

## MOLECULAR STRUCTURE AND DYNAMICS PROBED BY PHOTOIONIZATION OUT OF RYDBERG STATES

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Probing the structure of a molecule as a chemical reaction unfolds has been a long standing goal in chemical physics. Most spectroscopic and diffraction techniques work well when the molecules are cold and thus vibrational motion is minimized. Yet, the very ability of a molecule to undergo structural changes implies that a significant amount of energy resides within the molecule. In order to probe structures of even medium sized molecules on an ultrafast time scale a technique that is sensitive to the molecular structure, yet insensitive to the vibrational motion is required.

In our research we demonstrated that Rydberg electrons are remarkably sensitive to the molecular structure. Photoionization of a molecule out of Rydberg states reveals a purely electronic spectrum which is largely insensitive to vibrational motion. The talk illustrates how Rydberg electrons can serve as a probe for ultrafast structural dynamics in polyatomic molecules. The talk also demonstrates that photoionization through Rydberg states can be utilized for non-intrusive detection of polyatomic combustion intermediates in flames.