Spin Polarization and Metal-Insulator Transition in Strongly Correlated 2D Systems

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There has been great attention to the fundamental properties of strongly correlated two-dimensional (2D) electron or hole systems that are realized in "super clean" semiconductor interfaces, such as Si metal-insulator-semiconductor field-effect-transistors (Si-MOSFETs) and other semiconductor heterostructures. This is due to the observation of the metal-insulator transition (MIT) at low temperatures and zero magnetic fields in these systems [1], and the observation of the sharp enhancement of the spin susceptibility around the MIT [2][3].

The divergence of the spin susceptibility at or near the MIT has been reported for Si-MOSFETs, while there is another experimental result that is against its existence [1]. The tendency for the spin susceptibility to diverge has also been observed near the solid-liquid transition of 2D ^{3}He systems.

Recently, we have performed systematic measurements of magnetoresistance of a high-quality Si-MOSFET in order to study the spin state in the insulating regime. The results strongly suggest that no spontaneous full spin polarization occurs in the insulating regime [4].

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