Magnetic Reconnection in Astrophysical Systems

Dmitri A. Uzdensky (Princeton University and CMSO)

The main subject of my talk is the question: in what kind of astrophysical systems magnetic reconnection is expected to be interesting and/or important? First, I put forward three general criteria for selecting relevant astrophysical environments; namely, reconnection should be fast, energetically important, and observable.

From this it follows that the density of the reconnecting medium should be relatively low, so that the plasma is collisionless, force-free, and optically thin. (In particular, the requirement of fast reconnection implies that Petschek's reconnection mechanism must be at work, which requires the plasma to be in the collisionless regime.)

I then suggest that the force-free condition also implies that the magnetic field be produced in and anchored into a nearby dense massive object, e.g., a star or a disk, strongly stratified by gravity. I stress the importance of field-line opening (e.g., by differential rotation) as a means to forming a reconnecting current sheet and suggest the Y-point helmet streamer as a generic prototypical magnetic configuration relevant for reconnection in astrophysics. I then discuss several specific astrophysical systems where the above criteria are fulfilled: stellar coronae, magnetically-interacting star--disk systems, and magnetized coronae above turbulent accretion disks.