Dear Editors,

We are submitting our manuscript entitled “Comprehensive study of the global phase diagram of the J-K-\Gamma model on a triangular lattice” for your consideration in Physical Review X.

In recent years, the Kitaev magnetism in which the Kitaev interaction plays an essential role has attracted a lot of interest. The generic model to describe these real materials is the so-called J-K-Г model defined on the honeycomb lattice, which also contains the Heisenberg and off-diagonal Г interactions besides the Kitaev interaction. Thus, in order to understand the exotic physical phenomena observed in real materials and search for the Kitaev spin liquid, there is growing interest in the J-K-Г model. In fact, the J-K-Г model can naturally be generalized to the triangular lattice. Though a previous study has map out its classical phase diagram, the study on the effects of quantum fluctuations on the global J-K-Г phase diagram is still scarce. In particular, since no exact solution has been reported so far for the pure Kitaev and models on the triangular lattice, it also remains conceptually interesting to investigate whether QSL states could exist as possible ground states due to quantum fluctuations introduced by these exchange-frustrated interactions. Moreover, recent experimental progress in the research of triangular-lattice magnetic materials with exchange frustrations also calls for a detailed study of the triangular J-K-Г model.

In this paper, we provide a study of the triangular-lattice J-K-Г model in its full parameter space using a combination of the exact diagonalization, classical Monte Carlo and analytic methods, with an emphasis on the effects of the Г term. We believe it is the first comprehensive and extensive study of the J-K-Г model on the triangular lattice. We find that there are five quantum phases in the limit of Г=0. Due to the introduction of the Г term, five new phases emerge including two ferromagnetic phases, one stripe, one modulated stripe and a possible Z2 quantum spin liquid. We also elaborate that the pure Г model has a ferromagnetic ground state and the antiferromagnetic Kitaev model a stripe ground state, which are selected by the order-by-disorder mechanism from the degenerate classical ground states. Our study paves the way for future studies of a large group of triangular transition-metal materials with an appreciable spin-orbit coupling and electronic correlations, which is a rapid growing field currently.

Therefore, we believe this work will draw a broad readership of Physical Review X. We hope you share our excitement in these results and would appreciate your consideration of this manuscript for initiating the peer-review process.

Yours sincerely,

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