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über

## Superradiance of two-dimensional molecular aggregates


**ABSTRACT**

Assemblies of molecules (so-called molecular aggregates) have become versatile quantum systems with applications in photography, opto-electronics, solar cells, and photo-biology. The remarkable properties of these aggregates stem from the strong transition dipole-dipole interaction between the individual molecules which leads to eigenstates with excitation shared coherently by a large number of molecules. As a consequence the aggregate possesses strikingly different optical properties compared to the individual molecules.

In this talk I will discuss the superradiant emission of organic molecules arranged on dielectric surfaces. A particular focus is on the relation between the temperature dependence and the underlying eigenfunctions of the aggregate [1]. Knowledge about these eigenfunctions is not only important to understand the optical properties but also for the transfer characteristics of the aggregates. Optical spectroscopy, in principle, allows one to infer information on these eigenstates and about the interactions between the molecules. However, traditional optical techniques using an electromagnetic field which is uniform over the relevant size of the aggregate cannot access most of the excited states because of selection rules. We demonstrate that by using localized fields one can obtain information about these otherwise inaccessible states. As an example, we discuss in detail the case of local excitation via radiation from the apex of a metallic tip, which allows also scanning across the aggregate.The resulting spatially resolved spectra provide extensive information on the eigenenergies and wave functions [2,3].



[1] Eisfeld, et al, 119, 097402 (2017)
[2] Gao, Eisfeld, J. Phys. Chem. Lett. 9, 6003 (2018)
[3] Zheng, Gao, Eisfeld, arXiv:1905.07280 [quant-ph]


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