

demonstrate convincingly that both the proton–proton and antiproton–proton scattering amplitudes asymptotically approach those of a so-called black disk, presumably as a consequence of gluon saturation.

Martin Block remained productive up until the end, when he and collaborators were revising drafts of his latest manuscript. He was, his friends and colleagues agree, quite a character, and something of a force of nature.

Francis L. Halzen

University of Wisconsin–Madison



Virginia Ruth Brown

Virginia Ruth Brown died on 8 February 2016 in Chevy Chase, Maryland, after a long battle with cancer. She was a wonderful colleague, friend, and distinguished theoretical nuclear physicist. During her long career, Virginia made important contributions to our understanding of the nucleon–nucleon interaction, nuclear reaction theory, and nuclear structure, among other accomplishments. She loved physics and had a deep commitment to getting to the heart of things.

Born on 11 March 1934 in Massachusetts, Virginia received her PhD, under the supervision of Bernard Margolis, from McGill University in 1964. She was a postdoctoral fellow at Yale University and then worked at Lawrence Livermore National Laboratory (LLNL) from 1964 until 1995. She was an NSF program officer for nuclear theory from 1995 to 1998. Following that, she was a visiting professor in the physics department of the University of Maryland in College Park and a visiting scientist in the Laboratory for Nuclear Science at MIT.

During Virginia's early work on nucleon–nucleon bremsstrahlung, she explored the effects of parity nonconservation and demonstrated the importance of meson exchange in neutron–proton bremsstrahlung. Her calculations showed that meson exchange currents contributed a factor of 2 and were not dominated by one-pion exchange. Throughout her career she continued refining and extending her calculations, including for relativistic effects and noncoplanarity. She compared her results with experiment, most notably with the data on neutron–proton bremsstrahlung that



Virginia Ruth Brown

Stephen Wender, June Matthews, and their colleagues obtained at the Los Alamos Neutron Science Center. When Virginia was at MIT she interacted frequently with Matthews's group and directed the research of several of Matthews's undergraduate and graduate students.

Virginia's collaboration with experimentalists started soon after she joined LLNL; most prominently, she worked with John Anderson on charge-exchange reactions in nuclei.

Around 1973 Virginia also began her long partnership with theorist Victor Madsen. They developed the nuclear-structure and reaction theory needed to understand charge-exchange reactions; their breakthroughs included a model for mixing giant resonance states with the low-lying states that had been experimentally observed at the time. Their most important contribution was the systematic inclusion of isospin degrees of freedom that were required to understand the data. It was successfully applied to inelastic scattering processes without any additional modifications.

One of us (Bernstein) remembers how stimulating it was to work with Virginia. In the mid 1970s, he received a letter from her about how Madsen's and her isospin-dependence calculations could explain the puzzles and regularities that he had observed in inelastic alpha-particle scattering. Their collaboration started in their first meeting, and over many years it yielded a productive series of papers.

They covered electromagnetic tests of the accuracy of the observed neutron and proton transition matrix elements and their observation using different hadronic probes and electromagnetic methods such as electron scattering and Coulomb excitation. He remembers with great pleasure his annual spring-break trip to the University of California, Berkeley, and LLNL to work with Virginia and to enjoy great dinners with her in Berkeley and San Francisco. Their friendship and collaboration were reinforced while she was working as a visiting scientist at MIT from 1998 until her death.

Virginia was a deeply involved member of the American Physical Society (APS), including as secretary/treasurer of the division of nuclear physics (DNP) from 1986 to 1995. Because of her numerous contributions, her colleagues chose her in 2003 to receive the division's first Distinguished Service Award.

Another of us (Gibson) saw firsthand Virginia's remarkable contributions to APS. He first met Virginia when he was a postdoctoral fellow at LLNL in 1968. Their closest connection came through the DNP, when he succeeded her as secretary/treasurer in 1995, and she mentored him in that time-consuming position.

Virginia's efforts as part of the DNP leadership strengthened the division's fall meetings, assisted in funding APS's Hans Bethe and Herman Feshbach Prizes and the division's Nuclear Physics Dissertation Award, initiated the Department of Energy and NSF's Nuclear Science Advisory Committee Long Range Plan town meetings, and established the DNP archive and historical record.

While at NSF, Virginia suggested exploring a joint meeting with the nuclear physicists of the Physical Society of Japan. She chaired the first of the resulting series of successful international physics meetings in 2001 and remained instrumental in their success through the 2014 joint meeting. After Virginia left NSF, she was a visiting scientist at Los Alamos National Laboratory, where she conducted research and shared meals with Gibson and another of us (Seestrom). During one visit, she and Gibson drafted a history of the DNP. Virginia's imprint on the division is indelible, and the DNP owes her a great debt of gratitude.

With her contagious enthusiasm and

laughter, Virginia was a dear friend who will be sorely missed.

Aron M. Bernstein
Robert P. Redwine

*Massachusetts Institute of Technology
Cambridge*

Benjamin F. Gibson
Susan J. Seestrom

*Los Alamos National Laboratory
Los Alamos, New Mexico*



John David Jackson

John David Jackson, professor emeritus at the University of California, Berkeley, whose magisterial textbook *Classical Electrodynamics* has shaped graduate education for more than a half century, died on 20 May 2016 in Lansing, Michigan. His wide-ranging theoretical work combined fine craftsmanship, intuition born of meticulous scholarship, engagement with experiment, and respect for practical matters. He was a wise counselor and a tireless advocate for human rights and academic freedom.

Born on 19 January 1925 in London, Ontario, Canada, Jackson earned his BSc in honors physics and mathematics at the University of Western Ontario in 1946. The undergraduate curriculum's emphasis on electromagnetism pointed him toward MIT and its Research Laboratory of Electronics. His initial graduate research, carried out with Lan Jen Chu, concerned a field theory of traveling-wave tubes.

Victor Weisskopf's quantum mechanics course introduced Jackson to modern

physics and attracted him to Weisskopf's nuclear theory group. With postdoc John Blatt, Jackson analyzed low-energy nucleon–nucleon scattering; for his dissertation in 1949 he used Julian Schwinger's variational method to investigate S- and P-wave proton–proton scattering.

Jackson was appointed in 1950 to the mathematics faculty at McGill University, where he continued research on atomic processes and nuclear reactions and began his career as a revered teacher and mentor. The lecture notes for his course on electricity and magnetism evolved into a first draft of the famous textbook.

In 1956–57 Jackson spent a sabbatical year at Princeton University and was free to focus on research. A *New York Times* account of Luis Alvarez and collaborators' observation of muon-catalyzed fusion, and the prospect it raised of a new energy source, stirred his imagination. Within a week, Jackson estimated that one muon could catalyze no more than 130 deuterium–tritium fusion reactions, insufficient for practical energy production. That work led him to form lasting bonds with other “Mu-sketeers,” Russian physicists who pioneered and extended muon-catalysis theory. Following Chien-Shiung Wu and coworkers' discovery of parity nonconservation in beta decay, Jackson, Sam Treiman, and William Wyld analyzed possible signatures for violations of time-reversal invariance.

Jackson moved in 1957 to the University of Illinois at Urbana-Champaign. Inspired, he claimed, by the majesty of Midwestern thunderstorms, he developed the fearsome “Jackson problems” and in 1962 published the first edition of *Classical Electrodynamics*. His research interests included low-energy kaon–nucleon scattering, final-state interactions, and dispersion relations.

A 1963–64 sabbatical at CERN in Geneva marked another decisive turn in Jackson's research career. With Kurt Gottfried, he devised incisive methods to elucidate production mechanisms of resonances in two-body to two-body reactions. Insights they gained from the phenomenological analysis of resonances led them to develop the peripheral model with absorption of low partial waves to describe resonance production.

Jackson joined the Berkeley faculty and the Lawrence Berkeley Laboratory staff in 1967, when the ascendancy of

Regge theory put his beloved special functions at the heart of theoretical physics. Lecturing graduate students in 1968, and having covered every blackboard in the room with arcane calculations that culminated in Legendre functions of the second kind, he mused, “Born a century too late!”

As leader of the Theory Year program at Fermilab in 1972–73, Jackson founded a lab institution, the Joint Experimental–Theoretical “Wine & Cheese” Seminar.

Back at Berkeley, Jackson was in at the very beginning of the “November Revolution” of 1974. Alerted by colleagues to the discovery-in-progress of the ψ resonance in electron–positron annihilations at SLAC, he deduced in real time that the new particle was astonishingly narrow—with a total width less than 100 keV. Drawing on his broad scientific culture, he provided diverse insights into polarization in electron storage rings and the nature of the charmonium and upsilon families of heavy mesons.

Jackson served the physics community at Berkeley and around the world in many ways. An early proponent of the Superconducting Super Collider, he served for two years as deputy director of operations for the SSC Central Design Group. He edited the *Annual Review of Nuclear and Particle Science* for 17 years.

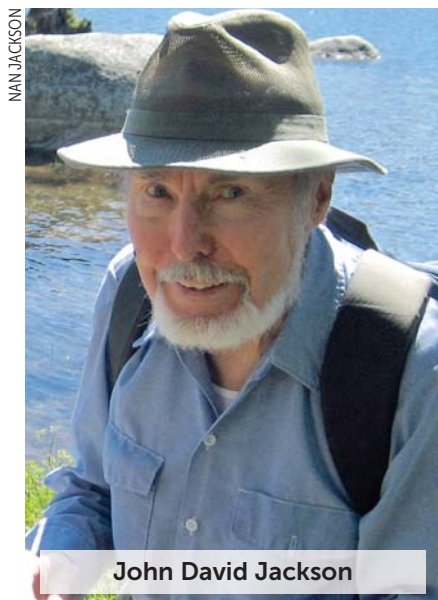
Jackson became a naturalized US citizen in 1988. The American Association of Physics Teachers established the John David Jackson Award for Excellence in Graduate Physics Education in 2010. A certificate conferring the title of Honorary Woman, presented by female graduate students in recognition of his outstanding achievements as department chair, hung on his living room wall for three decades.

After his formal retirement in 1993, Jackson remained active in research and community service, and he published numerous articles on pedagogical insights and physics history. Throughout his life he enjoyed mountain photography and listening to jazz.

Dave's colleagues and students recall with affection the twinkle in his eyes conveying the joy of insight, his uncompromising standards, and his generous spirit. We celebrate his example as a physicist, teacher, and humane world citizen.

Chris Quigg

*Fermi National Accelerator Laboratory
Batavia, Illinois* **PT**



John David Jackson