ENERGY-LEVEL-CLUSTER RELATED NUCLEAR-SPIN EFFECTS AND SUPER-HYPERFINE SPECTRAL PATTERNS: HOW MOLECULES DO SELF-NMR

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At several points in his defining works on molecular spectroscopy, Herzberg notes that "because nuclear moments ... are so very slight ... transitions between species ... are very strictly forbidden..." Herzbergs most recent statement of such selection rules pertained to spherical top spin-species[a].

It has since been shown that spherical top species (as well as those of lower symmetry molecules) converge exponentially with momentum quanta J and K to degenerate level clusters wherein even "very slight" nuclear fields and moments cause pervasive resonance and total spin species mixing[b]. Ultra-high resolution spectra of Borde, et .al [c] and Pfister et .al[de] shows how SF_6 and SiF_4 Fluorine nuclear spin levels rearrange from total-spin multiplets to NMR-like patterns as their superfine structure converges.

Similar super-hyperfine effects are anticipated for lower symmetry molecules exhibiting converging superfine level-clusters. Examples include PH_3 molecules[f] and asymmetric tops. Following this we consider models that treat nuclear spins as coupled rotors undergoing generalized Hund-case transitions from spin-lab-momentum coupling to various spin-rotor correlations.

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