Shubnikov - de Haas effect in tilted magnetic fields in wide quantum well

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Bilayer two-dimensional electron system in double quantum wells demonstrated oscillations of the symmetric–antisymmetric energy gap in the presence of the in-plane magnetic field [1] which has been attributed to Aharonov-Bohm interference effect between cyclotron orbits in different layers [2]. The charge distribution in a wide single quantum well is more subtle than the one in the double quantum well. Here the Coulomb repulsion of the electrons in the well leads to a soft barrier inside the well, which in turn results in a bilayer electron system. Applying of the in-plane magnetic field can also lead to the charge redistribution inside of the well and distortion of the circular Fermi contour.

In the present work we have measured and calculated Shubnikov – de Haas effect in wide wells in the tilted magnetic field. The samples used in this paper have a well with of w=45 nm with a density $n_s = 9.1 \times 10^{11}$ cm^{-2}, see sketch of profile in figure (a) with symmetric (S) and anti-symmetric (AS) wave functions.

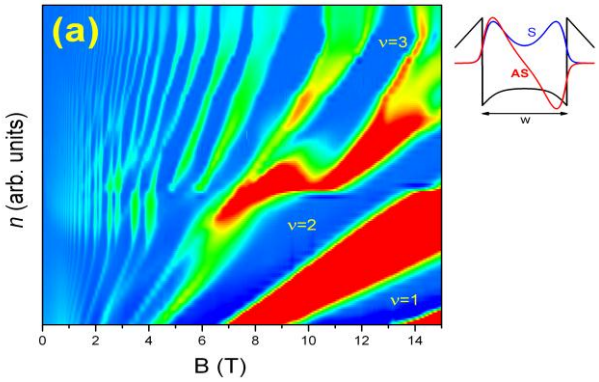

Fig. 1 Density *vs* magnetic-field diagram at T=50 mK. The energy Landau-level fan diagram for a bilayer system quantum well consists of two sets of spin split LL separated by symmetric–antisymmetric energy gap Δ_{SAS}.

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