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Abstract

Molecular QED Theory of Pair and Many-Body Resonance Energy Transfer

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One of the many successes of the molecular version of QED [1-3] is the unified description it provides of resonance energy transfer (RET) [4]. This process is viewed as arising from the exchange of a single virtual photon between an initially excited donor species and a ground state acceptor moiety. Asymptotic limits of the Fermi golden rule transition rate reveal a radiationless Förster type of exchange mechanism in the near-zone that has inverse sixth power separation distance dependence, and a radiative inverse square law behaviour at large displacements.

In this seminar an overview of molecular QED theory and its application to pair RET will be given first, before recent results are presented concerning the role that one and two additional passive polarisable molecules have in modifying the transfer rate [4-7]. Insight is gained into migration of energy in an environment of bath molecules by comparing these microscopic models of RET occurring between individual particles with a polariton based approach [8] in which direct excitation energy transfer is facilitated by medium-dressed photons.

- [1] D. P. Craig and T. Thirunamachandran, *Molecular Quantum Electrodynamics*, Dover, 1998.
- [2] A. Salam, *Molecular Quantum Electrodynamics*, John Wiley & Sons, Inc., 2010.
- [3] D. L. Andrews, G. A. Jones, A. Salam and R. G. Woolley, *J. Chem. Phys.* **148**, 040901 (2018).
- [4] A. Salam, *Atoms* **6**, 56 (2018).
- [5] A. Salam, *J. Chem. Phys.* **136**, 014509 (2012).
- [6] D. L. Andrews and J. S. Ford, *J. Chem. Phys.* **139**, 014107 (2013).
- [7] A. Salam, *J. Phys. Chem. A* **123**, 2853 (2019).
- [8] G. Juzeliunas and D. L. Andrews, *Adv. Chem. Phys.* **112**, 357 (2000).