

Spectrum of the Laplace operator on quantum graphs and defects in a graphene lattice

Marlena Nowaczyk

We consider the two-dimensional honeycomb structure of graphene that is a one-atom-thick layer of covalently bonded carbon atoms. The Laplace equation together with Kirchhoff boundary conditions at the nodes model the movement of low-energy free electrons in such structure. Our research is based on the trace formula that combines the spectrum properties of the Laplace operator with the geometric properties of the underlying quantum graph. To be more specific, we use a one-to-one correspondence between the eigenvalues and the lengths of the closed paths. We investigate the four common types of defects in graphene, and based on the closed paths of odd lengths, we show the method for determining the type and the position of a defect.

This is a joint work with Margaret Archibald and Sonja Currie.