PERTURBATION THEORETICAL APPROACH TO STRONG LIGHT-MATTER COUPLING

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In recent years experiments in chemistry, physics and material science have shown to be capable of coupling photons and matter in a way, that cannot be described by the classical interaction of electromagnetic fields with matter. In this so-called strong coupling regime light and matter form hybrid states, which alter the properties of the initial state of matter. While experiments made tremendous progress, consistent theoretical approaches capable of describing these effects within reasonable computational effort are still barely developed.

On this poster a short introduction to strong light-matter coupling phenomena is given along with a short motivation and a detailed example for an experiment[1]. Furthermore, some basic concepts of the theory are visualized[2], as shown in figure 1, and perturbation theoretical results for ground and excited states are shown in comparison to other theoretical data[3], whenever possible. In the end a short outlook for the possibility of approximation schemes is presented along with an example.

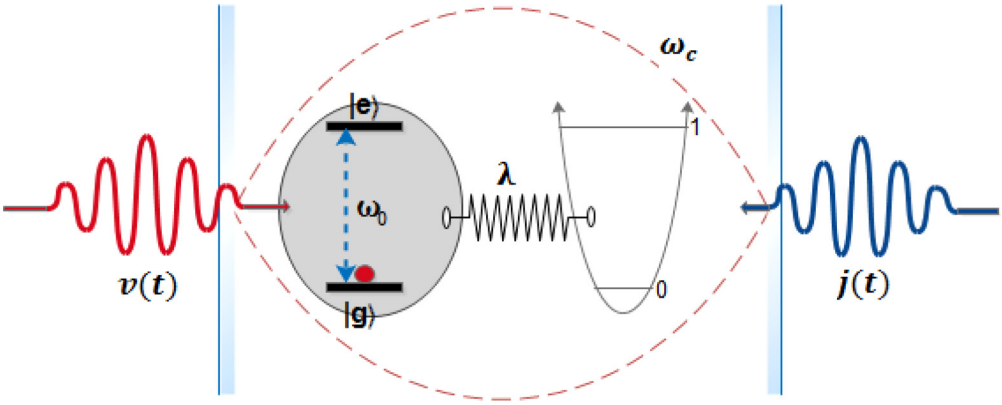

Figure 1. Graphical representation of the linear response of a polaritonic 2 x 2 level system. The electronic system is perturbed by a classical field **v(t)** and the photonic system is perturbed by a classical current **j(t)**, while both systems themselves are coupled via a constant **λ** multiplied with the transition dipole moment, represented by a spring.[2]

Reference

1 R. Chikkaraddy, B. de Nijs, F. Benz, S. J. Barrow, O. A. Scherman, E. Rosta, A. Demetriadou, P. Fox, O. Hess, J. J. Baumberg, *Nature* **2016**, *535*, 127–130.

2 J. Flick, D. M. Welakuh, M. Ruggenthaler, H. Appel, A. Rubio, *ACS photonics* **2019**, *6*, 2757–2778.

3 A. E. DePrince, *J. Chem. Phys.* **2021**, *154*, 094112.