BOOK REVIEW

The Calculation of Atomic Collision Process

By Kenneth Smith, Wiley-Interscience 1971,

The book is divided into two parts, the first dealing with single channel problems and the second dealing with many channel problems. The book is primarily aimed at graduate students taking a two semester course in atomic collisions and younger scientists who might be interested in this field. This makes the scope of the book rather limited. The first part consists of elementary topics which are easily understood by a graduate student. Section 1.4 on the second order ordinary differential equations is well written and will be of considerable help to those who want to work with computers in solving such equations. The emphasis of the book is to get meaningful algorithms for actual computations.

The second part starts with a section on Eigenfunction Expansion method, which forms the main theme of the book. This method is of particular value for Astrophysics and Plasma physics application and workers in these fields will find the book quite useful. However, this technique is in general rather poor for calculating excitation cross-sections for levels which are widely separated in energy from their neighbours. It would have been more useful if the author had also discussed in a little greater detail the method of dipole approximation which is most satisfactory for excitation processes of large oscillator strengths and small energy differences. Sections 2.2 and 2.4 on Racah Algebra and Numerical Methods for Coupled Differential Equations, respectively, will be useful for many active workers in the field.

A number of good problems are included in the book which will surely increase the understanding and the capabilities of readers to handle practical problems. The book is a welcome addition to the literature for the 'Computer Experimentalist'.

The book thus covers only a limited aspect of the calculation of atomic collision process and as such the title of the book should not be taken too generally.

- B. K. G.
Collision frequency describes the rate of collisions between two atomic or molecular species in a given volume, per unit time. In an ideal gas, assuming that the species behave like hard spheres, the collision frequency between A and B is: 

\[
P_{AB} = \frac{Z}{N_A N_B} \sigma \frac{1}{2} \left( \frac{v_A^2 + v_B^2}{v_A v_B} \right)
\]

where: 
- \(Z\) is the number of A molecules in the gas, 
- \(N_A\) is the number of B molecules in the gas, 
- \(\sigma\) is the collision cross section (unit: \(\text{m}^2\)), the area when two molecules collide with each other, simplified to. However, most courses in collision theory follow the traditional approach of emphasizing the various theoretical manipulations of the Schrödinger equation and derive their inspiration from the classic book by Mott and Massey. Indeed, this emphasis has dominated the half-dozen monographs published on the subject during the 1960s. 

Preface of how spin-dependent forces modify the formulae given here. However, the formulation of the atomic problem with spin-dependent forces is so close to that of low-energy nuclear physics, which is well documented, that perhaps no apology is necessary.