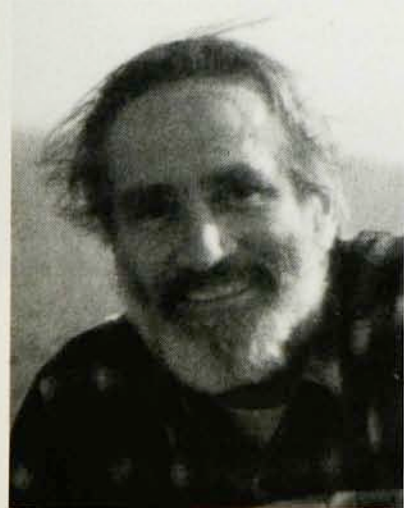


work in muon decay, together with subsequent contributions by Sam M. Berman, Toichiro Kinoshita and Sirlin, gained significance in the late 1950s, when it was used to verify the two-component theory of the neutrino, the $V-A$ theory and the CVC hypothesis.

Behrends's real love, however, was the study of symmetry. As early as 1959, he and Gerald Feinberg had explored some of the consequences of global symmetry in strong interactions. In 1960, in a collaborative attempt with Sirlin to generalize the CVC hypothesis, Behrends suggested the exceptional group G_2 as a possible flavor symmetry of the strong interactions. Subsequent developments showed that the alternative proposal by Murray Gell-Mann and Yuval Ne'eman of another second-rank group, $SU(3)$, was the correct phenomenological choice. Behrends's work nonetheless represents one of the earliest appearances of exceptional groups in particle physics. Both proposals, as well as previous ones based on higher-rank groups, were motivated by the idea, rather unpopular at the time, that weak-coupling currents are associated with the partial symmetries of the strong interactions.

Behrends's review article on symmetry groups (*Reviews of Modern Physics*, 1962), coauthored with Joseph Dreitlein, Christian Fronsdal and Benjamin W. Lee, has remained a classic in the field. In 1960, again in collaboration with Sirlin, Behrends discovered the nonrenormalization theorem for partially conserved vector currents in the $SU(2)$ framework and suggested its generalization to higher symmetry. This theorem plays a significant role in the experimental verification at the 0.2% level of the three-generation unitarity of the

Ralph E. Behrends



KMC matrix—one of the most precise tests of the "standard model." In 1958, shortly after the $V-A$ theory of the weak interaction was proposed by George Sudarshan and Robert Marshak, and Richard Feynman and Gell-Mann, Behrends published an elegant letter in *Physical Review* in which he derived this interaction from postulated symmetry requirements.

Behrends was an excellent and inspiring teacher, exceptionally devoted to his students and always available when they needed him. He was also a political activist and a strong proponent of academic freedom. He was deeply respected by his colleagues, friends and students for his high ethical and intellectual standards. His memory survives in the hearts, minds and lives of those who knew him.

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Sylvain Liberman

Both the French and international scientific communities were greatly saddened by the untimely death of Sylvain Liberman on 5 August 1988. His loss is felt well beyond the borders of atomic and molecular physics, since he actively supported exchanges with other disciplines, thereby ensuring that atomic physics was not confined within rigid boundaries.

Liberman started teaching laser spectroscopy in 1960, and joined CNRS in 1971. He was very dedicated to CNRS, playing a significant role in the scientific committees of which he was a member. He was well known overseas, especially in the United States, which he visited several times as part of extended exchange programs.

Liberman devoted his scientific work entirely to developing lasers and using them in high-resolution spectroscopy or in studies of the light-matter interaction. He invented a highly stable single-mode pulsed laser, and devised an ultrasensitive method of measuring optical resonances by atomic-jet deflection or ionization. His theoretical efforts include a PhD thesis on the interpretation of hyperfine structures and isotopic shifts in rare gases. He also made numerous contributions to the understanding of highly excited atomic states (Rydberg atoms), to the hyper-

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fine spectroscopy of large families of radioactive isotopes and to the study of spontaneous collective decay (super-radiance and sub-radiance).

All of these findings are important, but the most spectacular are probably those concerning hyperfine spectroscopy of radioactive atoms (work that was done chiefly at CERN). Several very large isotopic families were studied, revealing significant variations in nuclear properties at different atomic masses (for example, the family of cesium atoms with masses between 118 and 145). As part of this work, Liberman made the very first observation of the optical spectrum of francium. Although this atom had been discovered more than 40 years earlier, its spectroscopic features had never before been observed.

Sylvain Liberman was a warm, brilliant, profound man with an uncommon sense of humor and an excellent ability to communicate.

PIERRE JACQUINOT
CNRS
Orsay, France

Paul A. Treado

Paul A. Treado, a professor of physics at Georgetown University in Washington, DC, died at his home in Rockville, Maryland, on 3 January 1989. He had had an outstanding career as a scientist and engineer.

Paul attended the University of Michigan, from which he was awarded two bachelor's degrees, a master's degree and, in 1961, a doctorate in physics. In 1962 he came to Georgetown, where he served as chairman of the physics department from 1976 to 1984. He will be remembered as a sensitive and effective mediator and a wise and understanding adviser to both faculty and students.

Paul was an extraordinarily dedicated teacher. Although he was considered a "tough" professor by his students, this was only because he refused to allow them to receive anything less than the very best education that he could give. What the students did not generally know was how compassionate he was. Many times Paul helped ensure that a deserving student got a second chance even when outward appearances indicated against it. He was constantly assessing courses and serving on committees to improve the quality of education at Georgetown University. He gave the faculty direction and served as our collective conscience.

As an experimental nuclear physicist Paul not only worked at Georgetown but for many years was a



Paul A. Treado

consultant to the Naval Research Laboratory in Washington, DC, where he also worked on materials modification. He collaborated with scientists all over the world, coauthored a book on nuclear physics and was the director of the National Summer School in Nuclear Physics, which was supported by the National Science Foundation.

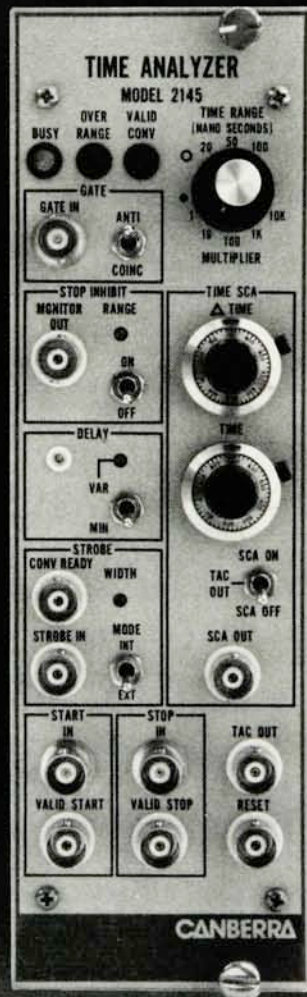
Paul will be remembered as the "grandfather" of the Conferences on the Application of Accelerators in Research and Industry. He served on all of the organizing committees and was always cochairman of the opening plenary session. As was typical of Paul, before leaving Denton, Texas, where his last conference was held, he had already compiled a long list of suggestions and ideas for the next conference.

In nuclear physics Paul specialized in the study of few-nucleon systems, and he was particularly interested in the three-body problem, performing experiments long before interest in that subject became widespread. These experiments were often very time consuming and difficult, but Paul was a master at setting them up and evaluating the data, often developing new methods of analysis to extract results.

In spite of his health problems in recent years, Paul remained extremely active and was always looking to the future. At the time of his death, he not only was teaching a full load but was actively working on a number of research proposals and a unique proposal associated with the review of scientific and legal aspects of new nuclear reactors. Those of us who knew him will never forget this extraordinary man.

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