ROAMING ATOMS: EXPLORING NOVEL REACTION MECHANISMS WITH HIGH-RESOLUTION IMAGING AND PHOTO-FRAGMENT EXCITATION SPECTROSCOPY.

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Recently, we have discovered a new mechanism of formaldehyde decomposition leading to molecular products CO and H_2, termed the roaming atom mechanism. Formaldehyde decomposition from the ground state via the roaming atom mechanism leads to rotationally cold CO and vibrationally hot H_2, whereas formaldehyde decomposition through the transition state (TS) leads to rotationally hot CO and vibrationally cold H_2. This discovery has shown that it is possible to have multiple pathways for a reaction leading to the same products with dramatically different product state distributions. Previously we have reported competition between dissociation via the roaming atom mechanism, dissociation through the TS and through simple bond fission (the radical channel). The threshold for dissociation through the TS and the radical channel is already known. It is now important to explore the threshold of roaming atom mechanism to improve understanding of branching between these channels and to understand the dynamics of the roaming mechanism. We will present recent results obtained from high-resolution DC slice imaging and photofragment excitation spectroscopy (PHOFEX) to investigate these issues.