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Giant Hall Effect in Laterally Inhomogeneous 2D Electron Gas

HANG XIE, PING SHENG, Department of Physics, HongKong University of Science and Technology — Giant Hall effect has been observed in non-magnetic granular metals at concentration close to the quantum percolation threshold [1], attributable to quantum interference effect. In this work we numerically simulate the Hall effect for 2D electron gas in a laterally inhomogeneous structure. At scales smaller than the electron dephasing length, we obtain the Hall coefficient of 2DEG by solving Schrodinger's equation, with 4 leads connected to the sample. It is shown that for special (laterally) nano-scaled structures, the Hall coefficient can be enhanced by at least 3 orders of magnitude. We have also simulated the effect of assembling such structures into a macroscopic sample, by solving the Laplace equation.

[1] X. X. Zhang, C. Wan, H. Liu, Z. Q. Li, P. Sheng and J. J. Lin, Phys. Rev. Lett. 86, 5562-65, (2001).

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