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How Weak Dipole Interactions Can Enhance of the Collective Coupling of an Ensemble of Single-molecule Magnets to a Microwave Cavity[1] JONATHAN FRIEDMAN, Amherst College Department of Physics, Amherst, MA 01002 — When N identical spins are on resonance with a resonant mode of an electromagnetic cavity, the coupling strength (Vacuum Rabi splitting) is enhanced by $\sqrt{N}$ [1]. Add some inhomogeneity so that the spins' resonant frequencies are distributed around the cavity frequency with width σ_ω, and this enhancement will remain as long as $\sigma_\omega < \sqrt{N}g_1$, where g_1 is the coupling strength of a single, isolated spin to the cavity [2]. Recent experiments have shown that $\sim 10^{16}$ spins in a crystal of the single-molecule magnet Fe_8 nevertheless exhibit the enhanced collective coupling to a cavity, despite substantial inhomogeneous broadening. I present numerical calculations that show that weak dipole interactions between the spins can enhance the coupling of the spins to the cavity, allowing collective coupling even when the inhomogeneous broadening is large (i.e. when $\sigma_\omega > \sqrt{N}g_1$).

[1] M. Tavis and F. W. Cummings, Phys. Rev. **170**, 379 (1968).
[2] R. Houdre, R. P. Stanley and M. Ilegems, Phys. Rev. A **53**, 2711 (1996).

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