Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Valley-Exciton Locked Optical Selection Rule in Monolayer WS2
JUN XIAO, ZILIANG YE, YING WANG, YUAN WANG, XIANG ZHANG, UC Berkeley — Layered transition metal dichalcogenide (TMDC) with hexagonal lattice structure has six valleys at corners of the Brillouin zone. The nontrivial Berry curvature distribution renders the adjacent valleys with distinguishable valley angular momentum, which enables itself as an ideal 2D valleytronic platform. Recent studies reported strong excitonic effect in monolayer WS2 and each excitonic state is identified with a well-defined orbital angular momentum, however the anticipated selection rules involve nonlinear optical processes are not clear. Here we show valley angular momentum (VAM) together with exciton angular momentum (EAM) impose different valley-exciton locked selection rules for second harmonic generation (SHG) and two photon luminescence (TPL) in monolayer WS2. Moreover, the two-photon induced valley populations yield net circular polarized photoluminescence after a sub-ps interexciton relaxation. The work demonstrates a new approach to control valley population at different excitonic states for next generation of optical circuits and quantum information computing.

JUN XIAO
UC Berkeley

Date submitted: 13 Nov 2014 Electronic form version 1.4