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Magnetic Reconnection and Particles Acceleration

Francesco Pecora (1), Antonella Greco (1), Qiang Hu (2), and Sergio Servidio (1)

(1) Università della Calabria, Dipartimento di Fisica, Italy (francesco.pecora@unical.it), (2) The University of Alabama in Huntsville, Department of Space Science and CSPAR, USA

It is widely known that turbulent astrophysical plasmas are characterised by the presence of coherent magnetic structures such as flux ropes and current sheets. These structures are present at different scales from the large energy containing eddies to the small dissipative regions. The interaction of the magnetic flux tubes can lead to magnetic reconnection, one of the most accredited mechanism for the conversion of magnetic energy to particles kinetic energy. Reconnection events have been spotted in solar wind in situ measurements (Retinò et al., Nat. Phys. (2007)) and they usually take place in between magnetic islands where strong electric fields and intense current sheets are generated after the magnetic field's topology modification. When charged particles are able to interact with these intense structures they can get effectively energised (Pecora et al., JPP (2018)).

We use in situ measurements from WIND satellite to reconstruct the topology of the magnetic field using the Grad-Shafranov method (Hu and Sonnerup, JGR (2002)) and see whether the most intense current sheets are located in between the magnetic flux tubes as expected and already observed (Servidio et al. PRL (2009)). Moreover we pair the observations with numerical simulations to show whether the picture of the resonance between the particles and dissipative scales is important for the particles to be effectively energised.