Ferromagnetic-Paramagnetic Transition in a Tilted Magnetic Field in p-Si/SiGe/Si Quantum Wells

I.Yu. Smirnov[a], I.L. Drichko[a], A.V. Suslov[b], O.A. Mironov[c], and D.R. Leadley[d]

[a]A.F. Ioffe Physical-Technical Institute of Russian Academy of Sciences, 194021 St. Petersburg, Russia
[b]National High Magnetic Field Laboratory, Tallahassee, FL 32310, USA
[c]Warwick SEMINANO R&D Centre, University of Warwick Science Park, Coventry CV4 7EZ, UK
[d]Department of Physics, University of Warwick, Coventry CV4 7AL, UK

Magnetoresistance components ρ_{xx} and ρ_{xy} were measured in two p-Si/SiGe/Si quantum well samples with an anisotropic g-factor in a tilted magnetic field of up to 18 T as a function of temperature (20mK-2 K) and tilt angle. We analyzed dependences of the conductivity, its activation energy ΔE and the filling factor ν on the tilt angle Θ. In the sample with density p=2×10^{11} cm^{-2} in the vicinity of ν=2 ΔE (Θ) undergoes a minima at $\Theta \approx 60^\circ$, while $\nu(\Theta)$ shows a sharp jump. These facts allowed us to conclude that at $\Theta \approx 60^\circ$ and $\nu \approx 2$ a crossing of the Landau levels 0↑ and 1↓ occurs. This leads to the first order ferromagnetic-paramagnetic (F-P) phase transition. A coexistence of two phases at the transition point also supports the idea. However, in another sample, with p=7.2×10^{10} cm^{-2}, no transition was observed. For both samples we have obtained the dependences of the effective g-factor on the tilt angle, which led us to conclusion that the F-P transition in the p-Si/SiGe/Si structure in a tilted magnetic field is a result of a violation of the g-factor axial symmetry due to disorder. RFBR 11-02-00223; NSF DMR-0654118.