

Abstract Submitted  
for the MAR14 Meeting of  
The American Physical Society

**Electric Field Tuning of the Rashba splitting in  $d$ -electron systems**

SHANAVAS VEEDU, SASHI SATPATHY, Univ of Missouri - Columbia — It has been found that the Rashba spin splitting is proportional to the electric field so that one can manipulate the electron spin through electric fields leading to potential applications in spintronics devices. Theoretical models based on phenomenological and symmetry arguments have been successful in reproducing the effects, but a complete understanding for  $d$  orbital systems is still lacking. Using tight-binding Hamiltonian approaches, we show that the effect can be understood by treating the electric field as a perturbation that leads to mixing of  $p$  and  $f$  states with  $d$  orbitals which can be shown to result in effective Hamiltonians of the Rashba type. We also propose a recipe for deriving the Hamiltonian terms using Gaunt coefficients for general lattice and orbital configurations. We have tested our predictions with density functional theory based calculations for various  $3d$  and  $5d$  systems. In the case of the perovskite oxide surface of  $\text{KTaO}_3$ , we find that Rashba effect originates from the first few layers near the surface and can be altered by moving the 2DEG in and out of the surface using applied fields and the model agrees well with the calculations.

Shanavas Veedu  
Univ of Missouri - Columbia

Date submitted: 15 Nov 2013

Electronic form version 1.4