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Title: Logarithmically enhanced area-laws for fermions in vanishing magnetic fields in dimension two

We consider fermionic ground states of the Landau Hamiltonian, H_B, in a constant magnetic field of strength $B>0$ in $\mathbb R^2$ at some fixed Fermi energy $\mu>0$, described by the Fermi projection $P_B\coloneqq 1(H_B\le \mu)$. For some fixed bounded domain $\Lambda\subset \R^2$ with boundary set $\partial\Lambda$ and an $L>0$ we restrict these ground states spatially to the scaled domain $L \Lambda$ and denote the corresponding localised Fermi projection by $P_B(L\Lambda)$. Then we study the scaling of the Hilbert-space trace, $\mathrm{tr} f(P_B(L\Lambda))$, for polynomials f with $f(0)=f(1)=0$ of these localised ground states in the joint limit $L\to\infty$ and $B\to0$. We obtain to leading order logarithmically enhanced area-laws depending on the size of LB. Roughly speaking, if $1/B$ tends to infinity faster than L, then we obtain the known enhanced area-law (by the Widom--Sobolev formula) of the form $L \ln(L) a(f,\mu) |\partial\Lambda|$ as $L\to\infty$ for the (two-dimensional) Laplacian with Fermi projection $1(H_0\le \mu)$. On the other hand, if L tends to infinity faster than $1/B$, then we get an area law with the leading $L \ln(\mu/B) a(f,\mu) |\partial\Lambda|$ asymptotic term as $B\to0$. This is joint work with Paul Pfeiffer.