BASIS: BEAM ACTION SPECTROSCOPY VIA INELASTIC SCATTERING

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Rotational state distributions in a supersonic molecular beam are very sensitive to inelastic scattering within the beam. Recently we have demonstrated a new form of action spectroscopy that exploits this sensitivity as an indirect probe of energetic processes occurring within the beam.[a] Specifically, the pure rotational line intensities of a reporting molecule seeded in the molecular beam can be used as a 'virtual' bolometer for detecting processes as diverse as photolysis and vibrational excitation. We call this new technique Beam Action Spectroscopy via Inelastic Scattering (BASIS) and have used it in two distinctly different types of experiments carried out at UNCG and MIT, respectively. In the first, the UV photodissociation action spectrum of OClO is recovered by monitoring the pure rotational line intensity changes in OCS, co-expanded with the parent molecule. Previously unassigned vibrational structure in the region between 30,000-36,000 cm^{-1} is revealed. In the second experiment, the mid-IR spectrum of acetylene is recovered by similarly monitoring a pure rotational line of OCS. The BASIS technique should prove to be quite general and may be particularly useful when the excitation products are dark to conventional spectroscopic techniques.

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