Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Splitting between Bright and Dark Excitons in Transition Metal Dichalcogenide Monolayers IANN GERBER, JUAN PABLO ECHEVERRY, BERNHARD URBASZEK, THIERRY AMAND, CEDRIC ROBERT, XAVIER MARIE, Universite Federale de Toulouse Midi Pyrenees, INSA-CNRS-UPS, LPCNO — The optical properties of transition metal dichalcogenide monolayers such as the two-dimensional semiconductors MoS_2 and WSe_2 are dominated by excitons, Coulomb bound electron-hole pairs [1]. The light emission yield depends on whether the electron-hole transitions are optically allowed (bright) or forbidden (dark). By solving the Bethe-Salpeter equation on top of GW wave functions in density functional theory calculations, we determine the sign and amplitude of the splitting between bright and dark exciton states. We evaluate the influence of the spin-orbit coupling on the optical spectra and clearly demonstrate the strong impact of the intra-valley Coulomb exchange term on the dark-bright exciton fine structure splitting [2].This paves the way for spin-orbit-engineering in $Mo_{(1-x)}W_xSe_2$ alloy monolayers for optoelectronics and applications based on spin- and valley-control [3]. [1] G. Wang et al , Phys. Rev. Lett. **114**, 097403 (2015). [2] J. P. Echeverry et al, Phys. Rev. B **93**, 121107(R) (2016). [3] G. Wang et al, Nat. Commun. **6**, 10110 (2015).

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Date submitted: 26 Sep 2016 Electronic form version 1.4