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Probing emitter-cavity dressed states through environmental transitions JAKE ILES-SMITH, Blackett Laboratory, Imperial College London, London, SW7 2AZ, UK, AHSAN NAZIR, Photon Science Institute and School of Physics & Astronomy, The University of Manchester, Oxford Road, Manchester M13 9PL, UK — In this work we explore the effect of phonons on the emission properties of a cavity QED system in several important parameter regimes – the semi-classical intermediate coupling, Fano, and strong coupling regime. Specifically, we examine the effect of phonon interactions on the emission spectrum of a quantum dot in a high-Q optical cavity, focussing in particular on a micropillar type setup. We demonstrate that the quantum mechanical nature of the phonon environment, and short timescales over which phonons processes occur, allows one to probe the joint eigenstates of the cavity and TLS even in a semi-classical regime. Not only does this demonstrate a failure of the traditional quantum optics treatment, but also challenges the notion that phonons decohere such a system to a more classical description. Furthermore, we demonstrate that the behaviour we predict may be observed in a straightforward fashion by considering the cavity reflectivity, associated phase shift, or the cavity emission spectra.

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