Thermodynamics of the $S = 1$ Heisenberg antiferromagnet on kagome lattice

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We discuss the thermodynamics of frustrated quantum Heisenberg antiferromagnets (HAFM) using high-temperature series [1] complemented by various interpolation schemes [2,3]. To be specific, we focus on the spin-1 kagome-lattice HAFM and examine the specific heat $c(T)$ and the uniform susceptibility $\chi(T)$ for this model. For the gapped ground state the energy values $e_0 = -1.369\ldots-1.4416$ are reported and the gap is estimated as $\Delta = 0.17\ldots0.28$. We use the entropy method [2] and the $\log Z$ method [3] assuming the low-T behavior $c(T) \propto \exp(-\Delta/T)/T^2$. If we assume $e_0 = -1.43\ldots-1.45$, various Padé approximants used for the interpolation yield almost the same temperature profiles $c(T)$ and $\chi(T)$. Moreover, the results using the entropy method agree well with those using the $\log Z$ method. The specific heat exhibits a shoulder-like behavior at low temperatures, i.e., starting from $T = 0$ it shows a fast increase to $c \approx 0.25$ until $T \approx 0.16$ which is followed by a slow increase to $c \approx 0.3$ as further increasing the temperature to $T \approx 1$, and the typical decrease to zero as $T \to \infty$. The entropy deficit estimated from the raw series [4] is noticeably smaller than the one for the spin-$\frac{1}{2}$ case thus giving some evidence for the absence of the low-T peak in $c(T)$ for the spin-1 kagome HAFM. The obtained $\chi(T)$ shows typical behavior growing to $\chi \approx 0.13$ at $T \approx 1$ and then following the Curie law as $T \to \infty$.

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