OBITUARIES

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John C. Light

John C. Light, emeritus professor of chemistry at the University of Chicago, died on 18 January 2016 in a Denver hospital following a severe illness.

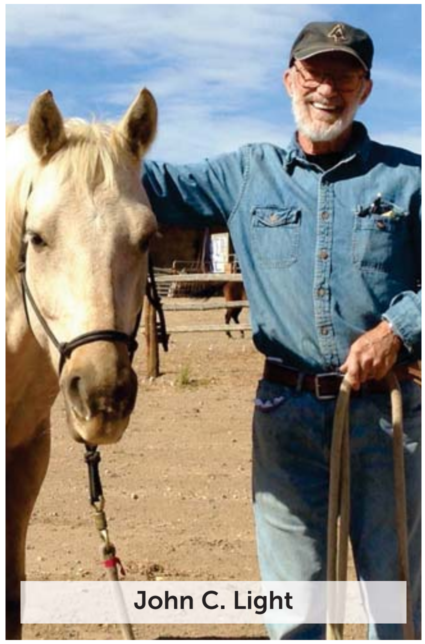
Born in Mount Vernon, New York, on 24 November 1934, John earned a BA with honors from Oberlin College in 1956 and, as an NSF predoctoral fellow, a PhD in chemistry from Harvard University in 1960. His dissertation research was done under the direction of Marshall Fixman. John spent two years, 1959–61, as an NSF postdoctoral fellow with Ilya Prigogine at the Free University of Brussels.

It was there, in early 1961, that I met him and helped recruit him to the University of Chicago. He joined the Chicago faculty in the fall of 1961 as an instructor in the chemistry department and in the James Franck Institute (then the Institute for the Study of Metals). He rose through the ranks to professor in 1970 and became professor emeritus in 2001. His continuity of service at the University of Chicago was punctuated twice, by positions as a visiting professor at Yale University in 1968 and as a visiting scientist at JILA in 1976.

In 2004 John and his wife Phyllis moved to Nathrop, Colorado, where they could enjoy skiing, hiking, and John's new passion for horseback riding, which fulfilled a boyhood dream. Nevertheless, he remained active in science; I last saw him at a meeting in Telluride in the summer of 2014.

I find it difficult to describe my friend of 54 years. It is not merely a matter of being too close to have perspective. The larger problem is to sum up in only a few words the personal traits, the accomplishments, and the aspirations of a complex being. Where does one begin and where does one end?

John was a notably superb colleague who participated fully and enthusiastically in all departmental and broader university activities. He was collegial, open minded, and flexible on diverse issues, and he was always ready to lend a hand. He served as director of the Materials Research Laboratory from 1970 to 1973 and as chair of the department of



John C. Light

chemistry from 1980 to 1982. John was also a successful educator and mentor; he had a very close and supportive relationship with his 31 PhD students and 25 postdoctoral research associates. That spirit was captured both by his saying that he learned much more from them than they learned from him and by his delight in their later successful careers.

Simultaneously with his active research program, John was editor of the *Journal of Chemical Physics*, arguably the preeminent journal in its field, for 14 years, from 1983 to 1997. His editorship was marked by the considerable growth of the journal, both in number of papers published and in diversity of topics covered, and by the implementation of modern submission and refereeing processes using programs that he wrote. The submission system he put in place was simple, efficient, and ahead of its time.

Creative scientists are fortunate in that they do something that is visible and that stands or falls on its own merits. The very visibility of an individual's contributions is in many senses the best memorial, since it mirrors the individual's development and vividly shows strengths and weaknesses. John Light was one of the pioneers of the modern theory of quantum dynamics of small systems as applied to chemical reactions, inelastic collision processes, and more. His contributions, which are marked by a keen eye for innovative and practical analyses, are remarkable for both scope and significance. They helped guide the evolution from general but approximate descriptions of reactions, such as the phase space (statistical) theory of chemical kinetics, to accurate, fully quantum calculations of reactions of small molecules and of molecule–surface interactions.

The methodological advances and computational techniques that John and his students devised include exponential expansions, short iterative Lanczos propagation, transition-state wavepacket propagation, and time-independent scattering via *R*-matrix propagation. Many of those advances have been incorporated into standard practice and are widely used. In particular, John's groundbreaking development of the discrete variable representation provided a versatile, efficient means of executing multidimensional bound-state and scattering calculations and significantly extended the dimensionality of systems amenable to exact quantum treatment.

I can't possibly end this obituary without commenting on the warm personal relationship I had with John. When we met during my trip to Brussels in 1961, for whatever reason, the chemistry was good; we became friends immediately and remained good friends for life. John was a warm and generous person, loyal to his friends and the institutions he served, and an always rational voice in a sometimes irrational, even chaotic, environment. He will be deeply missed.

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Lev Borisovich Okun

Theoretical physicist Lev Borisovich Okun died on 23 November 2015 in Moscow. For his work he had received numerous national and international scientific prizes and awards, including the 1988 Matteucci Medal from the Italian National Academy of Sciences and the 1996 Bruno Pontecorvo Prize from Russia's Joint Institute for Nuclear Research. In 1981 he became the first

Soviet physicist elected to CERN's Scientific Policy Committee.

Okun was born on 7 July 1929 in Sukhinichi, USSR. He attended the Moscow Engineering Physics Institute, with Vladimir Kogan and Arkady Migdal as his advisers. In 1954 he became a postgraduate student at the Institute for Theoretical and Experimental Physics (ITEP) in Moscow, which remained his scientific home for the rest of his life. He received his PhD on the topic of heavy mesons and hyperons in 1956 under the supervision of Isaak Pomeranchuk, and in 1961 he received his doctor of science degree.

At ITEP Okun organized and for more than 30 years headed a laboratory for elementary-particle theory. ITEP was the center of the "School of Okun" comprising his colleagues, his students, and students of his students. Many scientists from the USSR and around the world visited ITEP to discuss physics with him. He was an exceptional instructor, and the course on particle physics that he taught for many years was legendary. He always aimed for clarity and simplicity in understanding physics phenomena and concepts. His deep intuition for and approach to most fundamental ideas influenced the development of particle physics for more than half a century.

Okun contributed several fundamental results to the development of weak interactions, a favorite subject of his. In 1957, with Boris Ioffe and Alexei Rudik, he showed that violation of *P* (parity) symmetry in beta decay also means the violation of *C* (charge conjugation) symmetry. That same year he and Bruno Pontecorvo evaluated the difference between the masses of neutral K mesons.

In 1963 in the USSR, Okun published his influential book *Slaboe vzaimodeystvie elementarnych chastiz* (Fizmatgiz), which in 1965 was translated into English as *Weak Interaction of Elementary Particles* (Pergamon). Several generations of students and academics have used it as a textbook and desktop reference. Published before the quark model was introduced, the book was based on one of the first successful composite models of hadrons, which Okun and Shoichi Sakata had been developing since 1958. In the Sakata–Okun model, all known particles were constructed of three protoparticle predecessors of quarks. Okun introduced the term "hadron" into

Lev Borisovich Okun

the scientific language in 1962 during a talk he gave in Geneva at the 11th International Conference on High Energy Physics. Okun had also proposed in 1958 the existence of η and η′ mesons.

His work on strong interactions included a 1956 paper in which he and Pomeranchuk proposed the equality of cross sections for scattering of particles from the same isomultiplet at asymptotically high energies, now known as the Okun–Pomeranchuk rule. In the 1970s Okun and colleagues developed a new approach based on quantum chromodynamics sum rules that became known in the literature as the ITEP sum rules.

In the 1960s Okun also made seminal contributions to the study of dark matter and what was then a new field of study that encompassed astrophysics, cosmology, and particle physics. He, Pomeranchuk, and Igor Kobzarev proposed in a 1964 paper the concept of a "mirror world" and its "mirror matter," particles that have the sign of parity violation opposite that for our world's particles and that interact only very weakly, possibly exclusively by gravity, with ordinary matter. The mirror matter continues to be a possible dark-matter candidate. In a 1965 article that contains what is now a standard tool for studying dark matter's origins, Okun, Yakov Zel'dovich, and Solomon Pikel'ner devised a way to determine the relic abundance of elementary particles during the universe's expansion. They calculated the abundance of free quarks and strengthened one argument for quark confinement, the non-observation of free quarks.

In 1974 Okun produced two groundbreaking papers. In one, he examined vacuum domain walls, the first macroscopic object of quantum field theory to help determine how the universe evolved. In the other, he, Kobzarev, and one of us (Voloshin) wrote about the quantum tunneling mechanism of metastable vacuum decay; the 2012 discovery of the 125 GeV Higgs boson makes their finding particularly relevant to the study of our physical vacuum.

Okun thought deeply about many fundamental concepts of physics, such as the Pauli exclusion principle, *CPT* invariance, conservation of electric charge, the absence or existence of "other photons," electrical neutrality of atoms, and the masslessness of the photon. He sought to quantify the limits of applicability of each of the concepts and analyzed practical ways to improve those limits.

His colleagues and students found their scientific discussions with Okun to be invaluable and gained inspiration from his devotion to physics and his quest for truth. His relentless desire to clearly understand a subject was often intimidating, but it would undoubtedly prove beneficial in the end. Many are grateful to him for his ability to ask the right questions. A famous example is his comment during a talk by Alexander Polyakov in 1975, when Okun pointed out that Polyakov's solution to the Yang–Mills equations was nothing but a magnetic monopole.

To his family, friends, and colleagues, the preeminent physicist will be warmly remembered for his extraordinary integrity, intelligence, wisdom, and kindness.

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