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Structures and Dynamics of Solar Wind in the Inner Heliosphere

Die Duan[1], Jiansen He[1], Chuanpeng Hou[1], Rui Zhuo[1], Ziqi Wu[1], Xingyu Zhu[1], Yajie Chen[1]
[1] School of Earth and Space Sciences, Peking University, China
e-mail (speaker): dduan@pku.edu.cn

The successive launch of the Parker Solar Probe (PSP) and Solar Orbiter (SolO) have explored the inner heliosphere and upper solar atmosphere, advancing our knowledge of the physics of the nascent solar wind[1,2]. The spacecraft discover that the behavior of the inner-heliospheric solar wind is highly different from the solar wind observed at 1 AU, containing a variety of different multi-scale structures, for example, heliospheric current sheets (HCSs), magnetic reconnection, switchbacks, slow shocks, kinetic-scale waves, e.g[3-5]. We identify lots of these structures in the in-situ measurements and trace their companying solar wind back to the solar surface and locate their source region with the remote sensing data.

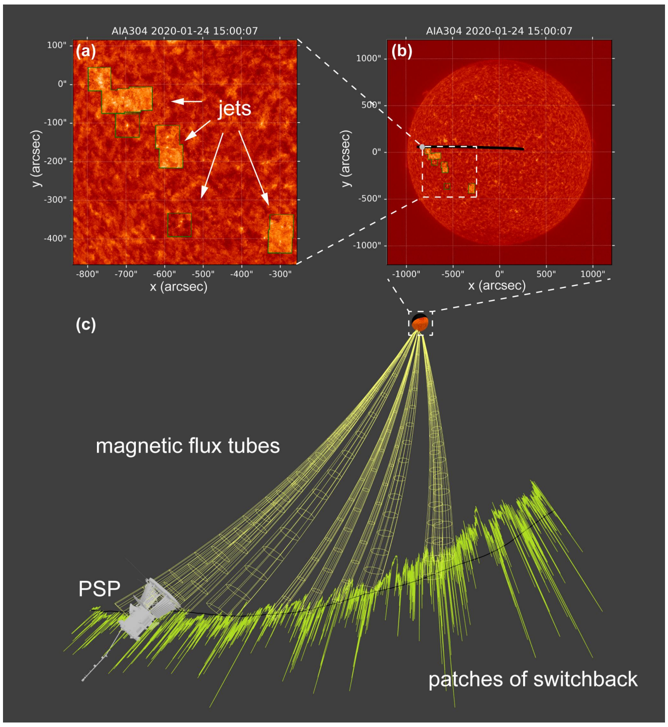

Figure 1. The connection between coronal jets and switchback clusters. (a) The position distribution of coronal jets in the field-of-view of AIA-304 ˚A. (b) The full disk AIA-304 ˚A image. The gray hexagon represents the projection point of PSP and the black line shows the trajectory of orbit. (c) The magnetic flux tubes connecting the solar surface and switchback clusters observed by PSP. The yellow tubes represent the magnetic flux tube. The green peaks show the radial magnetic component. The black line shows the orbit of PSP

In this talk, we will introduce our recent works about the the structures and dynamics of solar wind in the inner heliosphere in three topics:
(1) Switchbacks: We search the sources of the switchbacks in the solar atmosphere, and find the correlation between the switchbacks in the solar wind and jets from the chromospheric network boundaries.
(2) HCSs: We find the evidence of the “flapping” (small-scale movement) of HCSs in the inner heliosphere, and discuss the possible source of the flapping. We find the flapping is more possibly driven by the solar transients rather than local mechanisms in the interplanetary space.
(3) Slow shocks: We identify slow shocks in the inner-heliospheric solar wind, and statistically study the parameters and drive source of the shocks. We compare the evolution of the shocks with numerical models[6].
These results will help us understand the solar connection of the structures in the inner-heliospheric solar wind, and how the structures shape the solar wind.

References

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