ROVIBRATIONAL SATELLITE BANDS OF THE Br SPIN-ORBIT TRANSITION IN Br DOPED SOLID PARAHYDROGEN

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In the isolated atom the Br spin-orbit (SO) transition is electric-dipole-forbidden because this transition ($^2P_{1/2} \leftarrow ^2P_{3/2}$) does not involve a change in parity. The isolated Br SO transition therefore acquires intensity from magnetic-dipole and electric-quadrupole terms in the atom-field interaction Hamiltonian and this makes this transition inherently weak. Nonetheless, the Br SO transition is observed in Br-atom doped solid parahydrogen (pH_2) crystals prepared at liquid helium temperatures. It will be shown that the intensity of the Br SO transition is greater when isolated in solid pH_2 due to weak intermolecular interactions of the Br atom with the pH_2 matrix. The small increase in the Br SO transition strength results because the Br atom resides in a single substitution site of the hexagonal closed packed pH_2 crystal which lacks a center of inversion. In addition, a vibrational satellite absorption is detected shifted to higher energy by one quantum of H_2 vibration. This vibrational satellite absorption is stronger than the pure SO transition because simultaneous excitation of the Br SO and H_2 vibrational excitation in the pair gives even greater electric-dipole character to the transition. IR spectral evidence for rotational, vibrational, and rovibrational satellite bands of the Br SO transition will be presented. The fact that the rotational and vibrational quantum states of the H_2 molecule are conserved in solid pH_2 accounts for why these satellite absorptions come at well-defined discrete frequencies. The frequencies and lineshapes of these satellite absorptions provide detailed information on the SO state dependent Br-H_2 intermolecular potential.