Plenary Talk PV III Tue 8:30 B Audimax

Rydberg Dipole-Dipole Energy Transfer from 300K to 300μK

— •Thomas Gallagher — University of Virginia

A gedanken experiment, tuning the energy levels of two atoms to observe sharply resonant energy transfer, can be realized using Rydberg atoms, due to their large electric dipole moments. The dipole moments provide large Stark shifts, for tuning, and a strong coupling between the interacting atoms, allowing energy transfer to occur. The basic notions of these dipole-dipole interactions are illustrated by collision experiments with thermal, ˜300K, beams of atoms. Collisions with cross section σ˜109 Å2 and duration τ˜1 ns are observed, a time long enough that we can easily perturb the atoms during a collision. Reducing the temperature to ˜1 K, leads to even larger cross sections, but more interesting, to collisions of duration τ ˜1 μs, a time long enough that we can know when individual collisions start and end. The use of a magneto optical trap, with τ ˜ 300 μK, takes the atoms into a new regime, in which the atoms do not move on the 1 μs time scale of interest. The interactions are between static atoms, as in an amorphous solid. More generally, the strong dipole-dipole interactions of cold Rydberg atoms have suggested many fascinating new avenues of research.