SECCHI Observations Constraining The Initiation of Polar Coronal Jets

Spiros Patsourakos, NRL

SHOW HOW SECCHI CAN CONSTRAIN JET INITIATION

with:
E. Pariat
A. Vourlidas
S. Antiochos
R. Howard
Why Care About Jets?

Very possibly driven by magnetic reconnection

Ideal prototype to study reconnection in simple magnetic setups

Could be an important contributor to solar wind mass
Magnetic Twist as a Driver of Polar Jets

Axissymetric configuration
3D MHD simulations

Apply twist
kink

A high speed ~ V_A forms
with helical structure

A fraction of observed jets
exhibit similar properties

Pariat et al. 2007
Critical Elements of The Twist Model

Kink instability - High Speed Outflow - Helical structure

Can SECCHI 3D Observations constrain those elements?
Recap of the Observations

multipolar topology → slow rise → kink → rapid acceleration & helical structure

7 June 2007 ~ 05:00 UT
North Polar Coronal Hole
A-B ~ 11 degrees
Observed by EUVI, COR1, COR2
Height-time plot of the Jet
‘Real’ Velocity of the Jet

- Slow rise
- Rapid acceleration @ fraction of \( V_a \)
3D Trajectory of the Jet

evidence of kink
Helical Structure of the Jet I

Small but noticeable differences between A & B which increase with time.
The Helical Structure of the Jet II

The Helical Structure is REAL!
Helical Structure of the Jet III

Edge-enhanced Images
Emulating SECCHI Observations

mass isosurfaces

~ 10 degrees

evident differences
Assemble a database of jets

More realistic comparisons between obs-modeling

Establish a firm link between jets observations from EUVI & CORs
Summary

Performed the first 3D observations of polar jets

Taking advantage of the unique characteristics of STEREO to:
(1) Calculate ‘real’ $v$
(2) Demonstrate kink in action
(3) Demonstrate evidence of helical structure

Twist can drive polar jets

SECCII CAN STRONGLY CONSTRAIN JET INITIATION
Work In Progress: More Realistic Model-Obs Comparisons

\[ \int \rho^2_{\text{los}} \]
Acceleration of the Jet
Other Examples of Helical Jets
Difference Images

STEREO A

STEREO B

base diff

run diff
Observing Strategies with SECCHI

Probably focus on 195 & 304: higher contrast

Synop cadence in 171 probably OK.

But

higher cadence (~30 s) in required in order to see in 3D the jet oscillations that XRT sees. PFIs?

Deeper exposures with CORs? Anything in HIs?

Run a pilot program soon. The SC separation gets too big

Coordinate with Hinode
171, 195, 304 Movies