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**The low-energy magnetic excitations of a three-band Hubbard model with a strong spin-orbit coupling for 5d transition metal oxide $Sr_2IrO_4$** TOMONORI SHIRAKAWA, HIROSHI WATANABE, SEIJI YUNOKI, Computational Condensed Matter Physics Laboratory, RIKEN ASI — $5d$ transition metal oxides in a layered perovskite structure such as $Sr_2IrO_4$ have attracted much attention because of their unique properties caused by a strong relativistic spin-orbit coupling of $5d$ transition element. Recent experiments on $Sr_2IrO_4$ have revealed that the low-energy magnetic excitations can be described by an "isospin"-1/2 Heisenberg model with an effective exchange interaction as large as $\sim$ 60-100 meV. Motivated by these experiments, we study theoretically the ground state magnetic structure and the low-energy magnetic excitations for $Sr_2IrO_4$ using a three-band Hubbard model with the spin-orbit coupling. Our results demonstrate that the low-energy magnetic excitations are well described by an effective antiferromagnetic Heisenberg model composed of a local Kramers doublet. The estimated value of the effective exchange interaction is as large as 79 meV, which is in good quantitative agreement with the experiments.

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