



**13<sup>th</sup> December 2012 - 10:00**  
**Building 99, Seminar Room II (EG)**

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### OH-NO Scattering at the Quantum Level

The study of rotational energy transfer in collisions between simple molecules is one of the most fundamental methods to acquire a detailed understanding of molecular interactions, and can reveal valuable insights into the dynamic behavior of larger chemical systems. Here, we report the measurement of state-resolved inelastic scattering cross sections for collisions between two open-shell molecules that are both prepared in a single quantum state. A beam of Stark-decelerated OH ( $X^2\Pi_{3/2}, v=0, j=3/2, f$ ) radicals is scattered with a beam of hexapole state-selected NO ( $X^2\Pi_{3/2}, v=0, j=1/2, f$ ) radicals in a crossed beam configuration. Rotationally and spin-orbit inelastic scattering cross sections are measured on an absolute scale for collision energies between 70 and 300  $\text{cm}^{-1}$ . These cross sections show fair agreement with quantum coupled-channels calculations using a set of coupled model potential energy surfaces based on ab initio calculations for the long-range nonadiabatic interactions and a simplistic short-range interaction.

In this experiment, typically a fraction  $10^{-4}$ - $10^{-1}$  of the Stark-decelerated OH radicals is inelastically scattered. To experimentally observe the scattered OH radicals, an ultra-sensitive laser-induced-fluorescence detection scheme is developed. This scheme has allowed us to identify the magnetic dipole transition ( $A^2\Sigma^+, v=1, N=0 \leftarrow X^2\Pi_{3/2}, v=0, j=3/2, f$ ) of OH. We will discuss how magnetic dipole transitions can affect state-to-state scattering experiments, and how we eliminate this severe source of background. The transition strength ratio between the magnetic and electric dipole transition is experimentally determined via Rabi spectroscopy in combination with an external magnetic field, and compared to theoretical predictions.

