EXPERIMENTAL INVESTIGATION OF THE DISSOCIATION MECHANISMS OF He$\cdots$ICl(B,v') VAN DER WAALS COMPLEXES

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Two-laser, pump-probe spectroscopy experiments reveal different dissociation pathways for He$\cdots$ICl(B,v') intermolecular levels. Weakly bound He$\cdots$I^{35}Cl(B,v'=3) complexes that are prepared with different quanta of intermolecular vibrational excitation are observed to undergo vibrational predissociation to yield predominantly I^{35}Cl(B,v'=2) products. The I^{35}Cl(B,v'=2) rotational product state distributions formed following the excitation of different intermolecular vibrational levels and rotational states are all bimodal. Less rotational excitation is found in the products when preparing He$\cdots$ICl(B,v') bending levels that preferentially sample the linear He$-$I$-$Cl and anti-linear I$-$Cl$-$He orientations than when preparing the lowest intermolecular vibrational energy level, which has a preferred T-shaped geometry. Additionally, linear He$\cdots$I^{35}Cl(B,v'=2) complexes undergo a direct dissociation mechanism when prepared above the He + I^{35}Cl(B,v'=2) dissociation limit. The I^{35}Cl(B,v'=2) products are formed with significantly less rotational excitation via this mechanism. Dynamical effects believed to be associated with tunneling through the centrifugal barrier are observed and result in highly non-statistical rotational distributions.