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Magnetism in $S = 1/2$ Double Perovskites with Strong Spin-Orbit Interactions HIROAKI ISHIZUKA, LEON BALENTS, University of California, Santa Barbara — Motivated by recent studies on heavy-element double-perovskite (DP) compounds, we theoretically studied spin models on a FCC lattice with anisotropic interactions. In these systems, competition/cooperation of spin, orbital, and the lattice degrees of freedoms in the presence of the strong-spin orbit coupling is of particular interest. In a previous theoretical study, the magnetic phase diagrams of DP compounds with $5d_1$ electron configuration was studied using a model with four-fold degenerated single-ion state. On the other hand, a recent experiment on a DP material, $Ba_2Na_2OsO_6$, reported that the compound is likely to be an effective $S = 1/2$ magnet. Inspired by the experimental observation, we considered spin models with symmetry-allowed anisotropic nearest-neighbor interactions. By a combination of various analytical and numerical techniques, we present the magnetic phase diagram of the model and the effect of thermal and quantum fluctuations. In particular, we show that fluctuations induce $\langle 110 \rangle$ anisotropy of magnetic moments. We also discuss a possible "nematic" phase driven by spin-phonon couplings.

[1] H. Ishizuka and L. Balents, accepted for publication in PRB.

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