

The International Commission on Radiation Units and Measurements is pleased to announce the eleventh recipient of the L.H. Gray Medal, Dr. Martin J. Berger. The ICRU presentation and Gray Lecture will take place at the 45<sup>th</sup> Annual Meeting of the American Association of Physicists in Medicine in San Diego, CA.

Dr. Berger was born in Vienna, Austria in 1922 and immigrated to the United States in 1940, becoming a U.S. citizen in 1944. After receiving his B.S. in Physics from the University of Chicago in 1943, he served in the U.S. Army from 1944 to 1946. Berger returned to the University of Chicago, earning a M.S. in Physics in 1948 and his Ph.D. in Physics in 1951; his thesis work involved the scattering of fast charged particles.

Berger joined the staff of the National Bureau of Standards (now the National Institute of Standards and Technology) in 1952 to work with Ugo Fano in the Radiation Theory Section. Berger's work in the 1950s was focused on the development of gamma-ray transport theory and Monte Carlo calculations, culminating in the 1959 publication of a very complete treatise on the penetration and diffusion of x rays in the *Handbuch der Physik* he wrote with Fano and Lewis Spencer (the 1<sup>st</sup> recipient of the Gray Medal). Soon after, his work returned to focus on charged-particle transport, with emphasis on electrons and protons. Berger's 1963 monograph "Monte Carlo Calculation of the Penetration and Diffusion of Fast Charged Particles," in *Methods in Computational Physics*, thoroughly delineated the taxonomy, the methods, the underlying single- and multiple-scattering distributions, and the algorithms used in charged-particle Monte Carlo codes. Perhaps the most telling compliment is that this early pioneering work is still remarkably relevant today, nearly 40 years later.

In parallel with the development of charged-particle Monte Carlo calculations, Berger embarked on the development of critically evaluated cross-section data for electron and heavy-charged-particle interactions. Prominent among his accomplishments are the development of standard-reference databases for the stopping power of electrons, positrons, protons and alpha particles [see ICRU Reports 37 and 49], for electron-atom bremsstrahlung production cross sections, for cross sections for the elastic scattering of electrons and positrons, and for photon-interaction cross sections.

During the more than four decades of his development work in Monte Carlo calculations and radiation-interaction data, Berger has been busy also in applying the transport-theoretic methods to important problems in radiological physics. Berger became the Chief of the NBS Radiation Theory Section in 1964, serving until his retirement from government in 1988. He has continued to carry out research as a consultant. Berger received Silver and Gold Medals from the U.S. Department of Commerce and the 1990 Radiation Science and Technology Award from the American Nuclear Society.

The ICRU is honored to recognize Dr. Berger's seminal contributions in the development of Monte Carlo methods for the transport of photons and charged particles in extended media, and for his extensive body of critically evaluated radiation-interaction data. These data were not only necessary for his transport calculations but have become standard

reference data for the radiological sciences. The use of electron/photon Monte Carlo calculations is now widespread, and the field has matured so much that in many disciplines heavy reliance is placed on the results of the better-known Monte Carlo codes in preference to much more difficult measurements. In fact, the medical physics community has so thoroughly embraced Monte Carlo that calculated results are used extensively in medical radiation dosimetry research, development, protocols and therapy planning. Martin Berger, with his 1963 paper, quite literally established the Monte Carlo calculation of charged-particle transport at the energies of interest in medical and radiation protection physics; he is generally credited as being the father of modern electron and proton Monte Carlo methods. The methods he developed and the cross-section data for which he was largely responsible are imbedded in nearly all of today's coupled photon/charged-particle Monte Carlo codes.