

Long-Range Interparticle Forces: Molecular Quantum Electrodynamical Theory

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The fundamental physical theory describing the interaction of electrons and photons is quantum electrodynamics (QED). Its characteristic feature is that the radiation field, as well as matter, is subject to quantum mechanical rules. This enables the photon to emerge automatically from the formalism as the quantized particle of light. As a consequence, QED is able to treat all spectroscopic and intermolecular processes in a single theoretical framework. To date, the theory has been applied with outstanding success to single- and multi-photon absorption, emission and scattering of light, and to interactions occurring between particles at long-range, such as van der Waals dispersion and resonant exchange of energy.

In this talk, an outline of the development of the theory of molecular quantum electrodynamics will be given, followed by a presentation of simple applications of interest to chemists involving long-range forces between molecules.