DAMOP20-2020-000041

Abstract for an Invited Paper
for the DAMOP20 Meeting of
the American Physical Society

Quantum-mechanical studies of interactions with ultracold atoms and molecules[1]

SVETLANA KOTOCHIGOVA, Temple University

Laser cooling of atoms has enabled the production of diatomic molecules at a phase-space density that is sufficiently large for quantum degeneracy effects to be important. Extremely low temperatures have also allowed the confinement of these molecules in electric, magnetic, and optical traps, where they are isolated from their environment and can be carefully studied. A significant effort from the scientific community is now devoted to study the interactions and collisional dynamics between such molecules or with atoms. Here, I will describe our quantum simulations of collisions and reactivity of three- and four- atom systems by explicitly addressing individual ro-vibrational states. The choice of molecules is inspired by ongoing and planned US-based experiments. Quantum defect theory was also applied and leads to useful intuitive insights. Finally, we revisit time-dependent classical simulations to investigate collisions between non-reactive molecules in order to isolate the processes that lead to the severe limitations on the experimentally-observed lifetimes in optical dipole potentials.

[1]We acknowledge support from the ARO Grant No. W911NF-17-1-0563, AFOSR Grant No. FA9550- 14-1-0321 and the NSF Grant No. PHY-1619788.