Titel: Entanglement entropy of free fermions in a magnetic field

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Abstract:

We consider the two-dimensional ideal Fermi gas of indistinguishable charged particles subject to an external constant magnetic field of strength $B>0$. We assume this quantum gas to be in its ground state with chemical potential $\mu\ge B$. For this state we define its local entropy $S(\Lambda)$ associated with a bounded region $\Lambda\subset \mathbb R^2$ as the von-Neumann entropy of the state obtained by reducing the ground state to this region Λ. We prove that the leading asymptotic growth of $S(L\Lambda)$, as L tends to infinity, has the form $L\sqrt{B}|\partial\Lambda|$ up to a precisely given coefficient which is independent of Λ and dependent on B and μ only through the integer part of $(\mu/B-1)/2$. The boundary curve $\partial\Lambda$ of Λ is assumed to be sufficiently smooth so that the arc-length $|\partial\Lambda|$ exits. This asymptotic growth contrasts the zero-field case $B=0$, where an additional logarithmic factor $\ln(L)$ is known to be present.
This is joint work with Hajo Leschke and Alexander V. Sobolev.