Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

**Coherent and incoherent coupling dynamics between neutral and charged excitons in monolayer MoSe2**[1] LIXIANG XU, KAI HAO, Univ of Texas, Austin, PHILIPP NAGLER, Univ of Regensburg, AKSHAY SINGH, KHA TRAN, CHANDRIKER KAVIR DASS, Univ of Texas, Austin, CHRISTIAN SCHULLER, Univ of Regensburg, TOBIAS KORN, XIAOQIN LI, Univ of Texas, Austin, GALAN MOODY, NIST — The optical properties of semiconducting transition metal dichalcogenides are dominated by both neutral excitons (electron-hole pairs) and charged excitons (trions) that are stable even at room temperature. While trions directly influence charge transport properties in optoelectronic devices, excitons may be relevant through exciton-trion coupling and conversion phenomena. In this work, we reveal the coherent and incoherent nature of exciton-trion coupling and the relevant time scales in monolayer MoSe2 using optical two-dimensional coherent spectroscopy. Coherent interaction between excitons and trions is definitively identified as quantum beating of cross peaks in the spectra that persists for a few hundred femtoseconds. For longer times up to 10 ps, surprisingly, the relative intensity of the cross peaks increases, which is attributed to incoherent energy transfer likely due to phonon-assisted up-conversion and down-conversion processes that are efficient even at cryogenic temperature.

[1]NSF, DOE

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Date submitted: 11 Nov 2016 Electronic form version 1.4