



The S-Web Model for Slow Solar Wind

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Ulysses – SWICS fast latitude scan (Zurbuchen et al., 2012)

Observations Slower velocity Elevated charge-state ratios Elemental composition resembling the closed field corona Need Solar Orbiter for measurements closer to the source regions!

Conclusion

The slow solar wind originates from the closed-field corona.

But the slow wind can extend up to 30° away from the heliospheric current sheet. *How is this possible?*





For a purely dipolar magnetic field, the open-closed boundary could never release plasma at latitudes as high as ~30°.



The real sun's magnetic field leads to a **complex pattern of coronal holes which must be connected.** (Antiochos et al. 2011)

These corridors of open flux map to high latitudes in the heliosphere.



MHD simulation from Predictive Sciences, Inc.





Q measures the gradient in the mapping of the magnetic field from the surface at 10 Rs to the photosphere.

Heliospheric current sheet (black line) has infinite Q.

We expect slow wind to be released along all these arcs of high Q.





Fat elephant-trunk coronal hole created by a large active region.





The width of the corridor does not change the arc in the heliosphere. Photospheric dynamics along the corridor boundary will release slow wind along this S-Web arc.





Dynamic 3D MHD relaxation of the thin corridor.

In progress: Imposing a supergranular flow at the open-closed boundary.



Conclusions

- Dynamic open-closed interface can account for the slow wind.
- Need complex corridors at Sun and S-Web in heliosphere for large slow wind extent.
- Many implications for structure of heliosphere and space weather
 - propagation of CMEs to Earth
 - observations of SEPs at high latitudes and with large longitudinal extent
- I will calculate dynamics driven by photospheric motions (supergranules).
- I will calculate the expected plasma evolution for comparison to Solar Orbiter data.
- I will provide definitive observational tests for Solar Orbiter which will determine which of the theories for the slow solar wind is correct.