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Gapless magnetic excitation from quantum antiferromagnetic chains with strong spin-orbit coupling

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We report Raman-scattering and magnetic susceptibility measurements of Ba₅CuIr₃O₁₂ single crystals to explore its low-energy magnetic excitation. No magnetic ordering occurs down to 1.8K. We observe a gapless magnetic excitation, peaked at 150cm⁻¹ with a FWHM of 200cm⁻¹, which has A₁ symmetry of C_{3v} group and only appears when the system is excited along the chain direction. The static Raman susceptibility of this magnetic excitation increases from 300K to 50K, but decreases below 50K. The static magnetic susceptibility, on the contrary, increases on cooling below 50K. The low-energy Raman response at 12K obeys a cubic power law, indicating that the quasiparticle dispersion is gapless and linear near the Gamma point. This magnetic excitation probably comes from two-spinon scattering by virtue of strong spin-orbit coupling. Assuming two-spinon scattering, the exchange interaction J is estimated to be about 90cm⁻¹ (11meV).