

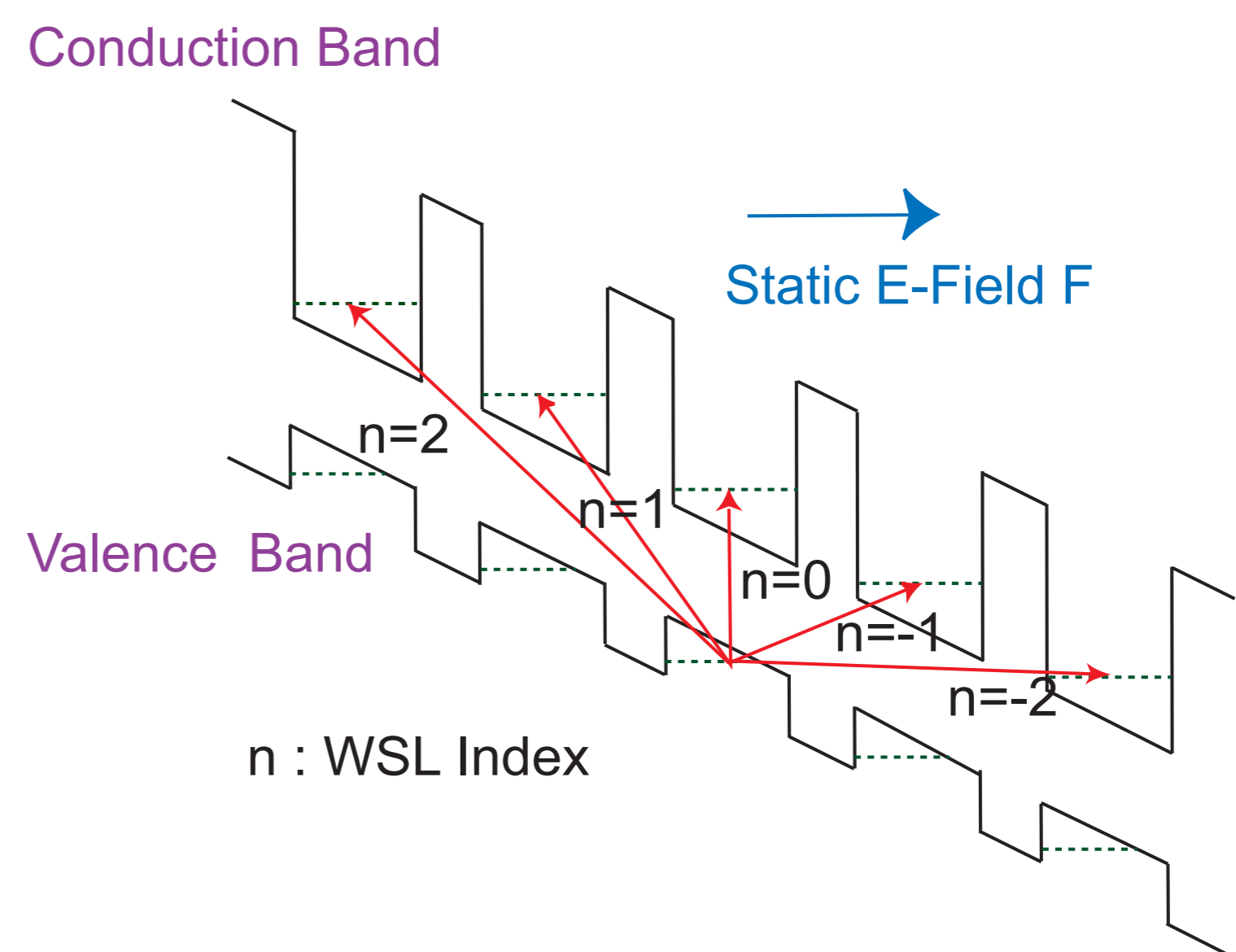


Miscellaneous Simulations in Materials Science

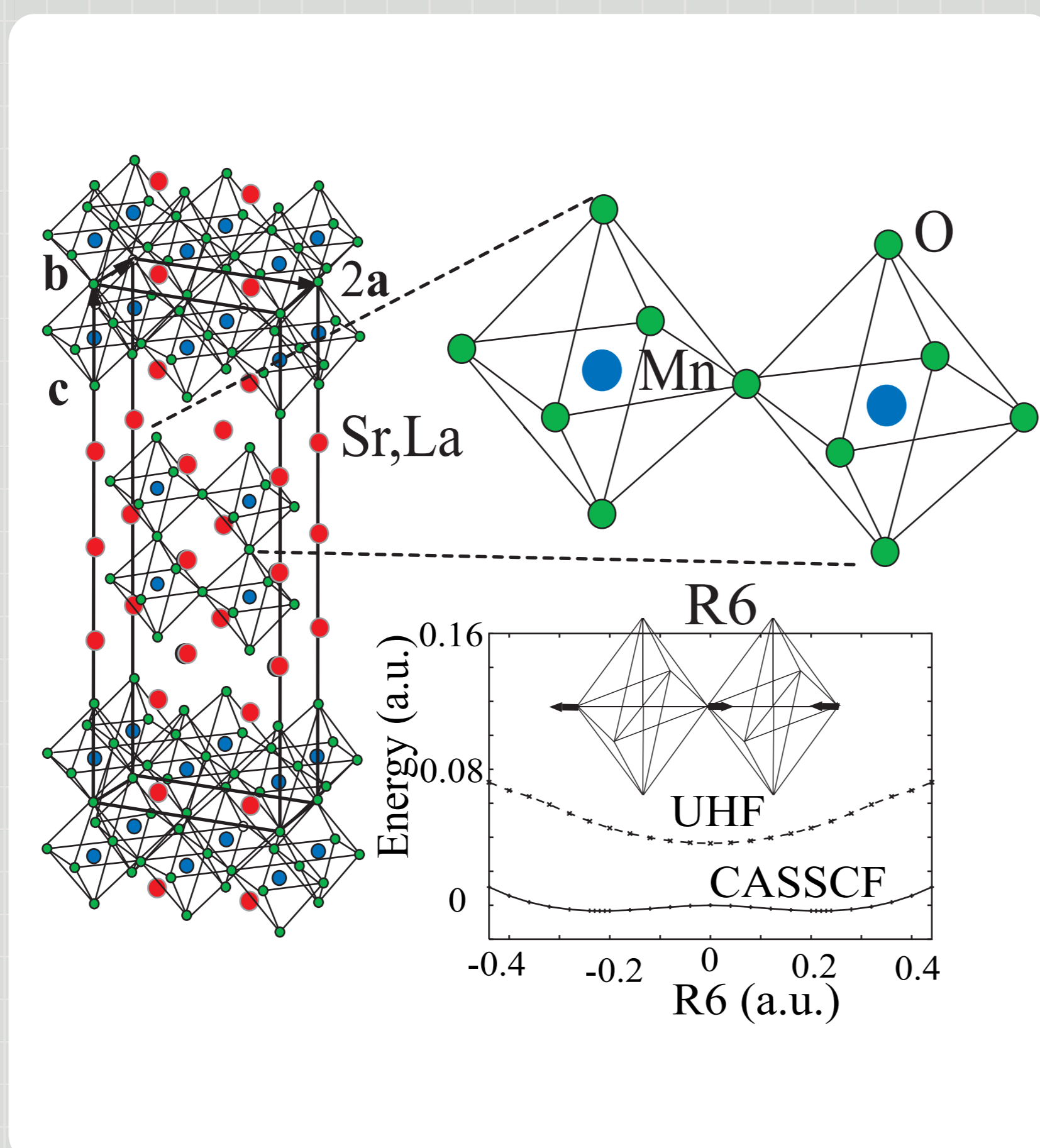
Nonlinear Optical Responses of Semiconductor Wannier-Stark Ladder (WSL)

- Non-linear optical phenomena ascribable to the WSL exciton are studied. An **asymmetric Autler-Townes doublet**, characteristic of excitonic Fano resonance, manifests itself in transient four wave mixing spectra. Moreover, an optically coherent control of electronic states of WSL in terms of a combination of laser parameters with strength of the bias allows one to be accessible to the novel effect of **the dynamic charge localization and delocalization**, which is found further enriched by the Zener resonance of WSL.

Schematic Diagram of WSL



Colossal Magnetoresistive Manganite



- Some manganites show a remarkable reduction of resistance in a magnetic field called, "**colossal magnetoresistance (CMR) effect**". The detailed mechanism of the CMR is still not known, but strong electron correlations and strong electron-lattice interaction are thought to be very important. We have been doing molecular orbital cluster calculations on the manganites to take into account the strong electron correlations. It was found that this system has local lattice instabilities to form **small polarons**, and the electron correlation is crucial for their formation.