PHYSICS OF ELECTRONIC AND ATOMIC COLLISIONS

THE third international conference on "The Physics of Electronic and Atomic Collisions", held in London during July, marks the rapid development from national to world communication in this field of physics. Before 1959 there were no specialized conferences; collision research was presented only at meetings on general physics and ionized gas meetings. But the unprecedented growth of interest in this field led to meetings in the United States in 1959 and 1961, balanced by two conferences in the U.S.S.R. Sir Harrie Massey invited the American meeting to University College, London, for 1963, and it has been possible to increase greatly the international participation. Plans have now been laid by a steering committee, under the chairmanship of Dr. W. L. Fite, for biennial world events, the next two to be held, it is hoped, in Canada and then in Leningrad. Meanwhile, the European conference on "Ionization Phenomena in Gases" will no longer cater for collision investigations; all this is in keeping with the typical pattern of cellular scientific development.

The stimulation of collision physics is very largely by magneto-hydrodynamic and thermo-nuclear power generation, aeronomy, astrophysics, plasma and gas laser technology; but the material at the conference did not show an unbalanced or empirical development of the subject, despite the fact that the 360 participants represent a one-sided distribution of research workers, namely, those able to obtain financial support for their journey. University College, London, is well known as a centre of collision research, and in addition to the work carried on in Sir Harrie Massey's own department, and in other establishments and universities under the direction of his old students and colleagues, some of the finest American contributions have been stimulated by extended visits to London.

A large concentration of theoretical work has been on collisions of electrons with the hydrogen atom; the investigations owe much to the availability of high-speed computation. An unexpected feature was found in the total scattering cross-section function calculations carried out by P. G. Burke and H. M. Schey: an extremely narrow and deep resonance just below the energy of the first excited state. The apparent transparency of the hydrogen atom to electrons of this energy might be regarded physically as being connected with the temporary formation of a virtual negative ion state, followed by re-emission of an electron. This prediction has awakened greater interest in total electron scattering than at any time since the days of Ramsauer and Townsend. Further resonances in eH scattering were predicted in London, although nothing has been reported in experiment. But in helium and other gases, narrow resonances were first found this year by G. J. Schulz, experimenting at Westinghouse Research Laboratories, Pittsburgh, with a highly developed electron velocity selector. There appears to be no known method of determining with high accuracy the electrical potential of a point in space to which electrons have been accelerated; it is likely that the resonances will find a ready application here. Fine structure peaks have also appeared in inelastic electron cross-section functions, and even in certain heavy particle collisions; the development of this subject represents an important testing ground for quantum theory. Various related phenomena are associated with the energy-levels which appear in the first ionization continuum. The results of experiments using far ultra-violet radiation, obtained from discarded electron accelerators, are eagerly awaited.

A large part of the London conference was devoted to elastic and inelastic heavy particle collisions. Investigations of the 'glories' or 'rainbow' effects in atom scattering are progressing, and the experiments on 'chemically reactive' scattering continue to be limited by the lack of efficient slow-atom detectors capable of discriminating in species. It would still appear that this important work is not treated sufficiently seriously by chemists. But in the investigation of strictly atomic collisions, charge transfer, excitation and so on, a large volume of work, more than thirty contributions, was reported. It would be wrong to say that excitation and ionization collisions are understood in any but the most general terms; however, the advances in optical techniques, and also the application of coincidence counting, will do much to change this.

Other fields discussed during the remainder of the four-and-a-half-day discussions were electron–ion recombination processes, inelastic electron–atom and electron–molecule collisions, collisions of excited atoms, muonium and positronium physics, gas lasers, and photon processes such as photodetachment. The 140 contributions will be available in published form at the end of the calendar year from the North Holland Publishing Co. Included will be eight reviews, as follows: "The Present State of Atomic Collisions Study", by Sir Harrie Massey; "The Excitation and Ionization of Atoms by Electron Impact", by D. W. O. Heddle and M. J. Seaton; "Inelastic Electron Molecule Collisions", by C. A. McDowell; "Electron–ion Recombination", by D. R. Bates; "Afterglow Processes", by M. A. Biondi; "Heavy Particle Inelastic Collisions", by A. Dalgarno; "Muonium and Positronium Physics", by V. W. Hughes and J. M. Bailey; "Electronic and Atomic Collision Processes Leading to Laser Action in Gases", by C. K. Patel. Summaries of the informal sessions on quantum-theoretical and experimental techniques will also be included; the latter sessions were largely concerned with the formidable problems encountered in the investigation of collision processes between two charged particles. Post-contribution discussion will not be included, since the informality of conference sessions is greatly hindered by the knowledge that chance remarks are to be published.

In fact, many discussions were as extended as might have been hoped. The decision was taken to run the conference on orthodox lines, that is, to give time to all relevant and competent contributions, rather than to allow extended discussion of a smaller number of topics. In this way the fullest possible representation and attendance was assured, and the highest form of communication, namely, private discussion during the intervals and the excellent social events, was given full rein. The principal lack of communication was not occasioned by this policy, but was that between experimentalists and theoreticians. The fault here usually lies not so much in the technical level of conference presentation, but in the low level of education of each type of physicist in the disciplines of the other. One wonders whether, in countries such as the United Kingdom where the division is unusually sharp, serious attempts should not be made at all levels to remedy the deficiency.

At all events, the often-repeated argument that there are too many scientific conferences has little application here. In a rapidly expanding subject there seems to be no way of keeping in touch other than by meetings, which serve the purposes of stimulation, clearing the air, reporting and criticism as well as review and bibliography.

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