Electron Paramagnetic Resonance (EPR): Principles and Applications

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Electron Paramagnetic Resonance (EPR) is a spectroscopic technique used to determine the structure, spatial distribution, and dynamics of paramagnetic species. These species, which contain at least one unpaired electron, often play a crucial role in chemistry. Compounds containing transition metals are important catalysts, and radical intermediates are frequently involved in organic reactions and electron transfer processes. In nature, metalloenzymes are characterized by the presence of paramagnetic centers, and radical species play a central role in photosynthetic and energy conversion processes. In solid systems, defect centers and paramagnetic impurities influence the magnetic, optical, and electronic properties of materials.
In all these contexts, EPR spectroscopy and associated techniques like ENDOR (Electron Nuclear Double Resonance) and ESEEM (Electron Spin Echo Envelope Modulation) provide highly detailed information about the electronic structure, as magnetic parameters are directly correlated with the electronic wavefunction and the configuration of nearby magnetic nuclei.
These series of lectures will cover the basic applications and an introduction to advanced EPR techniques. Practical sessions on a Bruker EMX Nano spectrometer will also be offered. The lectures will briefly introduce the principles of the technique and showcase its capabilities through examples involving inorganic and bioinorganic systems.