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Orbital magnetism of mesoscopic integrable system MING LOU, SLAVA SEROTA, University of Cincinnati — In the mesoscopic regime, magnetic properties (such as orbital magnetism) are sensitive to whether the corresponding classical dynamics is chaotic or integrable. Non-interacting electron gas in a rectangular box is proposed as a "generic" model to study orbital magnetism of integrable system. We derived the exact energy level correlation function for this system, including the perturbation by magnetic field. Combining the exact correlation function and Imry's formalism, we calculated the orbital magnetic susceptibility and discussed the field dependence at$T \to 0$ and temperature dependence at $B \to 0$. As a result, the susceptibility $\chi \sim |\chi_L| \sqrt{k_F L} \begin{cases} \log(\phi_0/\phi) & (T \to 0, \phi << \phi_0) \\ \log(\sqrt{\Delta E_F}/T) & (B \to 0, T << \sqrt{\Delta E_F}) \end{cases}$, where χ_L is the Landau susceptibility, k_F the is Fermi vector, L is the rectangle's side, ϕ_0 is the magnetic flux quantum, Δ is the mean level spacing, and E_F is the Fermi energy. For high temperature and large field, the mesoscopic part of susceptibility exponentially vanishes and only the bulk Landau diamagnetism is left. The logarithmic divergence at zero field and zero temperature is consistent with previous numerical calculations and is a manifestation of pronounced non-self-averaging properties of integrable systems.

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