Tomographic Reconstruction of the January 2010 Corona

Preliminary Results from JOP 225

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Problem

What are plumes?
Source of the fast wind (Teriaca 2003)?
Or is it interplumes (Gabriel 2005)?
Geometry: Tubes? Curtains? Both?
Lifetime: < 1 day? few days?

Can tomography help?
Plumes are dynamic objects
Tomography needs weeks of data

Yes.

Using three strategies

1. Reduce the acquisition time
2. Time dependent (4D) tomography
3. All of the above

Reducing the acquisition time

1 viewpoint: 28 days (full corona) or 14 days (poles)
2 viewpoints @ 90°: 7 days (March 2009)
3 viewpoints @ 60°: 4.2 days (September 2009)

Life-time of (some) plumes!

JOP 225

10-18 January 2010: ~65° / 70°, but
EUVI: ICER3 binned 2x2, increased exp. times
EIT: 195, additional 284, increased exp. times
SWAP: 171, best effort (commissioning)

Thanks to the SECCHI and SWAP ops. teams!
The tomography code

Typically: 3 $R_\odot$ 128 x 128 x 128 reconstruction cube
6 images per day
Images binned 512 x 512

2 or 3 bands + isothermal hypothesis > $N_e$, $T_e$

September 2009: Herschel sounding rocket
JOP 225 preliminary results

6 days of data: 13 – 18 January 2010
B0 < 0 on A and SWAP: south pole
Some structures last several days
A + B reconstructions @ 90°

March 2009: spacecraft separation = 90°
B0 ~ -5°: good coverage of the south pole
Only 7 days needed

Average of N reconstructions over p days
= Reconstruction over p x N days

A 3D reconstruction is an average over the acquisition time
Conclusions

3 point tomography!
  Helps
  Reduced acquisition time: 6 days
  Disparity of viewpoints: that’s good
  Disparity of data: that’s bad
  SWAP: still learning (pointing, noise, response, etc.)

Shortest snapshot of polar plumes!
  Interpretation still challenging
  Average quantities
  Quantification of artefacts

Work in progress
  Process 195 and 284
  Temperature, density
  Putting it all together: 3 viewpoints time dependent tomography

THANKS to the SECCHI and SWAP operations teams!