

Mario's selfless service to his profession is exemplified by the Iona family gift, in 2000, of a lounge within DU's department of physics and astronomy for members of the Society of Physics Students and Sigma Pi Sigma. His colleagues and former students remember him with great appreciation and high personal regard for his academic integrity and for his devotion to physics education.

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Edwin Albert Power

Edwin Albert Power, emeritus professor of applied mathematics at University College London, distinguished for his pioneering contributions to nonrelativistic quantum electrodynamics (QED), died on 31 January 2004 in London after a short illness.



Edwin Albert Power

Power was born in Honiton in southwestern England on 12 February 1928. He entered University College London in 1945 at age 17 and graduated with a BSc (1948) and an MSc (1949), both in mathematics. For postgraduate study, he worked on meson production in proton–proton collisions with John Gunn at the University of Glasgow. In 1951, the university awarded him the Kelvin Prize for the best physics thesis submitted for a PhD that year. He then returned to the mathematics department at University College, where he was promoted to professor of applied mathematics in 1967 and, in 1991, was made a fellow of University College for his

contributions to mathematics and services to the college.

In 1953, Power was awarded a Commonwealth Fund Fellow (now called Harkness fellowship) and traveled to the US to spend one year at Cornell University and another year at Princeton University. At Princeton, he and John Wheeler wrote an important paper in 1957 on thermal geons (their abbreviation for gravitational–electromagnetic entities), which they studied within the framework of classical Einstein–Maxwell theory. The paper was republished in a collection of Wheeler's papers entitled *Geometrodynamics* (Academic Press, 1962).

Power's research was on the interaction between the quantized radiation field and particles—nuclei and atomic or molecular electrons—moving at nonrelativistic speeds. Using methods he and his colleagues had largely developed themselves, he worked within the framework of nonrelativistic QED. In 1959, he and Sigurd Zienau published in the *Philosophical Transactions of the Royal Society of London* a seminal paper on the Coulomb gauge in QED and its applications to the shape of spectral lines, the nonrelativistic Lamb shift, and other phenomena. The work was timely, given the rising experimental interest in low-energy particles in atoms and molecules that interact with each other and with radiation when relativistic corrections are negligible. Power's results were more precise, and gave a clearer physical picture, than the conventional semiclassical calculations, which did not consider the quantization of the radiation field.

Power's interests included circular dichroism and optical activity, interactions between chiral (optically active) molecules, and nonlinear optics. Other researchers have used his methods in resonance energy transfer and aspects of intermolecular forces. In these applications, the underlying theory, known as molecular QED, involves the coupling of molecular multipole moments to the quantized radiation field. Power had a gift of expressing his results in ways that were easily visualized; for example, in *Magic Without Magic* (W. H. Freeman, 1972), a volume dedicated to Wheeler, he showed how the retarded Casimir–Polder potential between neutral atoms could be seen as the consequence of zero-point energy depression of the modes of the radiation field coupled to polarizable matter systems.

Power retired in 1992 but continued to be active in research until 2003. His last research effort, which

involved a collaboration with one of us (Thirunamachandran), was the derivation of the electric and magnetic fields of moving multipoles by solving Maxwell's equations without specifying the gauge or using the electromagnetic potentials. They first used the method to get the Feynman formulas for the fields of a moving charge. A central feature of the derivation is that it requires the integration of a differential equation that is first order in time.

Power's much-used book, *Introductory Quantum Electrodynamics* (American Elsevier, 1964), was based on postgraduate lectures he gave in Chile and in Boulder, Colorado. He lectured carefully and lucidly, and his introductory talks on mathematics for chemists at University College were models in their combination of well-judged content and precision. He was an entertaining speaker. At a conference on the electromagnetic vacuum, he said of his work, "For several years I have been working on nothing, and the college has been paying me!"

Although Power's academic base was University College, he held visiting appointments elsewhere, including at Cornell University, the University of Southern California, Australian National University, the University of Palermo, and the University of the West Indies. His graduate courses in QED inspired many to take up research in the field.

Power appeared reserved but formed close friendships and showed a warm interest in colleagues, collaborators, and friends. He was a devoted family man. He and his wife, Anne, took pleasure in the pastime of orienteering, in which they had to race on foot to find their way, point-to-point, with map and compass and a minimum of clues. He was a modest, nonassertive scientist and an effective communicator who made important forward steps in his field. There are few like him. He is sadly missed.

David Craig

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Thuraiappah "Thiru"

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Peter Wootton

Peter Wootton, medical physicist and professor emeritus of radiation oncology at the University of Washington, Seattle (UW), died at his home in Bellevue, Washington, on 3 May 2004 after a 3½-year battle with pancreatic cancer.