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Double-resonance spectroscopy of interacting Rydberg-atom systems AARON REINHARD, KELLY YOUNGE, TARA CUBEL-LIEBISCH, BRENTON KNUFFMAN, PAUL BERMAN, GEORG RAITHEL, The University of Michigan — Systems of cold Rydberg atoms provide an excellent platform for the study of many-body, collective phenomena. In this work, the energy level spectrum of a many-body system containing two shared, collective Rydberg excitations is measured using cold atoms in an optical dipole trap. Two pairs of independently tunable laser pulses are employed to spectroscopically probe the spectrum in a double-resonance excitation scheme. Depending on the magnitude of an applied electric field, the Rydberg-atom interactions can vary from resonant dipole-dipole to attractive or repulsive van der Waals, leading to characteristic signatures in the measured spectra. Our results agree with theoretical estimates of the magnitude and sign of the interactions.

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