

Report: “Superconvenors’ panel” meeting held at ISSI on 27-28 April 2010

Objective: To follow up suggestions for Workshops first made at the ISSI Forum on the future of magnetospheric research held at ISSI on 24-25 March 2009, and as presented to the ISSI Science Committee on 29-30 October 2009.

Participants in meeting:

Andre Balogh (ISSI)  
Andrei Bykov  
Peter Cargill  
Thierry Dudok de Wit  
Jonathan Eastwood  
Len Fisk  
Goetz Paschmann  
Lev Zelenyi

Outcome:

The Panel recommends that two of the proposed themes, C (filamentation) and D (acceleration), should be reformulated to form a logical proposal of THREE workshops, described in detail below. The Panel wished to emphasise the linked physical processes and their consequences on the wide variety of scales in cosmic plasmas. This is reflected in the proposal for the series of three workshops. The three proposed titles are:

- 1. Particle acceleration in cosmic plasmas**
- 2. Microphysics of governing processes in cosmic plasmas**
- 3. Multi-scale structure formation and dynamics in cosmic plasmas**

The Panel considered that theme B (laboratory vs cosmic scales) can be usefully integrated into one of the three proposed workshops (2). The Panel also considered that theme A (magnetosphere-like objects in the Universe) was primarily based on phenomenology and could form the basis of an independent workshop.

The Panel recommends that there should be a significant effort made to ensure a balanced representation of the different communities in the workshops, as the aim is to ensure a constructive dialogue between the astrophysical community and the solar system space plasma community. For this purpose, the Panel has identified potential convenors for the workshops and also a proposed list of participants, bridging the different communities, that would be offered for consideration by the convenors.

The Panel also recommends that there should be an overlap between groups of convenors and participants among the workshops. This naturally follows from the closely linked character of the three topics. In addition, the Panel recommends that there should be two coordinating convenors, overseeing the organisation of the workshops. (A. Balogh and A. Bykov have been proposed.)

## 1. Particle acceleration in cosmic plasmas

16 - 20 May 2011

### Convenors:

Andrey Bykov (Ioffe Physical-Technical Institute, St. Petersburg, Russia),  
Robert P. Lin (Space Science Laboratory, University of California Berkeley, USA), John C.  
Raymond (Harvard-Smithsonian Center for Astrophysics, USA),  
Manfred Scholer (Max-Planck Institut für Extraterrestrische Physik, Garching, Germany),  
André Balogh (ISSI)

### Objective:

Critical assessment of acceleration mechanisms and observations on a range of scales from suprathermal particles in the heliosphere to high energy cosmic rays [ $10^3$  eV to  $10^{20}$  eV] and a constructive comparison of acceleration processes across the scales.

### The Workshop will cover the following main themes:

- Review of observations of accelerated particles on all scales: *in situ* and remotely from space, and also ground-based, from the magnetosphere to extragalactic scales
- A detailed assessment of the physical processes underlying particle acceleration in the different physical environments: the aurorae, the Earth's radiation belts, bow shock- and interplanetary shock associated particles, flare-accelerated and generally solar energetic particles, acceleration at and beyond the heliospheric termination shock, particles accelerated by supernova remnants, jets, pulsars, gamma ray bursts. Competing processes in different physical contexts will be critically evaluated.
- Acceleration mechanisms in general:
  - Shocks and diffusive shock acceleration, magnetic field amplification,
  - Stochastic acceleration (2nd order Fermi): its mechanisms in the different environments, and its possible role on largest scales for accelerating highest energy cosmic rays
  - Turbulent acceleration: the description of mechanism and applicability across the cosmic scales
  - Acceleration in current sheets; acceleration by parallel electric fields; their applicability in different physical contexts
  - Nature of acceleration process and its possible scale-dependence that gives a distribution function with a power law in particle speed, with a spectral index of -5.
  - The contribution of different simulation and modelling studies to the understanding of the particle acceleration processes
- The status of particle acceleration research and future perspectives: identification of shortcomings in the theory, gaps in the observations and the improvements needed to remedy those problems.

### Current status:

- First circular, letters of invitations and list of 39 invited participants mailed on 8 October; deadline for registration 30 November.
- As of 12 October, 21 confirmations have been received.

## 2. Microphysics of cosmic plasmas

Objective: Review of processes that govern cosmic plasmas in all astrophysical environments. The emphasis is on non-MHD/kinetic processes.

Non-exhaustive, non-ordered list of topics for consideration:

- Magnetic reconnection / current sheets
- Turbulence
- Shocks
- Equilibration processes [ion-electron, ion-ion ...]
- Non-classical transport
- Turbulent transport
- Ionization non-equilibrium
- Heat conduction
- Auroral Kilometric Radiation (AKR), related emission/processes

Proposed convenors

|                   |                        |
|-------------------|------------------------|
| <u>J. Raymond</u> | <u>P. Cargill</u>      |
| <u>R. Dendy</u>   | <u>T. Dudok de Wit</u> |
| <u>A. Balogh</u>  | <u>A. Bykov</u>        |

## 3. Multi-scale structure formation and dynamics in cosmic plasmas

Objective: Assessment of the formation of inhomogeneities in cosmic plasmas on a wide range of scales, their role in multi-scale dynamics, particle acceleration, heating and transport.

Non-exhaustive, non-ordered list of topics for consideration:

- Auroral arcs
- Coronal arcs / loops / arcades
- Flux ropes – eg CMEs [?]
- Winds, jets, interaction with the environment
- Shocks
- Flux transfer events / magnetotail reconnection / current sheets
- Structure of accretion disks / similarities with coronal structures – Jovian plasma sheet [disk]
- On the largest scale: filaments and clusters of galaxies
- Plasma interfaces, boundary structures [heliosheath, heliopause, others]

Proposed convenors

|              |              |
|--------------|--------------|
| Andrei Bykov | J. Eastwood  |
| J. Kaastra   | S. Antiochos |
| A. Balogh    |              |