Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Hidden symmetry and enhanced Rudermann-Kittel-Kasuya-Yosida interaction in P-N junctions of two-dimensional materials[1] WEN YANG, SHUHUI ZHANG, 1Beijing Computational Science Research Center, Beijing 100094, China, JIAJI ZHU, Institute for quantum information and spintronics, College of Science, Chongqing University of Posts and Telecommunications, Chongqing 400065, China, KAI CHANG, SKLSM, Institute of Semiconductors, Chinese Academy of Sciences, P.O. Box 912, Beijing 100083, China — Correlation between magnetic atoms (spins) in non-magnetic two-dimensional (2D) systems and materials is one of the central issues in condensed matter physics. Engineering this correlation relies heavily on the carrier-mediated Rudermann-Kittel- Kasuya-Yosida (RKKY) interaction. However, tailoring and direct detection of spin-spin correlation has been limited to spins separated by a few nanometers due to the rapid $1/R^2$ decay of RKKY interaction with inter-spin distance R. Here we reveal a hidden symmetry – absent from the Hamiltonian – in planar P-N junctions, which could qualitatively change the spatial scaling of various response functions in a wide range of 2D systems and materials. In particular, it allows RKKY interaction to attain $1/R$ decay, the slowest decay in extended systems. This dramatically enhances RKKY interaction and enables long-range correlation between distant spins, with applications in nanoscale magnetism, spintronics, and solid-state quantum computation.

[1]This work was supported by the MOST (Grant No. 2015CB921503, and No. 2014CB848700) and NSFC (Grant No. 11434010, No. 11274036, No. 11322542, and No. 11404043).

Wen Yang
1Beijing Computational Science Research Center, Beijing 100094, China

Date submitted: 03 Nov 2015 Electronic form version 1.4