17th European Solar Physics Meeting ESPM-17

Contribution ID: **310** Type: **Poster**

Deciphering magnetic reconnection dynamics in the large and small-scale explosions on the Sun

Flares and jets are explosive phenomena driven by magnetic reconnection in the solar atmosphere. We present a comprehensive study combining observational analysis and numerical simulations to elucidate the intricate structures and processes underlying these events. Utilizing SDO/HMI vector magnetogram data, we performed a data-constrained simulation of a C1.3 class flare observed in an active region NOAA 12734 with the EULAG code. Our analysis reveals a complex magnetic configuration involving a magnetic flux rope with overlying envelope of quasi-separatrix layers (QSLs), augmented by the presence of a 3D null and null-line contributing to the flare ribbon brightening (spanning over 100 Mm x 50 Mm spatial scale). Inclusion of the Hall effect in our simulation leads to faster reconnection dynamics, along with the signatures of observed swirling motions absent in the traditional MHD simulation. On the lower end of the energy spectrum, jet activity that could potentially contribute to the solar wind is observed in coronal hole plumes at spatial scales of less than 1000 km. To probe the dynamics of these small-scale jets and their correlation with magnetic field evolution, we conducted a self-consistent 3D MHD simulation of a coronal hole plume using the MURaM code. Similar to the large-scale flare, we found that QSLs play an important role in structuring the flows along the boundaries of plumes. These findings highlight the role of magnetic structures in shaping solar eruptive events and flows around plumes, shedding light on their complex yet unified behavior.

Primary author: BORA, Kamlesh (Max Planck Institute for Solar System Research)

Co-authors: Dr PRASAD, Avijeet (Rosseland Centre for Solar Physics, University of Oslo); Prof. JOSHI, Bhuwan (Physical Research Laboratory, India); Dr PRZYBYLSKI, Damien (Max Planck Institute for Solar System Research, Germany); Dr CHITTA, Pradeep (Max Planck Institute for Solar System Research, Germany); Prof. HU, Qiang (Center for Space Plasma & Aeronomic Research, The University of Alabama in Huntsville,); Prof. BHATTACHARYYA, Ramit (Physical Research Laboratory, India); Dr CHEN, Yajie (Max Planck Institute for Solar System Research, Germany)

Session Classification: Coffee break and poster session 1

Track Classification: Fundamental mechanisms of solar plasmas: magnetic reconnection, waves, radiation and particle acceleration