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Discriminatory RET Mediated by One and Two Polarizable Molecules

A. Salam
Department of Chemistry, Wake Forest University, Winston-Salem, NC 27109, USA

It is well known that resonance energy transfer (RET) [1] between a pair of optically active molecules is discriminatory, depending on the handedness of each species [2,3]. Molecular chirality manifests through a pseudoscalar formed between transition electric and magnetic dipole moments, the reduced symmetry relaxing spectroscopic selection rules. A quantum electrodynamical (QED) [4-6] calculation of the Fermi golden rule migration rate, with energy transferred via the propagation of a single virtual photon between emitter and absorber, exhibits Förster-like inverse sixth power separation distance behaviour in the near-zone, and inverse square, radiative exchange at very long range.

Here we study the effect of one or two neutral, electric dipole polarizable mediator particles in modifying the energy transfer rate between a chiral donor and a chiral acceptor [7-8]. Diagrammatic time-dependent perturbation theory is employed within the framework of molecular QED [4]. Isotropic transfer rates are found to be discriminatory, retarded, and proportional to the polarizability of each mediator. Interestingly, a multi-level model of the mediator is required for many-body relayed RET to occur. When a single bridging molecule is present, the rate is a maximum for a collinear arrangement of the three particles and vanishes when they form a right-angled triangle [7]. Valuable insight is gained into RET taking place between chiral moieties in a dielectric medium.

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