

Abstract Submitted
for the SES15 Meeting of
The American Physical Society

Possible existence of van der Waals macrodimers JIANING HAN,
University of South Alabama — Few-body interactions offer the opportunity to study the isolated atom to few-body coupled molecules, and to condensed matter transitions. Atoms in molecules and in condensed matters are coupled by different orders of multipole-multipole interactions, which all stem from different orders of approximations from coulomb interactions between multiple charges. The lowest order multipole-multipole interaction is the dipole-dipole interaction, which is proportional to the size of the dipole. In this article, we use Rydberg atoms, which have more than 1000 times greater electric dipoles than the ground state atoms, to study the van der Waals interaction between few bodies. In addition to the large dipoles, the kinetic energy of the atoms is significantly reduced by reducing the temperature, which makes these interactions stable and observable. Here we report on the 2D and 3D few-body interaction potentials and possible ways of creating semistable molecules in such an ultracold Rydberg gas with a temperature of ≈ 100 nK. Although we use Rydberg atoms in this article, this calculation can be applied to other states too. The results reported here are useful for studying repulsive van der Waals interactions and creating ultracold molecules.

Jianing Han
University of South Alabama

Date submitted: 04 Sep 2015

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