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Quantum Process Tomography by 2D Fluorescence Spectroscopy
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Characterization of quantum dynamics is one of the most important steps toward the implementation of any quantum technology and therefore, it is of fundamental relevance. Traditionally, dynamics are studied for particular initial preparations and hence, only partial information about the underlying physical processes is obtained. To overcome this drawback, a variety of proposals based on spectroscopic techniques have been suggested. Quantum Processes Tomography allows for the experimental reconstruction of the dynamics regardless the initial condition. Despite the success of QTP, the spectroscopic techniques they are based on require large samples to enhance the non-linear signal. Hence, particular features of the dynamics and realistic time scales are hidden by the incoherent average over the large structural and electronic heterogeneity. Based on recent progress on non-linear spectroscopies using collinear phase-modulated ultra-short pulses, which are suitable for single molecule spectroscopy, a formulation of single molecule QPT with classical light is provided here. This technique is applied to recover the dynamics of a model dimer. The single molecule character of this technique predicts longer coherence times than those techniques based on the phase-matching condition.

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