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What are the possible values of the conductance of a graph?

The conductance h_G of a graph G (also known as the Cheeger constant) is a well studied parameter of a graph in mathematics and computer science. We study the unexplored problem of determining the set of possible values that h_G can achieve. We show that every rational in $[0, \frac{5}{9}]$ is achievable as a conductance and that only finitely many rationals in $(\frac{5}{9} + \varepsilon, 1]$ are achievable for all $\varepsilon > 0$. We further show that every graph with conductance close to $\frac{5}{9}$ must be close in edit distance to $K_{3,n}$, and that no graph has conductance in $(\frac{3}{4}, 1)$ which is best possible by considering $h_{K_3} = 1$ and $h_{K_5} = \frac{3}{4}$. This last result can be seen as a stability statement saying that $h_G < 1$ implies $h_G \leq \frac{3}{4}$.

This is joint work with Michal Bassan, Fiona Skerman, and Sam Spiro.