Applications of organic molecule-light strong coupling

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The typical tools utilized by chemists to control the rate of a chemical reaction include temperature, concentration of reactants, presence of catalysts, solvent, etc. In recent years a less intuitive notion has been explored: that the electromagnetic environment of the reactants one can perturb the reaction potential energy surface, much like the action of a catalyst, and thereby influence chemical reactivity. Work over the last decade shows that this becomes possible in the strong coupling limit of molecular interactions with light, where the new collective polaritonic states have very different energies to the unbound system. We have shown that reactivity is influenced in both photochemical reactions (coupling electronic transitions) and for thermal reactions (coupling vibrational transitions).[1]

Our other recent work has examined strong light-molecule coupling effects on electrical conductivity [2], energy transfer [3], non-linear optics [4], and in biological systems targeting protein vibrational modes [5], further evidence that exciton-polaritons are worthy of study in the context of the molecular sciences.

References

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