Angular Momentum in Chemistry

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Dedicated to Prof. Helgard G. Raubenheimer on the occassion of his 65th birthday

Noting that current chemical theory is based almost exclusively on electronic energy and spin variables the equal importance of orbital angular momentum is explored in this paper. From its classical definition the angular momentum of electrons in an atom is shown to obey Laplace's equation, which automatically leads to discrete values in terms of spherical harmonics. This analysis assumes a continuous distribution of electronic charge, which resembles a fluid at equilibrium. It serves to elucidate the success and failure of Bohr's conjecture and the origin of wave-particle duality. Applied to atoms, minimization of orbital angular momentum leads to Hund's rules. The orientation of angular momenta in lower-symmetry molecular environments follows from the well-known Jahn-Teller theorem.

Key words: Bohr Conjecture, Laplace's Equation