Solar-Terrestrial and Experimental Plasma Physics Synergy: STEPPS

10 - 13 April 2017 @Snellius

The STEPPS meeting covered a number of important scientific problems related to the multi-scale plasma processes, such as waves and particle acceleration, are thought to exist in a variety of magnetic structures in the atmosphere of the Sun and plasma structures generated in the laboratory plasma. More than 25 participants from Belgium, United Kingdom, Netherlands, Spain, United States, Russia, Ireland and France attended the meeting. Here, we summarise the most interesting outcomes and current progress with grant applications planned during STEPPS and paper publications/submissions.

A number of a new research links were established. For example, colleagues from the University of Sheffield, UK, University of California at Los Angeles (UCLA), USA, Northumbria University, UK, Trinity College Dublin, Ireland proposed collaborative research (Royal Society, [application submitted], ISF-EPSRC [joint call between UK and Ireland, application in preparation]) which has a potential of providing valuable insights into the important problem of propagation and damping of MHD plasma waves and oscillations in solar coronal loops and prominences. The existing solar observations do not have a good spatio-temporal resolution to identify the actual damping mechanism and test relevant theoretical models. To answer these outstanding questions in solar physics, it is planned to utilize laboratory plasma experiments (UCLA). In particular, it is proposed to: a) conduct laboratory experiments on kink modes in arched magnetized plasmas; b) analyse the evolution of the loop cross-section using direct measurement of three-dimensional magnetic-fields; c) investigate the development of Rayleigh Taylor (RT) type and Kelvin Helmholtz (KH) instabilities and energy dissipation using plasma density and temperature measurements (also relevant to the outstanding problem of the coronal heating); d) utilize numerical tools to help perform the experiment under conditions relevant to the Sun and better understand the experimental and remote-observational results. These efforts are expected to help initiate the wide international collaboration among solar and plasma physicists from UK, USA and research groups from other countries involved, and have an immense potential of making a major impact in diverse areas of solar and plasma physics. All of these activities include scientific support from our colleagues in the KULeuven University, Belgium and DIFFER, The Netherlands.

The most memorable "aha" moments came from Prof. Paul Bellan (Caltech, USA) as he described his many laboratory plasma experiments in generating self-collimating plasma jets. These jets are remarkably similar to solar spicules in behaviour and may provide verifiable and repeatable experimental data for solar physicists to compare with their theories and modelling. This was a revelation for the solar physicists present. Also, Paul has proven experimentally that the instabilities in the jets are of RT type and not KH as usually proposed in the solar community. If this is also true for solar spicules, this would be a paradigm shift.

Overall, the organisation, support provided by the local organisers and Lorentz Center facilities were of an exceptional standard. The inspirational atmosphere at the Center certainly provided a stimulating environment for all the attendees. We would definitely use this research facility again and have already advised many of our colleagues to organise meeting hosted at the Lorentz Center, especially for the interdisciplinary research topics.

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