

electron problems. A comparison of theory and experiment for electron affinities and negative-ion excitation energies, term splitting ratios in excited configurations and transition probabilities showed good agreement.

A measure of recent progress in the calculation of electron-atom collision parameters is the tolerant smile that can be produced on the face of a theorist by the phrase "Born approximation." The close-coupling approximation, in which the trial function Ψ is chosen to satisfy the Schrödinger equation "on the average," is a particularly useful approach. It is known that the estimates improve monotonically as the number of terms in Ψ is increased. Aided by a knowledge of how to extract long-range polarization effects exactly and how to account for short-range correlation effects, and abetted by the availability of high-speed computers, we may use the approach to give reliable results for an increasing variety of problems involving light atoms. Many examples are given by Philip G. Burke of The Queen's University of Belfast. He also discusses methods that are not so well founded but that have proved useful in estimating cross sections rapidly and fairly accurately over wide energy ranges. Burke includes semiclassical methods and adaptations of the impulse approximation.

Doubly excited states of atoms, of central interest in recent years, are discussed by Ugo Fano of the University of Chicago. These states can be produced by photon absorption or by particle impact, and they can be detected relatively easily because the discrete line radiation emitted on deexcitation stands out against the background continuum. The states also play a dominant role in resonance scattering. For $e^- + \text{He}^+$ scattering for example, the resonance positions are largely determined by the positions of the doubly excited states of neutral helium. Though the positions of the $e^- + \text{He}^+$ resonances can be accurately calculated from first principles, they are not fully "understood." Fano discusses the insight to be gained by introducing an approximate two-valued quantum number that describes whether the electron-electron interaction generates radial oscillations with the two electrons in or out of step.

The field of heavy-particle collisions is in a phase of rapid growth largely because of improved energy resolution and the measurement of angular distri-

butions. Felix Smith of the Stanford Research Institute reviews the field, discussing elastic scattering and inelastic processes involving electronic excitation, ionization and electronic energy or charge transfer. The theoretical emphasis was on simple concepts useful in the interpretation of large bodies of data. These include scaling laws, electron-symmetry effects present, for example, in $^4\text{He}^+ + ^4\text{He}$ scattering and in $^4\text{He}^+ + ^3\text{He}$ scattering and nuclear-symmetry effects present in the first example but not in the second.

Problems in low-density astrophysics for which atomic processes play a significant role are discussed in two papers, one mainly on neutral atomic-hydrogen regions and the other mainly on ionized atomic-hydrogen regions. George B. Field of the University of California, Berkeley, discusses the determination of the chemical composition of the interstellar gas—atomic versus molecular hydrogen, CH , CH^+ , CN —and the processes by which the gas radiates. Shock waves receive particular attention. Michael J. Seaton of University College London concentrates on the determination of the electron temperature, comparing the values obtained by a variety of methods, including the intensity ratios of particular lines of O^{++} , the Balmer line to Balmer continuum intensity ratios, the radio continuum of the free-free (bremsstrahlung) radiation emitted in the transition $\text{H}^+ + e \rightarrow \text{H} + e + h\nu$ and the radio recombination lines arising from transitions between states with principal quantum numbers n' and n , where $n' - n$ is small compared to n , and n is of order 100.

* * *

The three reviewers consider atomic physics among their most important interests and activities. Benjamin Bederson and Larry Spruch are professors of physics at New York University and Vernon Hughes is professor of physics at Yale University.

NEW BOOKS

ELEMENTARY PARTICLES

- The CP Puzzle: Strange Decays of the Neutral Kaon.** By P. K. Kabir. 137 pp. Academic Press, London, 1968. 40s
- Hadrons and Their Interactions.** (Conf. Proc.) A Zichichi, ed. 718 pp. Academic Press, 1968. \$26.50.
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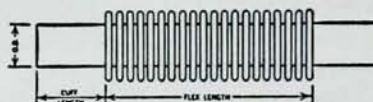


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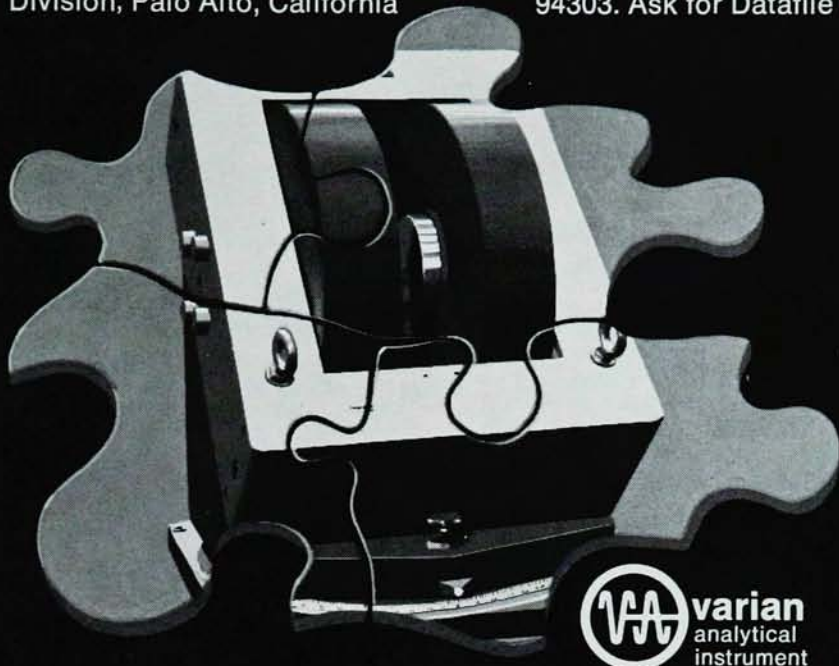
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