SLOW PHOTOELECTRON VELOCITY-MAP IMAGING SPECTROSCOPY

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A new technique recently developed in our lab, slow photoelectron velocity-map imaging (SEVI) spectroscopy, is presented. A tunable laser is used to photodetach anions slightly above the threshold and the resulting low kinetic energy electrons are collected using velocity-map imaging. The technique yields greatly improved resolution (up to 1 cm^{-1}) over conventional photoelectron spectroscopy, and the data-acquisition time is considerably shorter than anion-ZEKE. The ability of SEVI is demonstrated with the studies of carbon monohydrides ($C_{2n}H$ with n=1-3) where several new vibronic transitions on the two low-lying electronic states are resolved. SEVI has also been applied to high-resolution transition-state spectroscopy in the investigation of ClH_2^- and ClD_2^-, probing the shallow well at the entrance of the $Cl+H_2$ (D_2) reactive surface. The SEVI spectra showed clearly resolved features corresponding to the hindered-rotor motion of D_2 and the low frequency stretching vibration of the pre-reactive van der Waals cluster. Excellent agreement is found between the experimental result and the Franck-Condon simulations calculated from ab initio reactive potential energy surfaces.