Abstract Submitted
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Critical Temperatures of Finite Samples at Finite Observation Times[1] O. VEDMEDENKO, N. MIKUSZEIT, T. STAPELFELDT, R. WIESER, M. POTTHOFF, A. LICHTENSTEIN, R. WIESENDANGER, University of Hamburg — The analytical form of correlation function G(r), which is an essential ingredient of any theory of phase transitions is known for infinite systems at infinite observation times. At the forefront of the nanoscience revolution important experimental developments involve ever smaller length- and time- scales. For such nano-systems there is up to now no clear understanding of crossover phenomena like the crossover from a paramagnetic state at high temperatures via the thermo-activated switching [Science 317, 1537 (2007),Phys. Rev. Lett. 103, 127202 (2009)] to ferro- or antiferromagnetic order at low T and how they manifest themselves in the correlation function. This is related to the problem that a Curie or Néel temperature of nano-objects cannot be defined unambiguously. Here, a general expression for G(r) covering all sample sizes, all observation times and the entire temperature range from zero to infinity is derived. We demonstrate that the Curie temperature does not simply decrease with decreasing sample size but rather splits in finite samples for finite observation times. This new result does not violate scaling invariance, recovers all known laws as limiting cases, and provides a new algorithm by which critical singularities can be predicted or measured.

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