

Robert Dicke, Dicke Superfluorescence, Hopfield Polaritons and Amide-I Protein *alpha* Helix Coherent 4-Wave Mixing Gratings

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We will discuss quantum simple harmonic oscillators. Unlike collections of 2 level systems which when illuminated at the resonance frequency ω_o undergo Rabi flopping, that is periodic population inversion, a truly linear simple harmonic oscillator cannot be inverted. Does all of the remarkable physics of the Dicke super-fluorescence emission disappear for an ensemble of quantum linear oscillators? The answer is no, but things are different. The answer is that there remain fundamental mysteries in biology that seem be *perhaps* linked to coherent quantum mechanics. No, don't worry, we are not going down the Roger Penrose route of a possible connection between human consciousness and quantum gravity via the spatial organization of microtubules in tissue. Rather, we want to explore the possible dynamics of the α -helix motif so common in protein structures, especially in G-protein receptors which span membranes in cells, for a schematic of the G-protein receptor β -2 adrenergic receptor. What is notable in these proteins is the remarkable ordering of the α -helix bundles. The question we will address from a physics perspective is how binding of a ligand on the extracellular (top) side of the G-protein receptor is communicated to the G-protein which is bound on the cellular side of the complex, could there be some sort of a collective wave moving from one side to the other, via the chain of hydrogen bonds?