

Harmonic Analysis and Partial Differential Equations

Programme of the meeting

University of Bath, 7 June 2017

- **10:30 - 11:00** Welcome with tea and coffee

- **11:00 - 12:00** Professor Roger Moser (University of Bath)

A second order variational problem in L^∞

Abstract: What happens when we minimise the supremum of the Laplacian of a function under fixed boundary data? While variational problems of this sort can be difficult, this one allows a relatively simple approach and we get remarkably good information about the solutions. This is joint work with N. Katzourakis (Reading).

- **12:00 - 13:30** Lunch break

(suggestion: follow the locals to the various options in Building 2W).

- **13:30 - 14:30** Dr Susana Gutierrez (University of Birmingham)

The Cauchy problem for the Landau-Lifshitz-Gilbert equation in BMO and self-similar solutions

Abstract: The Landau-Lifshitz-Gilbert equation (LLG) is a continuum model describing the dynamics for the spin in ferromagnetic materials. In the first part of this talk we describe our work concerning the properties and dynamical behaviour of the family of self-similar solutions under the one-dimensional LLG-equation. Motivated by the properties of this family of self-similar solutions, in the second part of this talk we consider the Cauchy problem for the LLG-equation with Gilbert damping and provide a global well-posedness result provided that the BMO norm of the initial data is small. Several consequences of this result will be also given.

- **13:30 - 14:30** Dr Vladimir V. Kisil (University of Leeds)

The real and complex techniques in harmonic analysis rooted in the affine group

Abstract: There are two main approaches in harmonic analysis on the real line. The real variables technique uses various maximal functions, dyadic cubes and, occasionally, the Poisson integral. The complex variable technique is based on the Cauchy integral and fine properties of analytic functions. Sometimes these techniques are pragmatically combined, yet certain opposition of two is explicit.

We discuss both techniques in terms of the covariant transform on the affine group. This unified approach provides a foundation for further uses and generalisations.

- **15:30 - 16:00** Tea and coffee break
- **16:00 - 17:00** Dr Stephen Watson (University of Glasgow)

Emergent and Hidden Symmetries of Nano-Faceting Crystal Growth

Abstract: Nano-faceted crystals answer the call for self-assembled, physico-chemically tailored materials, with those arising from a kinetically mediated response to free-energy dis-equilibria (*thermokinetics*) holding the greatest promise. To explore this, we consider a singularly perturbed, fourth-order, hyperbolic-parabolic geometric partial differential equation that models the dynamics of slightly undercooled crystal-melt interfaces possessing strongly anisotropic and curvature-dependent surface energy, and evolving under attachment-detachment limited kinetics. The fundamental non-equilibrium feature of this dynamics is explicated through our analytical discovery of 1D convex- and concave- translating-front solutions (*solitons*), whose constant asymptotic angles provably deviate from the thermodynamically expected *Wulff* angles in direct proportion to the degree of undercooling. These *thermokinetic* solitons induce a novel emergent facet dynamics, which is exactly characterised via an original geometric matched-asymptotic analysis. We thereby discover an emergent parabolic symmetry, which naturally implies the universal scaling law $\mathcal{L} \sim t^{1/2}$ for the growth in time t of the characteristic facet length \mathcal{L} . Time permitting, we will touch on a beyond-scaling theory of coarsening that we have recently developed - *G-equivariant universality* - and illustrate its application through a hidden Lorentzian symmetry of the emergent facet dynamics

- **17:00** Conclusion, end of meeting.

Venue: Wolfson Lecture Theatre (Building 4 West Room 1.7).