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Cavity Perturbation Technique: The Effects of Crystal Size on the EPR Spectra of Fe_8 Single-molecule Magnets[1] MUHANDIS SHIDDIQ, Dept. of Physics and NHMFL, Florida State University, Tallahassee, FL 32310, USA, CHRISTOPHER C. BEEDLE, NHMFL, Florida State University, Tallahassee, FL 32310, USA, STEPHEN HILL, Dept. of Physics and NHMFL, Florida State University, Tallahassee, FL 32310, USA — The Cavity Perturbation Technique (CPT) is a contact-free technique that measures the change of the characteristics of a cavity resonator upon the introduction of the sample. In this experiment, we study the effect of crystal size with regards to the CPT transmission spectra for a single crystal of the Fe_8 single-molecule magnets. It is interesting to study the interaction between these two resonance systems, i. e. a cavity and a crystal of Fe8. We want to know whether it is a quantum mechanical or a classical interaction. The frequency shift and suppression of the cavity Q value increase linearly with increasing sample size. These observations are in agreement with the theoretical expectation for a classical coupling between the Fe_8 crystal and the cavity. From cavity perturbation theory, these phenomena may be explained by the following classical formula: $\Delta\omega/\omega = -\beta\chi$, where ω is the complex frequency, β is the filling factor that depends on the sample volume and the resonant mode of the cavity, and χ is the complex susceptibility.

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