

# Q-MATH

## seminar

### THE DISCRETE MAGNETIC LAPLACIAN: GEOMETRIC AND SPECTRAL PREORDERS WITH APPLICATIONS

**SPEAKER:** John Stewart Fabila Carrasco (UC3M)

**DATE:** Wednesday, 10 June 2020 - 11:00

**VENUE:** Online Seminar - <https://eu.bbcollab.com/guest/7b5c6d53f9cf45f4b7b6af543ba34aee>

**ABSTRACT:** Discrete geometric analysis is a hybrid field of several areas of mathematics including graph theory, combinatorics, geometry, theory of discrete groups, and probability. A central object in this field is the spectrum of the discrete magnetic Laplacians (a discrete analogue of magnetic Laplacians on manifolds) acting on weighted graphs and has applications in mathematics, physics and technology.

The magnetic potential  $\alpha$  acting on a weighted graph  $(G, w)$  allows studying several families of Laplacians at the same time (combinatorial, standard, normalised, signless, magnetic Laplacian, and more). We introduce a geometric and a spectral preorder relation on the class of weighted graphs with a magnetic potential. Some applications of these preorders are the following:

1. We found a simple geometric condition that guarantees the existence of spectral gaps of the discrete Laplacian on periodic graphs. For proving this, we analyse the discrete magnetic Laplacian on the finite quotient and interpret the vector potential as a Floquet parameter.
2. We present a new geometrical construction leading to an infinite collection of families of graphs, where all the elements in each family are (finite) isospectral (weighted) graphs for the magnetic Laplacian. The parametrisation of the isospectral graphs in each family is given by a number theoretic notion: the different partitions of a natural number.

We conclude this talk with other applications (the Cheeger constant, minor graphs, etc.) and some open questions.