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Mesoscopic fluctuation of off-diagonal matrix elements of the angular momentum and orbital magnetism of free electrons in a rectangular box MING LOU, University of Cincinnati, J.M.A.S.P. WICKRAMASINGHE, R.A. SEROTA — We study, analytically and numerically, mesocsopic fluctuation of the off-diagonal matrix elements of the ortbital angular momentum between the nearest energy levels $i = (n_x, n_y)$ and $f = (k_x, k_y)$ in a rectangular box with incommensurate sides. In the semiclassical regime, where the level number $N >> 1$, our derivation gives $\left\langle \left| \widehat{L}_{if} \right|^2 \right\rangle \sim \sqrt{N}$. Numerical simulations, using simultaneous ensemble averaging (over the aspect ratios of rectangles) and spectral averaging (over the energy interval), are in excellent agreement with this analytical prediction. Physically, the mean is dominated by the level pairs $k_x = n_x \pm 1, k_y = n_y \pm 1$ .Also in a rectangular box, we investigate the mean orbital susceptibility of a free electron gas and argue that it reduces, up to a coefficient, to the two-level van Vleck susceptibility that involves the last occupied (Fermi) level and the first unoccupied level. This result is confirmed numerically as well, though the effect of fluctuations is much more pronounced for the susceptibility since it is due both to large fluctuations in $\left\langle \left| \widehat{L}_{if} \right|^2 \right\rangle$ and in level separations $\varepsilon_f - \varepsilon_i$.

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