

Abstract Submitted
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Rydberg states via CPmmW spectroscopy YAN ZHOU, DAVID GRIMES, ROBERT FIELD, Massachusetts Inst of Tech-MIT — Rydberg-Rydberg transitions of Ca atoms are directly observed by chirped-pulse millimeter-wave spectroscopy, which is a form of broadband, high-resolution, free induction decay (FID) spectroscopy with accurate relative intensities. At moderate to high number densities ($\sim 10^6 \text{ cm}^{-3}$), interactions between many Rydberg atoms are mediated by an AC electric field, absorbing and radiating cooperatively. A semiclassical model describes several significant time-domain and frequency-domain cooperative effects in two-level systems and Λ -type three-level systems. Experimental evidence that supports this model will be discussed. A new experiment, employing the buffer gas cooling technique has been constructed and I expect to present preliminary results. In part, the >100 -fold increase in number density will permit study of “pure electronic” spectra of Rydberg molecules, such as BaF. We expect to produce 10^8 state selected core-nonpenetrating Rydberg molecules in a single pulse of a laser-laser-mm-wave excitation sequence.

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