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High resolution spectroscopy of Rydberg atom interactions[1] K.C. YOUNGE, A. REINHARD, P.R. BERMAN, G. RAITHEL, FOCUS Center and Department of Physics, University of Michigan — We present progress toward a direct spectroscopic measurement of the dipole-dipole and van der Waals interactions between Rydberg atoms excited from a cold gas. We have collected ^{85}Rb atoms in a broadband optical dipole trap (laser wavelength 1064nm) with a 15 micron FWHM diameter, and characterized the temperature, atom number, density, and size of the trapped sample using shadow imaging. The dipole trap will be employed to measure Rydberg-atom interactions using two independently tunable Rydberg excitation laser pulses. The first pulse is tuned to the interaction-free Rydberg excitation resonance; this pulse prepares a dilute gas of cold Rydberg atoms. The frequency of the second pulse is scanned relative to that of the first one, allowing us to map out the spectrum of energy-shifted collective states. In our poster, we will discuss methods and results, as well as potential applications in quantum information processing.

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