Multipoint Study of Solar Wind at Solar Minimum

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STEREO SWG
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Interplanetary Shock Genesis at 1 AU Due to Stream Interaction
The normal directions of the two forward shocks at STEREO A were similar. They might eventually form a single forward shock leading the SIR.

\[
\mathbf{N}_1 = 0.91\mathbf{R} + 0.37\mathbf{T} - 0.20\mathbf{N}
\]
\[
\mathbf{N}_2 = 0.93\mathbf{R} + 0.30\mathbf{T} + 0.22\mathbf{N}
\]
Multipoint Study of Stream Interaction Region (SIR)
Shock normal in RTN coordinates
A: 0.64R + 0.04T - 0.77N
B: 0.16R - 0.32T + 0.94N
The shock at B is ambiguous, possibly an Earth’s bow shock

Stream interface (SI) in RTN coordinates
A: 0.84R + 0.54T - 0.04N
B: 0.98R - 0.05T + 0.17N
Magnetic Field Near Stream Interface

Hard to point out the clear stream interface
Stream interface (SI) in RTN coordinates

A: 0.84R + 0.54T − 0.04N
B: 0.98R − 0.05T + 0.17N

The angle between the two interfaces was about 37.9°
gradual increase of entropy suggests the existence of the dissipation between streams

Shock normal in RTN coordinates

A: 0.85R + 0.50T - 0.17N
B: 0.86R + 0.49T + 0.13N
SI: 0.86R + 0.06T + 0.51N

Probably a small flux rope with low Np, Tp, and high B
STEREO B was at about (636, 408, 81) \( R_E \) in GSE coordinates.

It observed frequent passes of Earth’s bow shock (~2s once).

Consistent with the flare angle of the Earth’s bow shock becoming much larger under a strong solar-wind magnetic field strength.
SI: $0.70R - 0.37T + 0.62N$
Summary of Multipoit Observations of SIRs during Feb – May of 2007

- Most SIRs appeared earlier at STEREO A than STEREO B ➔ the radial propagation time from A to B spacecraft was longer than the corotation time from B to A spacecraft for SIRs.

- Shock association with SIRs differ between the two spacecraft, but not necessarily more shocks at B spacecraft, which observed SIRs often later.

- The plasma properties and magnetic field within the SIRs could differ significantly at the two locations for some events.

- The temporal profiles of the combined parameters (entropy and Pt), could also change much from A to B spacecraft.

- Heliospheric current sheet crossings were observed at several SIRs.

- The stream interfaces did not strictly follow the Parker spiral, and the shock driven by SIRs near 1 AU should be of small scales and somewhat transient.
Small-Scale Structures
Magnetic Holes

To study

- the occurrence rate and the properties of magnetic holes vs. the plasma properties
- the variations of the occurrence rate and properties of magnetic holes from STEREO A to B spacecraft
Discontinuities

\[ B_1 \land B_2 = 158^\circ \]

\[ B_1 \land B_2 = 162^\circ \]
Backup