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his work, and most poignantly, by those of us who had the privilege to know him and work with him.

Chris Quigg
Fermi National Accelerator Laboratory
Steven Weinberg
Harvard University

Gersh I. Budker

Gersh Itskovich (André) Budker died 4 July, after an extraordinarily productive career. His work, characterized by an unfettered ingenuity and skill, is well known to his many friends throughout the world working on accelerators and plasma physics.

Budker was born 1 May 1918, and graduated in 1941 from the University of Moscow. In 1946 he joined Igor V. Kurchatov at the Institute of Atomic Energy of the USSR Academy of Sciences and worked on many phases of atomic energy, including the theory of graphite-moderated reactors. In 1956 he became a professor at the Moscow Engineering Physics Institute.

I remember meeting Budker at the Kurchatov Institute in 1956 during the memorable first visit by American high-energy physicists to various particle-accelerator institutions in the Soviet Union. At that time he showed us a number of advanced devices whose promise appeared without precedent in Western accelerator technology. There was an ironless betatron, and magnetic-beam transport channels with boundaries set by eddy currents, rather than magnetic-pole faces. There was a space-charge-stabilized model of a high-energy, high-current electron circular accelerator. All these devices led to intensive critical studies at home. Shortly after this visit, Budker transferred his work to a new institute of the Siberian branch of the Soviet Academy of Sciences. The facility, of which he became director, is the Nuclear Physics Institute and is located in the "academic city" near Novosibirsk. In 1964 Budker became a member of the Soviet Academy of Sciences.

Budker's work in Novosibirsk continued to concentrate on the development of novel accelerator ideas, controlled thermonuclear reactions, and pulsed high-powered devices of various kinds. He shunned the mainstream of Soviet (and also Western) accelerator design—his disdain of scaling up established accelerator designs to larger and larger powers was well known.

In general, his developments were frequently ahead of their time, and he always insisted that completed systems were constructed of components designed and built according to the most advanced principles at his institute, or with the help of surrounding industry. All this added up to a pattern of intensive creativity in a certain degree of isolation. As a result, Budker's developments were always challenging technologically, but, not infrequently, final success was elusive because the performance of some advanced component fell short of expectation. In many respects it was just this pattern that made a visit with Budker at his institute a memorable experience. New ideas were constantly being introduced and many of these came to fruition, either at his institute or abroad.

A substantial part of the work of Budker's institute concentrated on a family of electron–positron colliding-beam storage rings, which were designated by a series of numbers from VEPP-1 to VEPP-4. Two of these installations became productive as tools in particle physics. A small group of elementary-particle physicists exploited these machines, specifically VEPP-2 and its high-luminosity version, VEPP-2M. These storage rings made important contributions to elementary-particle physics, in particular by determining the precise masses and decay widths of vector mesons and the branching ratios of their decays. Budker gathered around him a group of able theorists who made important contributions in many phases of accelerator and plasma theory including various collective-instability phenomena and the theory of polarization of stored electron beams.

PHOTO: G. B. LUBKIN

BUDKER

Budker's storage ring VEPP-3 is being used for synchrotron-radiation research, and he had been planning to supply storage rings for this new field of endeavor to other institutes in the Soviet Union. VEPP-4 is nearing completion and is expected to reach higher e^-–e^+ collision energy—14 GeV—than any attained to date. One of the most fruitful accelerator innovations that Budker originated was the idea of electron cooling. This is the method by which the phase space of protons stacked in a storage ring is shrunk by having the protons interact with a stream of electrons travelling at the same velocity. The electrons exchange transverse momenta with the protons. This idea was demonstrated experimentally at Novosibirsk and is now being exploited intensively both at CERN and at Fermi National Accelerator Laboratory for the construction of antiproton storage rings desirable for the achievement of antiproton–proton collisions. This work, if successful, would be a memorial to only one of Budker's many creative ideas.

Not only did Budker innovate technologically, but he also introduced novel social patterns of operating a creative laboratory. Part of the effort of his institute was dedicated to the design and production of low-energy accelerators, including pulse-transformer accelerators, and of high-powered microwave tubes that could be marketed both at Soviet institutes and medical centers and also abroad. From the proceeds of these sales, Budker was able to support his program more flexibly than would have been possible through exclusive dependence on government support.

Budker was a strong exponent of increased collaboration with the West in the accelerator arts and particle physics. In this field, as in the science itself, his ideas and plans were frequently ahead of his time. His initiatives for major joint undertakings in which Western technology, particularly in data processing, would complement some of the achievements of Budker's laboratory, have not yet come to fruition. No better memorial to Budker's work could be made than a practical realization of his dream of collaboration in storage-ring physics bridging Siberia and America.

Budker was an exceedingly capable analyst and designer as well as a fearless innovator. He surrounded himself with a young group of associates and students who shared with him responsibility for major decisions at the famous "round table" council. His disciples will perpetuate much of his style and ideas, but a great driving spirit is gone.

WOLFGANG K. H. PANOFSKY
Stanford Linear Accelerator Center

Walter L. Bond

Walter L. Bond, a retired member of the technical staff at Bell Laboratories, died 30 March. He was born in the state of Washington in 1903, and in 1928 he graduated from Washington State College with highest honors in physics.

From that time until his retirement in 1968, Bond was a research physicist in the Bell Laboratories research division. There his special combination of theoretical competence and mechanical skill resulted in many scientific contributions, from the large-scale production of precisely oriented and dimensioned quartz oscillator plates in the 1940's to laser construction in the 1960's.

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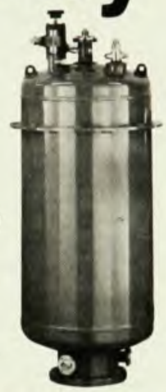

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