Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Quantum State Transfer Between Valley and Photon Qubits MING-JAY YANG, YU-SHU WU, HAN-YING PENG, Natl Tsing Hua Univ, NEIL NA, Artilux Inc. — Quantum state transfer (QST) between valley and photon qubit is presented for the application of quantum communication. This QST is analogous to spin-photon QST [1], and is based on the electron-photon interaction in 2D hexagonal materials that obeys an unique optical transition selection rule, the electron valley – photon polarization correspondence [2]. A generic proposal involving two optical cavities is introduced. The incoming photon carrying quantum information in its polarization enters the first cavity to interact and become entangled with the valley qubit. It is then followed by a measurement performed on the polarization of the photon exiting the second cavity to un-entangle the both qubits and transfer the information to the valley qubit. A quantum-mechanical wave equation-based analysis is performed, and analytical expressions are derived for the two important figures of merits that characterize the transfer, yield and fidelity. In conclusion, the study suggests that the unique valley-polarization correspondence in 2D hexagonal materials can be exploited to achieve valley-photon QST with promising yield and high fidelity.[1] H. Kosaka et al., Phys. Rev. Lett. 100, 096602 (2008). [2] G. Y. Wu et al., Phys. Rev. B 86, 045456 (2012).

Ming-Jay Yang
Natl Tsing Hua Univ

Date submitted: 31 Dec 2016 Electronic form version 1.4