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Coherent radiation from a collection of molecules interacting with surface plasmons[1] MICHAEL STOPA, SEMION SAIKIN, ALAN ASPURU-GUZIK, Harvard University — A collection of molecules interacting coherently with a radiation field has dramatically different absorption and emission properties than the same collection of molecules interacting incoherently with the field. In the former case, the collective states of the molecules become important and these consist of states which radiate super-classically (Dicke superradiance) as well as states which are dark. Treated as two-level systems such a collection of molecules can be thought of as a set of spins. The product state of those spins can be transformed to a basis of states of good total "angular momentum" J, and good J_z (z-component of total angular momentum). Here, we construct a numerical, invertible transformation between the direct product basis and the total J basis for N total molecules. For an arbitrary product state we calculate the rate of transition via radiation out of an arbitrary state in first order perturbation theory. For an ensemble of initial states we calculate the statistical distribution of the radiance (as a function of the J_z quantum number and disorder in the couplings) of the initial state. We show that the average radiance is approximately equal to the classical value but that the distributions have an asymmetric tail toward superradiance.

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