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Excitation spectra of the spin-1/2 triangular-lattice Heisenberg antiferromagnet RAJIV R. P. SINGH, University of California at Davis, WEI-HONG ZHENG, University of New South Wales, JOHN FJæRESTAD, ROSS MCKENZIE, University of Queensland, RADU COLDEA, University of Bristol — We use series expansion methods to calculate the dispersion relation of the one-magnon excitations for the spin-1/2 triangular-lattice nearest-neighbor Heisenberg antiferromagnet above a three-sublattice ordered ground state. Several striking features are observed compared to the classical (large-S) spin-wave spectra. Whereas, at low energies the dispersion is only weakly renormalized by quantum fluctuations, significant anomalies are observed at high energies. In particular, we find roton-like minima at special wave-vectors and strong downward renormalization in large parts of the Brillouin zone, leading to very flat or dispersionless modes. We present detailed comparison of our calculated excitation energies in the Brillouin zone with the spin-wave dispersion to order $1/S$ calculated recently by Starykh, Chubukov, and Abanov [cond-mat/0608002]. We find many common features but also some quantitative and qualitative differences. We show that at temperatures as low as $0.1J$ the thermally excited rotons make a significant contribution to the entropy. Consequently, unlike for the square lattice model, a non-linear sigma model description of the finite-temperature properties is only applicable at temperatures $\ll 0.1J$.

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