ANION SLOW ELECTRON VELOCITY-MAP IMAGING (SEVI): APPLICATIONS TO SPECTROSCOPY AND DYNAMICS

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The principles and appliciations of anion slow electron velocity-map imaging (SEVI) are discussed. SEVI is a variant of photoelectron (PE) imaging in which mass-selected anions are photodetached at a set of wavelengths using a tunable laser source. The resulting photoelectrons are collected via velocity-map imaging (VMI) using relatively low extraction voltages, with the goal of selectively detecting slow electrons with high efficiency and enlarging their image on the detector. This technique offers photoelectron energy resolution of a few cm^{-1}, comparable to that of anion zero electron kinetic energy (ZEKE) spectroscopy, while retaining much of the versatility of conventional PE spectroscopy. The capability of SEVI is demonstrated with the study of the vibronic structure of various heteroatom-doped carbon species (C_nH, C_nO, C_nS and C_nN) as well as the van der Waals rare-gas oxide (RgO) clusters. The application of SEVI to the study of chemical reaction dynamics by the high-resolution mapping of bimolecular reactive potential energy surfaces is also discussed. Photodetachment of $Cl^-{\cdot}H_1$ and $Cl^-{\cdot}CH_4$ anions probes the shallow well at the entrance of the $Cl+H_2$ and $Cl+CH_4$ reactive surfaces, while SEVI of the $F^-{\cdot}H_2$ and $F^-{\cdot}H_4$ anions probes transition state structure in the $F+H_2$ and $F+CH_4$ reactions.