### Project title
Spectral Properties of Systems with Aperiodic Order

### Principal supervisor
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### Second supervisor
Ian Short

### Discipline
Pure mathematics / Applied mathematics

### Research area/keywords
dynamical systems; symbolic dynamics; spectral theory

### Suitable for
Full time or part time applicants

### Project background and description
Aperiodically ordered systems are interesting both mathematically and in view of applications, in particular in crystallography. The discovery of quasicrystals in 1982, which was recognised by the award of the Nobel Prize in Chemistry to Dan Shechtman in 2011, shows that Nature can indeed realise such intricate types of order.

There are several natural spectral properties that can be associated to aperiodically ordered systems. On the mathematics side, you can consider the dynamical system with translation action, and its associated dynamical spectrum. Closely related to the dynamical spectrum is the diffraction spectrum, which is of primary importance in crystallography, where it is used to detect (periodic or aperiodic) order in materials. A third spectral property concerns aperiodic Schrödinger operators, which are of interest in connection with electronic transport in aperiodic structures. Much less is currently known about the relation between these electronic spectra and the dynamical or diffraction spectra.

The project will start from some concrete examples of aperiodically ordered systems which arise from symbolic dynamics, and analyse their spectral properties. Depending on the background of the candidate, the project may focus more on the dynamical/diffraction side or on the electronic spectra, or consider both and the possible relations between these spectral properties. The project follows on from recent work on systems with singular continuous or absolutely continuous spectrum.

### Background reading/references