On the sum of eigenvalues of the discrete Laplace operator

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The ground state energy of N non-interacting, spinless electrons in a finite domain D is given by the sum of the N lowest eigenvalues of the Laplace operator with Dirichlet boundary conditions. Li and Yau proved a lower bound in 1983, namely that this sum is larger than a 'bulk term' that is proportional to $|D|$.

Motivated by a study of the Falicov-Kimball model, we considered the analogous problem on a lattice. One can show that the ground state energy of N electrons in an arbitrary domain $D \subset \mathbb{Z}^d$ goes like a bulk term proportional to $|D|$, plus a positive term proportional to the boundary of D.

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