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Theoretical investigation of the magnetic dynamics and superconducting pairing symmetry in α-$RuCl_3$[1] WEI WANG, ZHAO-YANG DONG, SHUN-LI YU, JIAN-XIN LI, Nanjing Univ — We study the spin-wave excitations in α-$RuCl_3$ by the spin-wave theory. Starting from the five-orbital Hubbard model and the perturbation theory, we derive an effective isospin-1/2 model in the large Hubbard (U) limit. Based on the energy-band structure calculated from the first-principle method, we find that the effective model can be further reduced to the $K-\Gamma$ model containing a ferromagnetic nearest-neighbor (NN) Kitaev interaction (K) and a NN off-diagonal exchange interaction (Γ). With the spin-wave theory, we find that the $K-\Gamma$ model can give magnetic excitations which is consistent with the recent neutron scattering experiments. Furthermore, to investigate various particle-hole excitations and possible superconducting pairing symmetry in the doped systems, we ignore the effects of the e_g orbitals and use the random-phase approximation. Our results show that the $J_{\text{eff}} = 1/2$ picture is robust in the doped systems, and the d-wave pairing is the most favourable superconducting pairing symmetry.

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