

# Transport and magnetism at ferromagnetic-paramagnetic critical point in (Ga,Mn)As

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The critical behavior of resistivity at the paramagnetic-(anti-)ferromagnetic critical point is one of the open problems in the physics of conducting magnets. In  $\text{Ga}_{1-x}\text{Mn}_x\text{As}$  which has become an archetypical carrier-mediated dilute ferromagnetic semiconductor, a phenomenological approach showed that the singularity in  $dR/dT$  at  $T_C$  can be consistently interpreted in terms of large wave vector scattering of hole carriers from spin fluctuations [1]. However, the recent studies of *insulating* dilute ferromagnet  $\text{Ga}_{1-x}\text{Mn}_x\text{N}$  of similar Mn composition,  $x \leq 10\%$  demonstrated a highly nonstandard critical *magnetic* behavior [2]. In this work we re-examine the transport characteristics of  $\text{Ga}_{1-x}\text{Mn}_x\text{As}$  in the vicinity of  $T_C$  and relate them to the directly measured magnetization in the same experiment. The magnetic measurements for conducting  $\text{Ga}_{1-x}\text{Mn}_x\text{As}$  material revealed the same departure from the classical, single-value critical exponent, description of the divergence of the initial susceptibility at  $T_C$  in  $\text{Ga}_{1-x}\text{Mn}_x\text{As}$  as observed, and explained, for  $\text{Ga}_{1-x}\text{Mn}_x\text{N}$  [2]. Its consequences onto the critical behavior of resistivity are examined experimentally and theoretically.

[1] V. Novak *et al.*, Phys. Rev. Lett., **101**, 077201 (2008).

[2] S. Stefanowicz, G. Kunert, Tian Li, H. Reuther, C. Kruse, S. Figge, W. Stefanowicz, A. Bonanni, M. Sawicki, T. Dietl, and D. Hommel, Phys. Rev. B **88**, 081201(R) (2013)