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Alexander Dalgarno

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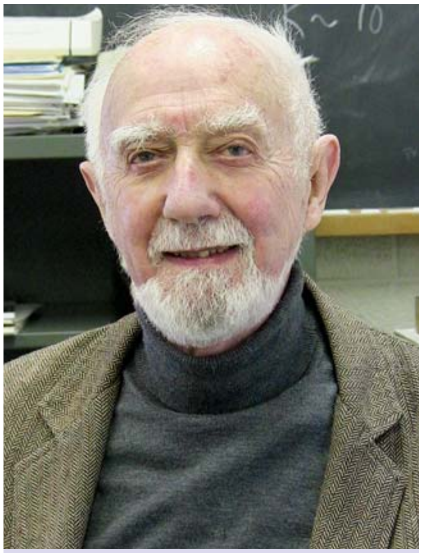
Alexander Dalgarno



ALICE KALEMKIARIAN

Alexander Dalgarno

Alexander Dalgarno, Phillips Professor of Astronomy Emeritus at Harvard University and senior scientist at the Smithsonian Astrophysical Observatory, died in Cambridge, Massachusetts, on 9 April 2015. For six and a half decades, he was a leading figure in atomic and molecular physics and its applications to astrophysics and atmospheric physics. His contributions to science fundamentally influenced the fields of atomic and molecular physics, astrochemistry, and aeronomy.

Born on 5 January 1928 in London, Alex earned a BSc with first-class honors in mathematics from University College London. He stayed there for his graduate studies, but with encouragement from Harrie Massey he chose to pursue physics. His PhD, done under the supervision of Richard Buckingham, concerned collisions of metastable helium atoms in helium gas. In 1951 he joined David Bates in the department of applied mathematics at Queen's University Belfast as an assistant lecturer and rose rapidly to become a professor.

The rocket flights of the early 1950s produced a treasure trove of data on upper-atmosphere physics and chemistry. With his considerable foresight, Alex began to develop techniques for calculating cross sections and rate coefficients for a host of radiative and collisional processes, including ionization, recombination, and dissociation. He invented elegant perturbative quantum mechanical techniques to study problems in atomic and molecular physics. One such approach became known as the Dalgarno–Lewis method. His research during that period, in which he used numerical methods, sometimes augmented by carefully selected empirical data, included wide-ranging explorations of atomic and molecular polarizabilities and long-range interactions.

Alex's interest in aeronomy led him to astrophysics. He was offered a professorship in the astronomy department of Harvard University, with additional support from the Smithsonian Astrophysical Observatory, and he moved to Massachusetts in 1967. At Harvard, Alex developed models for the networks of chemical reactions in interstellar clouds, planetary atmospheres, and shocked gases. His investigations into charge-exchange collisions began in Belfast, but he continued them. One outgrowth of that research was the study of cometary x-ray emissions resulting from charge exchange between solar-wind ions and neutral species in cometary atmospheres, which he explored in depth with his collaborators.

With the advent in the 1990s of cooling and trapping methods for atomic and molecular species, the same theoretical techniques that Alex established decades earlier found broad application to physics and chemistry in ultracold temperature regimes. Already in his late sixties, Alex applied himself with youthful vigor to predicting precise values for *s*-wave scattering lengths, photoassociation resonances, and collisional trap-loss cross sections.

Alex served as the editor of *Astrophysical Journal Letters* for nearly 30 years, and he chaired the Harvard astronomy department for 5. During his career, he received numerous honors, including the Davisson-Germer Prize in Atomic or Surface Physics from the American Physical Society in 1980, the American Geophysical Union's John Adam Fleming Medal in 1995, and the Franklin Institute's Benjamin Franklin Medal in Physics in 2013. Alex reflected on his career in an oral history interview by the American Institute of Physics in 2007 (https://www.aip.org/history-programs/niels-bohr-library/oral-histories/32898).

In the 1980s, concerned with the decline of theoretical atomic and molecular physics in major physics departments, Alex and others began to study how the field could be strengthened. A series of community meetings culminated in 1987 with the publication of the National Research Council report *The State of Theoretical Atomic, Molecular, and Optical Sciences in the United States*. After the success of an NSF proposal from the Harvard–Smithsonian Center for Astrophysics, for which Alex was the lead author, the Institute for Theoretical Atomic, Molecular, and Optical Physics (ITAMP) was founded in 1988. Alex served as its first director.

The enormous influence of ITAMP testifies to Alex's visionary leadership. In existence for more than 25 years, ITAMP has organized more than 100 workshops, hosted thousands of visitors, and nurtured the careers of numerous fellows, many of whom occupy permanent senior-level positions in academia and national laboratories.

Alex was a deep and insightful thinker gifted with a phenomenal memory. Colleagues could ask him about a particular property of an atom or molecule and be assured of a correct answer. In the course of a discussion, he might offer the complete citation to a journal article that was published decades before. He was known for his wit and his concise and elegant writing. He responded quickly to emerging areas of research, often using applications of theoretical atomic and molecular physics as a point of entry. Professionally, he was known for his open-door policy. New students, intimidated perhaps by Alex's status, usually would be surprised that he had ample time for consultation in spite of his many other commitments. A constant stream of visitors from around the world would come for joint research projects in the summers. Nevertheless, several times a week, a squash or tennis appointment took priority, and he would rush off to give his opponents a stiff workout.

The world has lost a brilliant mind and a true gentleman. Alex's countless colleagues around the world, and those of us who worked closely with him over many decades, will miss him greatly.

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