Quantum networks: random and regular

PhD student project
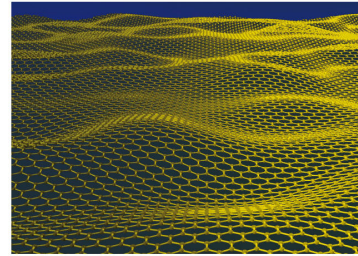
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Figure 1. Graphene. The almost perfect web is only one atom thick. It consists of carbon atoms joined together in a hexagonal pattern similar to chicken wire.

Quantum graphs - differential operators on metric graphs - is a rapidly growing branch of mathematical physics lying on the border between differential equations, spectral geometry and operator theory. Studies of spectral properties of such systems are very important for applications in physics, for example to nano systems. The theory of quantum graphs is a relatively young branch of mathematics with many open problems and a broad perspective. If the spectra of compact finite graphs are rather well-understood, for infinite graphs (networks) a lot of questions remain open. The current project aims to investigate spectral and scattering properties of infinite quantum networks. In particular the following networks will be investigated

- periodic networks,
- fractal networks,
- random graphs,
- random networks.

Successful accomplishment of the research program will help to clarify the relation between two Nobel prizes: 2010 in Physics for graphene (Andre Geim and Konstantin Novoselov) and 2011 in Chemistry for quasicrystals (Dan Shechtman).

It is expected that the candidate will take an active part in the work of the Research and Training Network "QGRAPH" (http://www2.math.su.se/ pak/QGRAPH/) joining 15 research teams from all over the world.

Supervisor: Pavel Kurasov, Stockholm university.

If you are **interested**, please send an e-mail to Pavel Kurasov at pak@math.su.se

Deadline for application: May 2, 2012