

# Preface

This online volume contains a selection of papers arising from two workshops organised within the six-month programme Topological Dynamics in the Physical and Biological Sciences held at the Isaac Newton Institute for Mathematical Sciences, Cambridge, from July to December 2012.

The first of these was a ‘satellite workshop’ held at the International Centre for Mathematical Sciences (ICMS), Edinburgh, 15-19 October 2012, under the title Tangled Magnetic Fields in Astro- and Plasma Physics, and with Scientific Organising Committee: Konrad Bajer (Warsaw), Mitchell Berger (Exeter), Steve Cowley (Culham Centre for Fusion Energy), Andrew Gilbert (Exeter), Gunnar Hornig (Dundee), and Clare Parnell (St Andrews). The second was the workshop Quantised Flux in Tightly Knotted and Linked Systems held at the Newton Institute, 3- 7 December 2012, with Scientific Organising Committee: Natalia Berloff (DAMTP, Cambridge), Anne-Christine Davis (DAMTP, Cambridge), Jason Cantarella (University of Georgia), Thomas Kephart (Vanderbilt University), Paul Sutcliffe (Durham University), and Tanmay Vachaspati (Arizona State University). Videos of the lectures given at this second workshop can be viewed at <http://www.newton.ac.uk/webseminars>.

The papers published here follow a natural progression through the following topics: helicity and related invariants of magnetic fields in ideal MHD; relaxation under topological constraints; lower bounds on magnetic energy; current and vortex filaments; applications in the solar corona, tokamak plasmas, and cyclone dynamics; higher-order invariants; topology of curves and surfaces, and energy measures; tight knots; applications to Bose-Einstein condensates, QCD, and cosmic superstring theory. Some of the papers span more than one of these areas.

We owe a great debt of gratitude to Konrad Bajer, who was one of the guiding spirits behind the whole Newton Institute program, and who took particular responsibility for the Satellite Workshop at ICMS, Edinburgh. Konrad fell seriously ill in June 2014, having completed much of the editorial work for these Proceedings. Following an operation at the end of July, he remained optimistic of a complete recovery, but sadly this was not to be, and he died from a particularly malignant form of cancer on 29th August. The funeral was held in Warsaw on 5th September. Konrad’s warmth of personality and generosity of spirit will be remembered by all who participated in these workshops and in the wider Newton Institute program.

The Isaac Newton Institute provided an ideal environment for informal interactions before and after both these workshops. We wish to express our thanks to the Director and staff of the Institute for their tireless efforts to ensure the success of the whole program; also to the staff of ICMS, Edinburgh, for their expert hosting of the satellite workshop.

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22 September 2014