Optimization of Eigenvalues of the planar magnetic Dirichlet-Laplacian.

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Abstract: Following the work by Antunes and Freitas on the Dirichlet-Laplacian, we seek to numerically minimize low eigenvalues as well as sums of low eigenvalues of the planar magnetic Dirichlet-Laplacian with constant magnetic field on bounded, open domains of fixed area. To achieve that, we adapt the Method of Fundamental Solutions to gain an efficient eigenvalue solver for the magnetic Laplacian and apply a gradient descent scheme for the shape optimization. For the first eigenvalue we observe that the disc is the minimizer for any magnetic field strength, a result already proven by Erdös in 1996. For higher eigenvalues however, we gain a whole zoo of shapes depending on the eigenvalue index and the field strength considered. A remarkable observation is that the n-th eigenvalue appears to be optimized by a disc whenever the magnetic flux exceeds n.