平成 20 年 5 月 16 日

応用物理学会北海道支部
会員各位

応用物理学会北海道支部

講演会のお知らせ

下記講演会を開催いたしますので、多数ご参加下さいますようご案内申し上げます。

演題：Experimental study of 2D hole systems: coherent transport in quantum dots and magnetothermopower
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（現：北海道大学大学院情報科学研究科　博士研究員））
日時：平成 20 年 5 月 30 日（金）　16：30～18:30
場所：北海道大学　情報科学研究棟 5F 中会議室
主催：応用物理学会北海道支部

講演の要旨
Two-dimensional (2D) carrier systems built from semiconductor heterostructures have been at the center of a wide variety of experimental and theoretical research over the past decades. The quality improvement of GaAs/AlGaAs systems has allowed the observation of several peculiar ground states stabilized by the subtle interplay between carrier-carrier interaction, disorder and magnetic field. More recently, 2D systems in semiconductor heterostructures have also been used as a prime substrate for further confinement of the carriers to mesoscopic systems of major interest for the emerging fields of quantum computing and spintronics. This presentation addresses both magnetotransport measurements in hole open quantum dots (QDs) and thermopower studies of 2D holes in (311)A GaAs heterostructures.

In the first part of this presentation, we describe the fabrication process for hole GaAs open QDs and investigate their magnetotransport properties at very low temperature T. Below 500 mK, the magnetoconductance of the open QDs exhibits clear signatures of coherent transport, namely magnetoconductance fluctuations and weak anti-localization. From these effects, a T dependence for the dephasing time tau_phi, together with an upper limit for the spin-orbit scattering time tau_so is extracted using the random matrix theory. Both tau_phi and tau_so are found to be much smaller than for electrons in similar systems.

In the second part of this presentation, we discuss low-T thermopower measurements in the parallel magnetic field-induced metal-insulator transition (MIT) of 2D GaAs hole heterojunctions with different interface-dependent mobilities. When the magnetic field is increased, the diffusion thermopower S^d decreases across the MIT. The reduction of S^d is more pronounced for the lower mobility sample where it reverses its sign. This behaviour indicates that the system does not undergo any ground state modification through the MIT but rather that the parallel magnetic field induces a dramatic change of the dominant hole scattering mechanisms.

Finally, the last part of this presentation is devoted to the thermopower study of the insulating phase (IP) observed in 2D GaAs bilayer hole systems around the total Landau level filling factor nu = 1. Our measurements show that S^d diverges with decreasing T in the IP. This divergence of S^d at low T indicates the opening of an energy gap in the system's ground state and suggests the formation of a pinned bilayer hole Wigner crystal around nu = 1.

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