where he rapidly rose from junior research scientist to the Head of the Theoretical Department and to Deputy Director of the Institute. His new work on electrodynamics of relativistic particles in various media formed the basis of his thesis for Doctorate of Physicomathematical Sciences, presented and defended in 1962 at the FIAN (Moscow). The material of this thesis plus the results of his subsequent research were covered in Ter-Mikaelyan’s monograph *High-Energy Electromagnetic Processes in Condensed Media*, published in Russian in 1962 (Yerevan: Armenian Academy of Sciences Publ.), and in English in 1972 (New York: Wiley-Interscience). The book is very well known and is still used the world over.

In 1963, M L Ter-Mikaelyan accepted the position of Dean of the Physics Department in Yerevan State Uni-

versity and was able to completely reorganize it in a very short time — eight new chairs were created. Simultaneously, Ter-Mikaelyan himself drastically changed his field of research: he became the head of a novel area for Armenian physics — laser physics and nonlinear optics in general. He created the Joint Radiation Laboratory of the National Academy of Sciences and Yerevan State University (ORLANEGU) with a very broad scope — from theoretical work on the fundamentals of quantum generators and amplifiers to their industrial production (mass production of the first Soviet quantum generator ‘Arzni’, and its subsequent improved models). ORLANEGU soon gained international recognition. The results of this work (up to 1967) on solid-state lasers were included in the monograph *Solid-State Optical Generators* (Moscow: Sovetskoe Radio, 1967) by A L Mikaelyan, M L Ter-Mikaelyan, and Yu S Turkov.

Expanding the subject field of interest, Ter-Mikaelyan began to create the Institute for Physical Research (opened in 1968) and became its first Director. New results immediately started to pour out of the institute. For instance, first direct confirmation was obtained of the nonlinearity of interaction between laser radiation and gaseous media. Work on a novel direction in nonlinear optics — resonance coherent interaction of radiation with atoms and atomic media — was conducted in the Theoretical Department which Ter-Mikaelyan also headed. The theory of ‘dressed’ states involving ‘atom plus field’, successfully developed by Ter-Mikaelyan, made it possible to explain many new effects that are still being investigated now and find novel applications in the framework of the latest technologies. Unfortunately, Ter-Mikaelyan’s book on resonance optics that summarized these results was never completed.

In the 1980s, the Institute for Physical Research was one of the leading organizations in laser physics. Nevertheless, Ter-Mikaelyan again switched to a new field — superconductivity. Some people had been working on it in the Institute before but the discovery of high-temperature superconductivity stimulated an unprecedented explosion of research activities. It took just two weeks after the announcement of this discovery to have all published results reproduced at the Institute and for superconducting ceramics to be fabricated. The new laboratory organized for this purpose soon gained recognition by the international research community.

The creation of the Institute for Physical Research (and its affiliate in Kirovakan) revealed another talent in Ter-Mikaelyan — that of administrative and even economic manager. He thoroughly thought out every detail. The Institute was built on a rocky plateau near Ashtarak, a small town 30 km from Yerevan. Nowadays, the research buildings (for a staff of about 500) are surrounded with cottages where scientists live, with tennis courts and dozens of hectares of orchards (Ter-Mikaelyan began the construction of the research center by planting these orchards). The Institute survived the post-Soviet years (which hit Armenia especially hard). In 1988–1993, Ter-Mikaelyan was the Secretary-Academician of the Division of Physical and Mathematical Sciences of the ArmSSR Academy of Sciences, but in 1994 he resigned from all his administrative positions and became the Honorary Director of the Institute, devoting all his time to research. He kept working virtually until his last days (no one knew of his then hidden illness until his last week, nor he himself until the very end).

His last paper was published in the December issue of *Physics Uspekhi* 2003.

M L Ter-Mikaelyan was an outstanding physicist who amazed colleagues by the scope of his scientific interests, his enormous erudition, and brilliant intuition. With his immense charm and wonderful sense of humor, he was far more than a scientific adviser to those who worked with him — he was their spiritual father. He was ethically meticulous and followed the strictest principles. No single paper was published where his name was included among the authors for formal reasons. For him, not even the formulation of the problem, nor even numerous discussions of the work were reason enough for joining the group of authors. “Come on, I calculated nothing here” would be his answer to such requests. His study was always open for students and postgraduates. Ter-Mikaelyan raised a rich crop of scientists who successfully work not only in Armenia but also far beyond its borders. He lived a life filled with creative work in science, keeping his dignity when he was led to battle through periods that were agonizingly hard, and always manifested the brilliant sides of his personality.

The memory of Mikhail Leonovich Ter-Mikaelyan — the outstanding scientist and wonderful person — will live in the hearts of his students and colleagues and all those who knew him.

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