Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Competing quantum phases in the K_1-K_2 Kitaev model on the honeycomb lattice JOHANNES REUTHER, Free University Berlin, RONNY THOMALE, University of Würzburg, STEPHAN RACHEL, Technical University Dresden — The Kitaev-spin model on the honeycomb lattice has attracted enormous interest in recent years as an exactly solvable 2D spin system. Research in this field has been fueled by the possibility to realize the Kitaev model in strongly spin-orbit coupled iridate compounds of the form A_2IrO_3. In these materials the bond-dependent spin anisotropies of the Kitaev model are provided by spin-orbit entangled Kramers doublets. Experimental as well as theoretical investigations indicate that second neighbor honeycomb interactions are not necessarily small, which particularly applies to the second neighbor Kitaev exchange. We study the K_1-K_2 Kitaev model on the honeycomb lattice with nearest neighbor and second neighbor Kitaev couplings K_1 and K_2, respectively. Using a pseudo-fermion functional renormalization group approach for spin systems we map out the entire phase diagram of this model, allowing both couplings to be positive and negative. Aside from Kitaev-spin liquid phases at $K_2 = 0$ we find spin chain-like phases at $K_1 = 0$ where correlations only take place along effective 1D chains. Away from these special points we identify four different types of magnetic phases with collinear orders which retain a clear 1D character in large parts of the phase diagram.

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Date submitted: 12 Nov 2014 Electronic form version 1.4