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Simulation of a strong van der Waals blockade in a dense ultracold gas[1] JESUS HERNANDEZ, FRANCIS ROBICHEAUX, Auburn University — We report on simulations involving the blockade effect on a dense ultracold gas. The blockade effect is seen when the interaction energy between two excited Rydberg atoms is large enough to shift the two-excitation state out of resonance. In this paper we investigate a system that exhibits a strong van der Waals blockade, where only one out of thousands of atoms can be excited per blockade volume. With such a high number of atoms blockaded, the collective oscillation rate of an ensemble of atoms is much faster than the single atom oscillation rate. We examine the effects of this high density and the effects of a non-uniform density distribution as commonly seen in a magneto-optical trap (MOT). We use three different models and compare them to recent experimental data. The agreement between theory and experiment, although qualitative, suggests the non-uniformity of the density within a blockade region presents a new challenge to theoretical models.

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Jesus Hernandez
Auburn University

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