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Electron Impact Ionisation of Molecules

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Electron impact ionisation studies can be used to fully characterise the collision dynamics of a system. Collisions with atomic systems are now relatively well understood, as evidenced by the excellent agreement between experimental measurements and theoretical predictions over a wide range of impact energies. Molecular targets provide a new challenge for both experiment and theory. Detailed studies have now been carried out using diatomic targets such as H_2 and N_2, and reasonable agreement with theory is obtained for these simple systems. However, for more complex polyatomic molecules, large discrepancies are seen between theory and experiment. A possible cause of this is due to the theoretical approximations required to account for all orientations of the molecule (as is necessary to compare to current experiments). The inherent symmetry of methane (CH_4) makes it an ideal molecule to study, since in this target the orientational variance of the wavefunctions needed to predict the collision dynamics are minimised. The experimental restrictions due to the random orientation of effusive molecular targets is also being addressed in our laboratory by developing a method of pre-aligning the molecules using a laser field. Progress towards these goals will also be discussed.