

DE/ER/45755-1

Report on DOE proposal "Electronic Transport in Disordered Two Dimensional Electron Systems"

Grant number: DF-FG02-99ER45755

There are two major efforts under the support of the DOE grant: (i) To study the electronic transport properties in an interacting two-dimensional electron system; (ii) To study the magneto-transport properties, such as giant magneto-resistance (GMR) or colossal magneto-resistance (CMR). Both efforts are in collaboration with Dr. Zhang from Oak Ridge National Lab. Dr. Zhang and I have visited each other's institutions 5 times over the funding period and also met many times in the conferences that both of us attended. Because of the close collaborations, my student Dr. Junren Shi now is a postdoc with Dr. Zhang at Oak Ridge national Lab. In order to achieve our research goal, we have to build up large-scale numerical programs. We have succeeded in building such programs and have obtained several interesting results. Following I list some accomplishments under the support of the grant over the funding period (1999-2002).

Publications resulted from the DOE-EPSCoR grant:

- (1) "Giant Magnetoresistance in Non-magnetic Granular Material," X.R. Wang, S.C. Ma and X.C. Xie, *Europhys. Lett.* **45**, 368 (1999).
- (2) "A Droplet State in an Interacting Two-Dimensional Electron System," J.R. Shi, S. He and X.C. Xie, *Phys. Rev. B* **60**, R13950 (1999) *Rapid Communications*.
- (3) "Metal-Insulator Transition in Colossal Magnetoresistance Materials," V.N. Smolyaninova, X.C. Xie, F.C. Zhang, M. Rajeswary, R.L. Greene, and S. Das Sarma, *Phys. Rev. B* **62**, 3010 (2000).
- (4) "Orbital Orderings and Two Ferromagnetic Phases in Low Doped $La_{1-x}Sr_xMnO_3$," S.Q. Shen, R.Y. Gu, Q.H. Wang, Z.D. Wang, and X.C. Xie, *Phys. Rev. B* **62**, 5829 (2000).
- (5) "Quantum AC Transport Through Coupled Quantum Dots," Z.S. Ma, J.R. Shi and X.C. Xie, *Phys. Rev. B* **62**, 15352 (2000).
- (6) "Harmonic Generation for AC Nonlinear Response," Z.S. Ma and X.C. Xie, *Phys. Rev. B* **63**, 125310 (2001).
- (7) "Dephasing and Metal-Insulator Transition," J.R. Shi and X.C. Xie, *Phys. Rev. B* **63**, 045123 (2001).

1 DOE Patent Clearance Granted

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Office of Intellectual Property Law

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- (8) "Percolative Conductivity and Critical Exponents in Mixed-Valent Manganites," Ye Xiong, S.Q. Shen and X.C. Xie, Phys. Rev. B **63**, R140418 (2001) *Rapid Communications*.
- (9) "Dephasing Effect in Photon-Assisted Resonant Tunneling through Quantum Dots," J.R. Shi, Z.S. Ma and X.C. Xie, Phys. Rev. B **63**, R201311 (2001) *Rapid Communications*.
- (10) "Theory for high spin systems with orbital degeneracy," S.Q. Shen, X.C. Xie, and F.C. Zhang, Phys. Rev. Lett. **88**, 027201 (2002).
- (11) "The Droplet State and the Compressibility Anomaly in 2D Electron Systems," J.R. Shi and X.C. Xie, Phys. Rev. Lett. **88**, 086401 (2002).
- (12) "Coulomb-Enhanced Dynamic Localization and Bell-State Generation in Coupled Quantum Dots," P. Zhang, Q.K. Xue, X.G. Zhao, and X.C. Xie, Phys. Rev. A **66** 022117 (2002).
- (13) "Spin-Dependent Transport Through An Interacting Quantum Dot," P. Zhang, Q.K. Xue, Y.P. Wang and X.C. Xie, Phys. Rev. Lett. **89**, 286803 (2002).

Graduate students supported by the DOE grant:

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