Non-monotonic magnetic field dependence of the staggered-moment in two-dimensional frustrated antiferromagnets

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We present an efficient method to identify the degree of frustration in quasi-two-dimensional (2D) antiferromagnets described by the $J_1$-$J_2$ quantum Heisenberg model. The frustration ratio $J_2/J_1$ is commonly obtained from the analysis of magnetic susceptibility, specific heat, and saturation field. We show that the field-induced suppression of quantum fluctuations causes a nonlinear and non-monotonic magnetic field dependence of the staggered moment which depends strongly on the frustration ratio. This serves as a powerful criterion to determine $J_2/J_1$ using a combination of the exact diagonalization method on finite clusters and the spin-wave analysis. We apply this method to the quasi-2D compound Cu(pz)$_2$(ClO$_4$)$_2$ obtaining an intermediate ratio of $J_2/J_1 \approx 0.2$ for the frustration.

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