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Effective J_1-J_2 model for the spin wave in the superconducting $(Tl, Rb)_2Fe_4Se_5$ SONGXUE CHI, FENG YE, Quantum Condensed Matter Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA, WEI BAO, Department of Physics, Renmin University of China, Beijing, 100872, China, ANDREI T. SAVICI, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA, MATTHEW B. STONE, Quantum Condensed Matter Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA, RANDY S. FISHMAN, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA, H.D. WANG, C.H. DONG, MINGHU FANG, Department of Physics, Zhejiang University, Hangzhou 310027, China — Spin wave excitations in the superconducting state of $(Tl, Rb)_2Fe_4Se_5$ were determined by inelastic neutron scattering measurements. Four doubly degenerate spin wave branches, one gapped acoustic and 3 optical, span an energy range of about 210 meV. The spin wave spectra were successfully described by a J_1-J_2 Heisenberg model which includes the in-plane nearest (J_1 and J_1'), next nearest neighbor (J_2 and J_2') interactions within and between the 4-spin blocks, inter-plane interaction (J_c) and a single-ion anisotropy. The exchange coupling constants obtained indicate that the spin block order verges on a noncollinear in-plane-spin phase observed in $Tl_2Fe_4Se_5$.

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