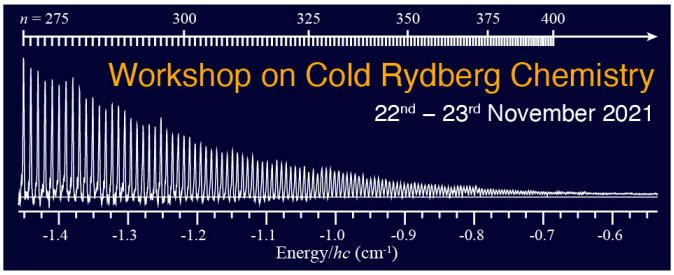

Contribution ID: **14** Type: **Hot topic**

Electrically-tuned Förster resonances in cold collisions of Rydberg-stated-selected helium atoms with ground-state ammonia molecules

Monday 22 November 2021 17:22 (7 minutes)

Collisions at low translational temperatures between atoms in Rydberg states with large electric dipole transition moments, and polar ground-state molecules represent an ideal setting to study Förster resonance energy transfer between electronic and nuclear degrees of freedom [1-4]. This type of atom-molecule interaction has applications, for example, in quantum sensing and coherent control [5-7]. Here we report intrabeam collision experiments with ground-state NH_3 molecules, and He atoms in triplet Rydberg states with principal quantum numbers, n, between 38 and 43. The pulsed supersonic beams used in this work were formed of NH_3 seeded in He at a ratio of 1:99. This resulted in a relative speed of the atoms and molecules in the moving frame of reference of $\sim$ 70 m/s, and hence relative collision energies approaching $E_{\rm kin}/k_{\rm B} \sim 1$ K. Electric fields of up to 8 V/cm were used to tune selected Rydberg-Rydberg transitions into resonance with the NH_3 inversion intervals. At the collision energies accessible in this work, the resonant energy transfer observed is dominated by dipole-dipole interactions between the atoms and molecules. The Förster resonance widths have been found to be strongly Rydberg-state dependent. This has been inferred by comparison of the experimental data with the results of numerical calculations of the Stark shifts, and electric-field-dependent transition dipole moments in the Rydberg states.

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