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Computational Studies of Many-Body Interactions in Ultra-cold Rydberg Atom Samples of Various Geometries THOMAS J. CARROLL, Ursinus College, MICHAEL W. NOEL, Bryn Mawr College, CHRISTOPHER DANIEL, TIMOTHY SIDIE, Ursinus College — Ultra-cold highly-excited atoms in a magneto-optical trap (MOT) are strongly coupled by the dipole-dipole interaction. The effect of the spatial arrangement of a sample of Rydberg atoms on their interactions is a complex experimental question. We have developed a computational model of these systems in order to explore the importance of many-body effects, geometry, and energy level structure on the time evolution of the sample. The model simulates the time evolution of groups of Rydberg atoms in different geometric arrangements of atoms including amorphous, thin cylinder of excitation vs. thick, two closely spaced cylinders, and a crossed cylinder arrangement. Simulation results are presented for the time-dependence, peak widths, and interaction strengths for the different geometries while also varying the density of the atomic sample. Where possible, results are compared to experiment.

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