Enhancement of spin susceptibility of low-density two-dimensional electrons in a high quality Si/SiGe quantum well

TZU-MING LU, XIAOYAN SHI, WEI PAN, Sandia National Laboratories, SHI-HSIEN HUANG, CHEEWEE LIU, JIUN-YUN LI, National Taiwan University — We report magneto-transport measurement results of two-dimensional electrons in a high quality Si/SiGe quantum well under tilted magnetic fields. The electron peak mobility reaches $2 \times 10^6 \text{ cm}^2/\text{Vs}$ and the density is varied from $0.8$ to $2.1 \times 10^{11} \text{ cm}^{-2}$. Under tilted magnetic fields, two Landau levels with opposite spins are brought into energetic coincidence. From the coincidence angles we determine the effective spin susceptibility $g^*m^*$. At $n = 2.1 \times 10^{11} \text{ cm}^{-2}$, $g^*m^* \sim 4$ (in units of $m_0g_b$), consistent with previous work [Lai et al, PRL 96, 076805 (2006)]. Our results further show that the spin susceptibility is enhanced by 20% at $0.8 \times 10^{11} \text{ cm}^{-2}$ from its high density value. Surprisingly, unlike previous results in modulation doped Si/SiGe quantum wells, a resistance peak is observed at $\nu = 3$ when Landau level coincidence occurs in our undoped Si/SiGe field-effect transistor sample. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.

Tzu-Ming Lu
Sandia National Laboratories

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