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Abstract

Professor Michael John Seaton, hailed as the "Father of Atomic Astrophysics," passed away on May 29, 2007. He was one of the few Honorary Fellows of both the American Astronomical Society and the American Physical Society, so honored for his monumental contributions to both physics and astronomy.

Mike Seaton was born on January 16, 1923 in Bristol, England. He attended Wallington County High School. But his leftist political activities, even at that stage, led to his expulsion, though he was eventually allowed to matriculate. He enlisted in the Royal Air Force as a navigator during the Second World War, and flew many dangerous missions. His legendary concentration and precision are reflected in the following anecdote. Once after a bombing mission his aircraft was lost in fog over the Alps. Seaton calculated the position and coordinates in flight to guide the aircraft. When the fog lifted, the crew found themselves flying perilously close to the mountains, but made it safely back. His associates often said, "A Seaton calculation is carried out as if his life depended on it." After the War he was admitted to University College London (UCL) as an undergraduate. Thereafter, he spent all of his professional career at UCL. Seaton received his Batchelor's degree in 1948, and his Ph.D. in 1951. His tenure at UCL coincided with the golden age of atomic astrophysics, for he was largely responsible for it.

Seaton was elected Fellow of the Royal Society in 1967, and as President of the Royal Astronomical Society (RAS) in 1978. He was the recipient of an Honorary Doctorate from the Observatoire de Paris, an Honorary D.Sc. from the Queen's University of Belfast, the Gold Medal for Astronomy by the RAS, the Guthrie Medal by the Institute

of Physics, the Royal Society Hughes award for lifetime work by the RAS, and several other prestigious awards. Nevertheless, as Alex Dalgarno recently remarked, Seaton was not part of the establishment because he chose not to be. Though rooted in the idealism of youth, Seaton's early leftist leanings cast a long shadow, including problems with United States immigration. However, he was later disillusioned with communist ideology, with a decisive break from it after the Soviet invasion of Hungary in 1956.

Seaton's groundbreaking papers range over several areas of physics and astrophysics. He was the author of nearly 300 journal publications and many other articles. His pioneering research papers in physics include the non-hydrogenic treatment of photoionization, implementation of the coupled channel approximation, proton-impact excitation of ions, quantum defect theory (based on Seaton's theorem), a precise theory of dielectronic recombination (the Bell and Seaton theory), the widely used Percival-Seaton formula for polarization, and many other contributions.

Seaton's works in astrophysics range from seminal papers on spectroscopic density diagnostics using forbidden lines (developed jointly with Donald Osterbrock), the Seaton extinction curve (the paper has well over 1,000 citations), central stars of planetary nebulae (PNe), early work on PNe using the then newly commissioned International Ultraviolet Explorer satellite, hydrogenic recombination spectra, radio recombination lines in masers, and several other topics.

(In this context, a remarkable incident deserves mention. At the tragic death from a motorcycle accident of his graduate student, R. Harman, Seaton said to Harman's parents at the funeral that Harman was working on something important, and would be remembered for it. He is. The so called Harman-Seaton sequence on the H-R diagram refers to hot sub-dwarfs and nuclei of planetary nebulae.)

For almost all of the last quarter century of his life, 1983-2007, Seaton led the Opacity Project (OP), an international team of about thirty atomic physicists and astrophysicists, to carry out highly accurate atomic calculations for radiative transition probabilities and photoionization cross sections that determine stellar opacities. The large-scale calculations revealed extensive features in photoionization such as resonances due to photoexcitation-of-core or PEC (as named by Seaton). The new opacities solved some outstanding problems and have been in use in some major astrophysical applications, recently by John Bahcall and others to explore discrepancies in solar elemental abundances from different models. A National Science Foundation reviewer once hailed the Opacity Project as the "crowning achievement of computational atomic physics."

At an AAS meeting hosted by the Ohio State University in 1992, Seaton named a follow-up project "The Iron Project," focused particularly on the important Fe-peak elements, with many of the original members of the Opacity Project as participants. But Seaton himself remained preoccupied with improvements and applications of opacities. Seaton's most recent work was on radiative accelerations of elements in stars using the Opacity Project data and element diffusion in stellar interiors. Seaton continued to be highly active in research until his death at age 84, even writing large complex computer codes that now form the basis of an electronic database for

opacities.

There are precious few scientists who have his unique abilities that ranged from profound theoretical insights to mathematical formulations and highly technical computational developments. Mike Seaton was an immense source of inspiration to all who knew him. There is no doubt that his many students and collaborators, if ever paid a complement on their work, would surely reply: "I learnt the craft from a Master."

Mike Seaton is survived by his wife Joy and their son Tony, and a son and daughter from his first marriage to Olive Singleton who passed away in 1958.

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