

## **Postdoctoral Fellowship: Spiral waves and heteroclinic cycles in Rock-Paper-Scissors**

Applications are invited for a 23-month Postdoctoral Fellowship at the University of Auckland for the project "Spiral waves and heteroclinic cycles in Rock-Paper-Scissors". This research is funded by a Faculty Research Development Fund grant and will be supervised by Associate Professor Claire Postlethwaite and Professor Hinke Osinga in the Mathematics Department. Professor Alastair Rucklidge (University of Leeds, UK) will collaborate on the project. The Fellowship is available from January 2018; the exact start date will be negotiated with the successful applicant.

### **Project description**

Scissors cut Paper, Paper wraps Rock, Rock blunts Scissors: the simple game of Rock–Paper–Scissors provides an appealing model for cyclic dominance between competing populations or strategies in evolutionary game theory and biology. The model has been invoked to explain the repeated growth and decay of three competing strains of microbial organisms and of three colour-morphs of side-blotched lizards. In a mathematical model of three competing species which allows for spatial distribution and mobility, waves of Rock can invade regions of Scissors, only to be invaded by Paper in turn; these waves can be organised into spirals, with roughly equal populations of the three species at the core of each spiral, and each species dominating in turn in the spiral arms.

The proposed project is to further our understanding of the spiral patterns in the spatially-extended model, in particular, to understand what determines the wavelength, rotation speed and stability of the spiral waves. Computations will be done using bifurcation theory techniques and advanced numerical analysis. If successful, we predict that the methods of analysis developed for the Rock-Paper-Scissors example could be amenable to a wide variety of physical models, including heart ventricular fibrillation, excitable chemical systems and reaction-diffusion systems.

The successful applicant will hold a PhD in Mathematics or Applied Mathematics and will ideally have demonstrable skills in the following:

- Dynamical systems theory.
- Numerical analysis, particularly numerical continuation and boundary value problems.
- Simulation of partial differential equations.
- Programming skills in Matlab, Fortran or similar.

Informal enquiries are welcome by email, to either Claire Postlethwaite ([c.postlethwaite@auckland.ac.nz](mailto:c.postlethwaite@auckland.ac.nz)) or Hinke Osinga ([h.m.osinga@auckland.ac.nz](mailto:h.m.osinga@auckland.ac.nz)).

Applications should include a cover letter, CV, and names and email addresses of three academic referees who can be contacted in support of your application. Applications should be sent by email to the above email addresses; those received before Oct 31<sup>st</sup>, 2017 will receive full consideration.