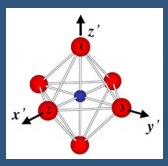
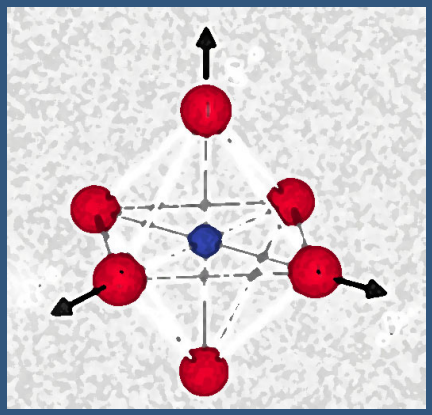
Materials Physics





Introduction

The interplay of crystal structure, charge, orbital, and spin degrees of freedom create complex while intriguing physical properties of strongly correlated systems. A research group led by L.-H. Tjeng discovered that orbital quen-ching in $LaTiO_3$ is actually due to strong local crystal field splitting, rather the previously proposed novel orbital liquid state, or strong orbital fluctuation. Their conclusion stems from a combination of X-ray absorption at Ti *L*-edge, spin polarized photoemission, as well as theoretical calculation. It was discovered recently that Na_xCoO_2 reveals superconductivity when intercalating with H_2O. The compound has layer structure similar to HTSC but with triangular lattice. Using polarization dependent soft X-ray absorption spectroscopy at O *K*-edge and Co *L*-edge, Huang *et al.*, found that Na_xCoO_2 exhibits strong electron correlation with a charge transfer character rather than a Mott-Hubbard character, answering previously unresolved issues. Dilute magnetic semiconductors have great potential to be the major materials for future spintronics. One of the key issues is if the ferromagnetism is due to magnetic ions replacing host cations. Pong *et al.*, combined techniques of XRD, EXAFS, XANES, XMCD, and SPEM on $Zn_{1-x}Co_xO$ to show that Co indeed replaces Zn. They conclude that the ferromagnetism of $Zn_{1-x}Co_xO$ nanorods is strongly associated with the transfer of electrons from *deep* defect states near/below E_f to valence-band Co 3*d* orbitals, which induces spin-spin interactions between Co ions. The electronic structure of various phases of H_2O solids and its hydrogen bonding under high pressure and low temperature is essential for understanding the icy planetary interiors. Cai *et al.*, utilize the powerful hard X-ray Raman Scattering at the Taiwan Contract Beamline at SPring-8 to measure the O *K*-edge excitation under extreme conditions to study the hydrogen bond ordering. Their experiment discovered a possible new phase of ice at low temperature.