Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Competing electronic ground states in $(LaAlO_3)_M/(SrTiO_3)_N(111)$ and $(LaAlO_3)_M/(LaNiO_3)_N(111)$ quantum wells[1] DAVID DOENNIG, University of Munich, WARREN E. PICKETT, University of California, Davis, ROSSITZA PENTCHEVA, University of Munich — Complex oxide heterostructures exhibit a broad variability of functional properties and electronic states, not available in the bulk. Beyond the much studied (001)-oriented systems, here we highlight theoretical results on (111) perovskite superlattices with and without a polar discontinuity. Density functional theory calculations including an on-site Coulomb repulsion term (GGA+U) reveal a rich set of competing ground states in $(LaAlO_3)_M/(SrTiO_3)_N(111)$ [1] and $(LaAlO_3)_M/(LaNiO_3)_N(111)$ superlattices ranging from spin, orbitally polarized, Dirac point Fermi surface to charge ordered flat band phases. For the bilayer (N =2), forming a buckled honeycomb lattice, a Dirac-point Fermi surface is obtained in both cases, while symmetry breaking leads to band gap opening with two inequivalent interfaces. Orbital reconstructions and metal-to-insulator transitions show a pronounced sensitivity on the thickness of the quantum well N and in-plane strain.

[1] D. Doennig, W. E. Pickett, and R. Pentcheva, Phys. Rev. Lett. **111**, 126804 (2013).

[1]Funding by DFG SFB/TR80, project C3 is acknowledged.

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Date submitted: 15 Nov 2013 Electronic form version 1.4