Estimation of the critical points and the thermal scaling exponents for the square-lattice Ising antiferromagnet in nonzero uniform magnetic fields using its specific heat

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The specific heat for the square-lattice Ising antiferromagnet in a uniform magnetic field H is obtained from its exact grand partition functions on $L \times L$ lattices ($L = 4 \sim 16$), in an arbitrary nonzero external field at arbitrary temperature. In the limit $L \to \infty$, the antiferromagnetic (Néel) critical points for $H \neq 0$ are estimated from the locations of the specific-heat peaks. For the first time, the thermal scaling exponents y_t of the square-lattice Ising antiferromagnet in a magnetic field are obtained to be $y_t(H \neq 0) = 1.0$ directly from its specific heat, implying that the specific heat retains the logarithmic singularity at the Néel critical points even in a uniform magnetic field.