Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Skyrmion defects of antiferromagnet and its competing singlet states in a Kondo-Heisenberg model CHIA-CHUAN LIU, Department of Physics and Astronomy, Rice University, PALLAB GOSWAMI, Condensed Matter Theory Center, University of Maryland, QIMIAO SI, Department of Physics and Astronomy, Rice University — The competition between antiferromagnetism and a variety of proximate paramagnetic spin-singlet states is a common feature for many heavy fermion compounds, and has been discussed in the proposed global phase diagram [1]. It is important yet a challenging problem to develop a general scheme to access the paramagnetic, spin singlet states from the antiferromagnetically ordered side, and vice versa. In this work, we study the problem on a honeycomb lattice by starting from the Kondo-destroyed antiferromagnetic phase. Here, the local moment is represented by a non-linear sigma model field, whose topological defects are known to induce the singlet orders based on a perturbative gradient expansion [2]. By solving low energy effective Dirac Hamiltonian in the skyrmion background, we identify the singlet orders through an enhanced correlations in the corresponding channels. In the Kondo lattice model, we find two leading singlet channels, one in the spin Peierls and the other in the Kondo singlet. The relative stability of the Kondo singlet and spin Peierls channels is tuned by varying the Kondo coupling. Our results provide new insight into the global phase diagram of the heavy fermion systems. **References:** [1] Q. Si, Phys. Status Solidi 247, 476 (2010); Physica B 378, 23 (2006). [2] P. Goswami and Q. Si, Phys. Rev. B **89**, 045124 (2014).

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Date submitted: 17 Nov 2016 Electronic form version 1.4