Magnetotransport of gate confined cavities

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The two dimensional electron gas(2DEG) that forms at the interface of a GaAs/$Al_xGa_{1-x}As$ heterostructure was grown using molecular beam epitaxy at the Wiezmann Institute in Israel. Electrons can be confined in a small region forming a cavity by negatively biasing a pair of metallic gate, depleting the 2DEG $\sim$ 93nm beneath the surface. Cavities with topological area of around $0.5\mu m^2$ are studied. Conductance oscillations are present in conductance-gate voltage characteristics and source-drain spectroscopy. In the presence of perpendicular magnetic field, two quantum interference effects take place in longitudinal resistances. In high magnetic fields, resistance oscillation occurs at a periodicity of magnetic flux due to Aharonov-Bohm effect. In low magnetic fields, a negative magnetoresistance is obtained and can be ascribed to weak localization effect. By varying confined gate voltage, the line shape of low field MR would transits from Lorentzian linear. We suggest that the transition may be resulted from the shape change of cavity from chaotic to regular with decreasing gate voltage. [1]

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[1]J.P. Bird, D.M. Olatona, R. Newbury, R.P. Taylor, K. Ishibashi, M. Stopa, Y. Aoyagi, and T. Sugano, Phys. Rev.B **52**, R14336 (1995).