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Absence of magnetic order in low-dimensional (RKKY) systems
FABIO PEDROCCHI, University of Basel, Department of Physics, ANTHONY LEGGETT, University of Illinois at Urbana-Champaign, Department of Physics, DANIEL LOSS, University of Basel, Department of Physics — We extend the Mermin-Wagner theorem to a system of lattice spins which are spin-coupled to itinerant and interacting charge carriers. We use the Bogoliubov inequality to rigorously prove that neither (anti-) ferromagnetic nor helical long-range order is possible in one and two dimensions at any finite temperature. Our proof applies to a wide class of models including any form of electron-electron and single-electron interactions that are independent of spin. In the presence of Rashba or Dresselhaus spin-orbit interactions (SOI) magnetic order is not excluded and intimately connected to equilibrium spin currents. However, in the special case when Rashba and Dresselhaus SOIs are tuned to be equal, magnetic order is excluded again. This opens up a new possibility to control magnetism electrically.

References: D. Loss, F. L. Pedrocchi, and A. J. Leggett, Phys. Rev. Lett. **107**, 107201 (2011).

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