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*Theoretical studies of oxide heterostructures*

In 2004, Ohtomo and Hwang find a metallic interface with high carrier mobility between two insulating perovskite oxides  $\text{LaAlO}_3$  (LAO) and  $\text{SrTiO}_3$  (STO). This interface continues to attract much attention with reports that it can be conducting, strong spin-orbit coupled, magnetic or even superconducting. In contrast to the striking experimental observations, the physical origin of this metallic behavior is still the subject of intense debate. Two types of doping mechanisms are proposed to account for the conducting behavior: pure charge transfer or the creation of oxygen vacancies and other defects. There is experimental support for both mechanisms but some critical evidence is also missing. In this talk I will present a single framework that can naturally reconcile these two doping mechanisms, as well as the corresponding experimental evidence.

In addition, I will present our theory of spin-orbit coupling (SOC) at LAO interfaces and STO surfaces. We find that LAO/STO has peculiar SOC properties arising from the multiorbitals character which are absent in the standard single-band description as for the nearly free two dimensional electron gas in semiconductor heterostructures.

Host:  
Prof. Evgeny Tsybal  
Department of  
Physics & Astronomy

**Monday, March 25—2:30 pm**  
**Room 145 Jorgensen Hall**

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