Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Controlling spin-orbital and electronic structure in iridate thin films and heterostructures JIAN LIU, JIUN-HAW CHU, CLAUDY RAYAN SERRAO, DI YI, XAVI MARTI, RAMAMOORTHY RAMESH, UC Berkeley —
Epitaxial thin films and heterostructures have been showed to be a versatile platform for tuning the Mott physics and inducing novel phase in complex oxides with $3d$ transition metal elements. The strong spin-orbit coupling in $5d$ transition metal oxides adds a new dimension to this area and attracts strong interests since many theoretical proposals have been put forward for unconventional electronic, magnetic and topological phases. While the combination of correlation and spin-orbit coupling holds huge potential for appealing quantum states and functionalities, the fundamental challenge of realizing experimental manipulation on the spin-orbitals of the d-electrons and modulation on the resulting electronic structure has yet to be addressed. Here we report our study on gaining possible control on these spin-orbitals by epitaxial layering. We take perovskite $SrIrO_3$ as a model system of $5d$ complex oxides and investigate its response to heteroepitaxial strain. Results from x-ray spectroscopy, optical spectroscopy and transport measurements demonstrate that epitaxial constrain offers a unique pathway to tuning the spin-orbit coupling, its interaction with the ligand field, and the macroscopic electronic properties.

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Date submitted: 14 Nov 2013 Electronic form version 1.4