Photochemistry of dihalogen molecules in cryogenic solid parahydrogen

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Detailed studies of gas-phase reactions of halogen atoms with small molecules have explored the importance of shallow van der Waals wells in the entrance channel to reaction, the possibility of non-adiabatic chemistry, and the vibrational control of reactions. The photochemistry of dihalogens in rare gas solids have been studied to understand how the reaction dynamics are altered in a dissipative many-body condensed phase, with most recent studies focusing on the dihalogen nuclear quantum dynamics triggered by ultrashort laser pulses. In this talk, I will present recent studies of dihalogen (Cl_2 and Br_2) photochemistry in solid parahydrogen at liquid helium temperatures that reveal nearly no cage effect for photodissociation, illustrate how *in situ* photochemistry can be used to synthesize weakly bound pre-reactive complexes of the halogen atom (e.g., Br-HBr), and infrared induced tunneling reactions of Cl in solid H_2, HD, and D_2. The unique properties of low density cryogenic solid hydrogen make it an excellent host for photochemical studies and these specific advantages with be discussed throughout the talk.