Spin-Droplet State of an Interacting 2D Electron System

N. Teneh[1], A. Yu. Kuntsevich[2], V. M. Pudalov[2,3] and M. Reznikov[1]

[1] *Solid State Institute, Technion, Haifa 32000, Israel*
[2] *P.N. Lebedev Physical Institute, Moscow, 119991 Russia*
[3] *Moscow Institute of Physics and Technology, Moscow, 141700, Russia*

We report thermodynamic magnetization measurements of two-dimensional electrons in several high mobility Si metal-oxide-semiconductor field-effect transistors. We provide evidence for an easily polarizable electron state in a wide density range from insulating to deep into the metallic phase [1]. The temperature and magnetic field dependence of the magnetization is consistent with the formation of large-spin droplets in the insulating phase. These droplets melt in the metallic phase with increasing density and temperature, although they survive up to large densities.

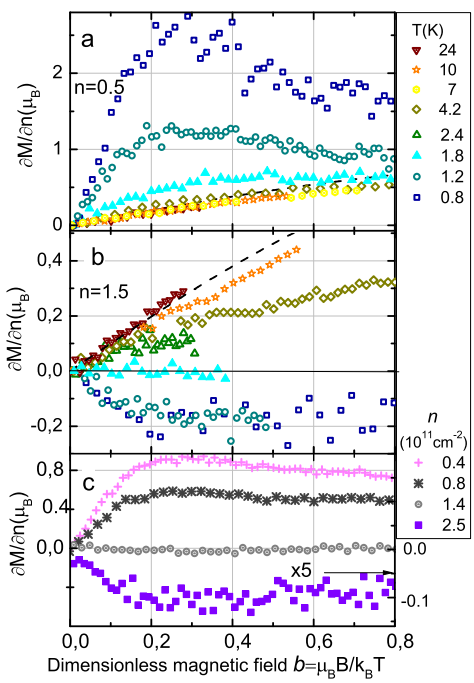

Figure 1: Panel (a): $\partial M/\partial n$ vs normalized magnetic field $b = \mu_B B/k_B T$ at $n = 0.5 \times 10^{11}\text{cm}^{-2}$ (insulating phase). We subtracted the diamagnetic contribution estimated from the high-temperature data, $\sim 0.04\mu_B$ per tesla [2]. Panel (b): the same as panel (a) at $n = 1.5\times10^{11}\text{cm}^{-2}$ (metallic phase); the subtracted diamagnetic contribution is $\approx 0.035\mu_B$ per tesla. Dashed lines in (a) and (b) show $\partial M/\partial n$ for localized spins 1/2. Panel (c) $\partial M/\partial n$ vs b at different densities at $T = 1.8$K. Note that $\partial M/\partial n(b)$ becomes nonlinear at the density and temperature independent b^*.

[1] N. Teneh, A. Yu. Kuntsevich, V. M. Pudalov, M. Reznikov, Phys. Rev. Lett. **109**, 226403 (2012).
[2] M. Reznikov, A. Yu. Kuntsevich, N. Teneh, V. M. Pudalov, JETP Lett. **92**, 470 (2010).