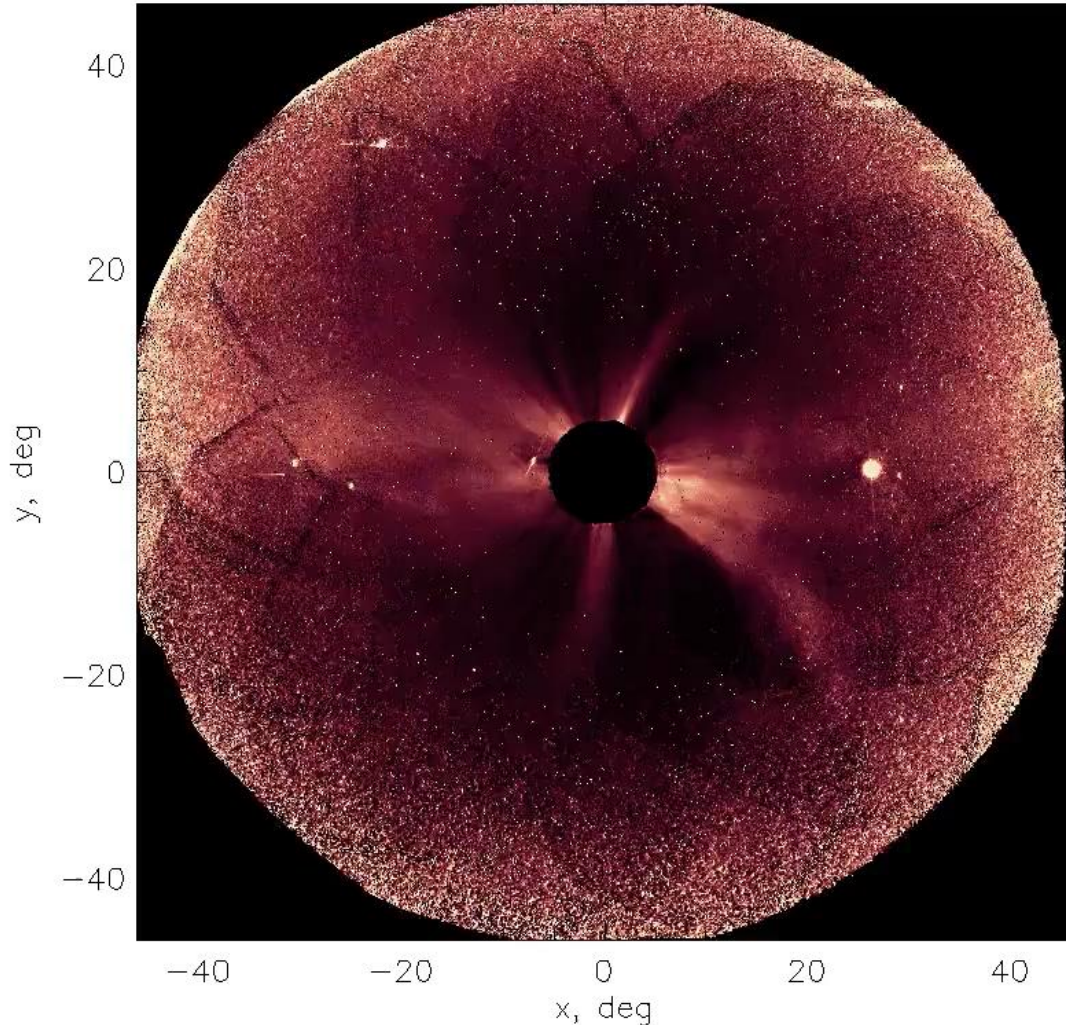


CME In 3D With PUNCH

Anna Malanushenko, HAO/NCAR

PUNCH event: CME in SW limb on 2025-09-23

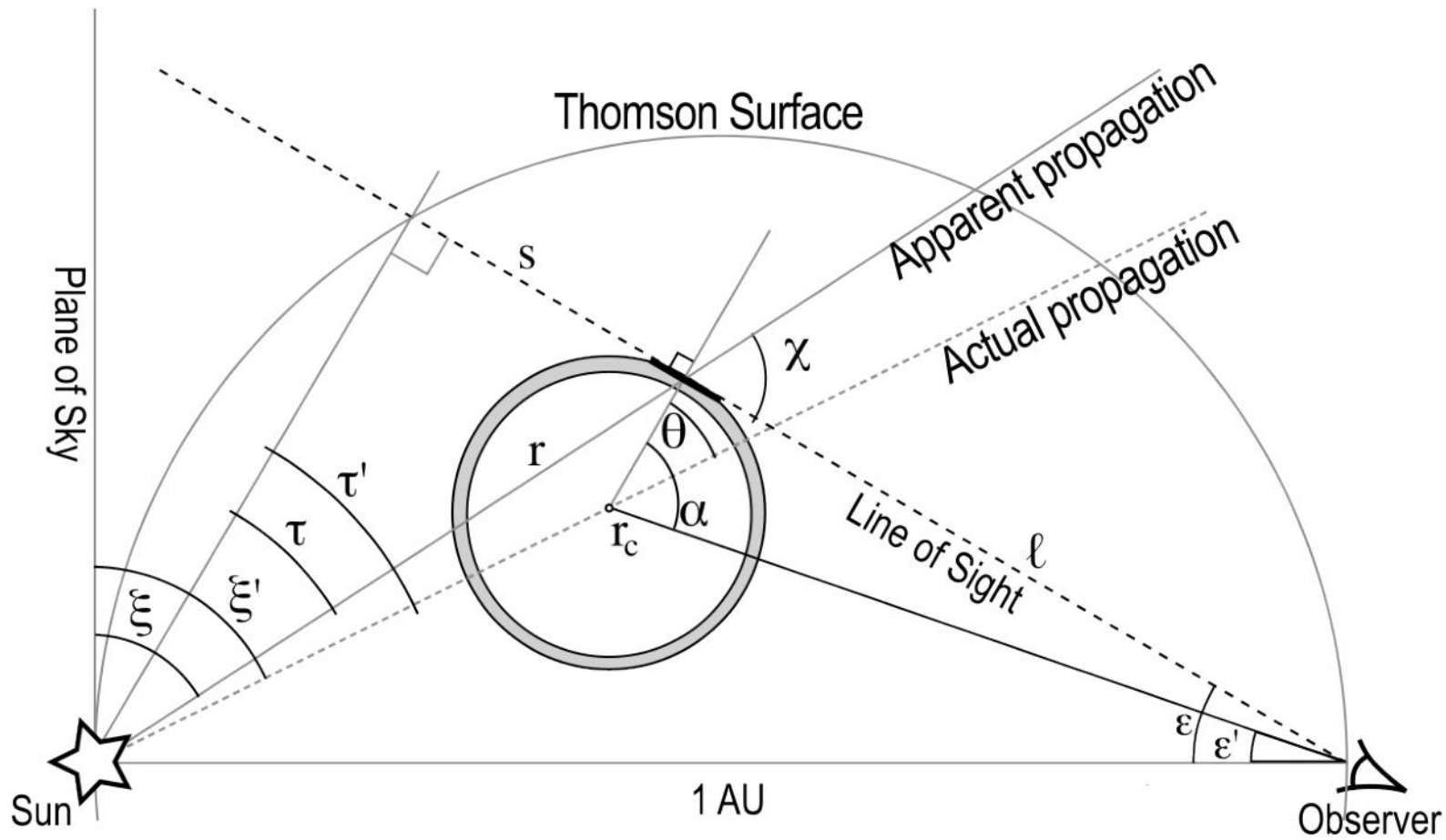
2025-09-22T00:16:00.000 | tB | data version: PAMv0k



Agenda:

- make a “J-map”
- make a “ τ -J-map”
- figure out τ

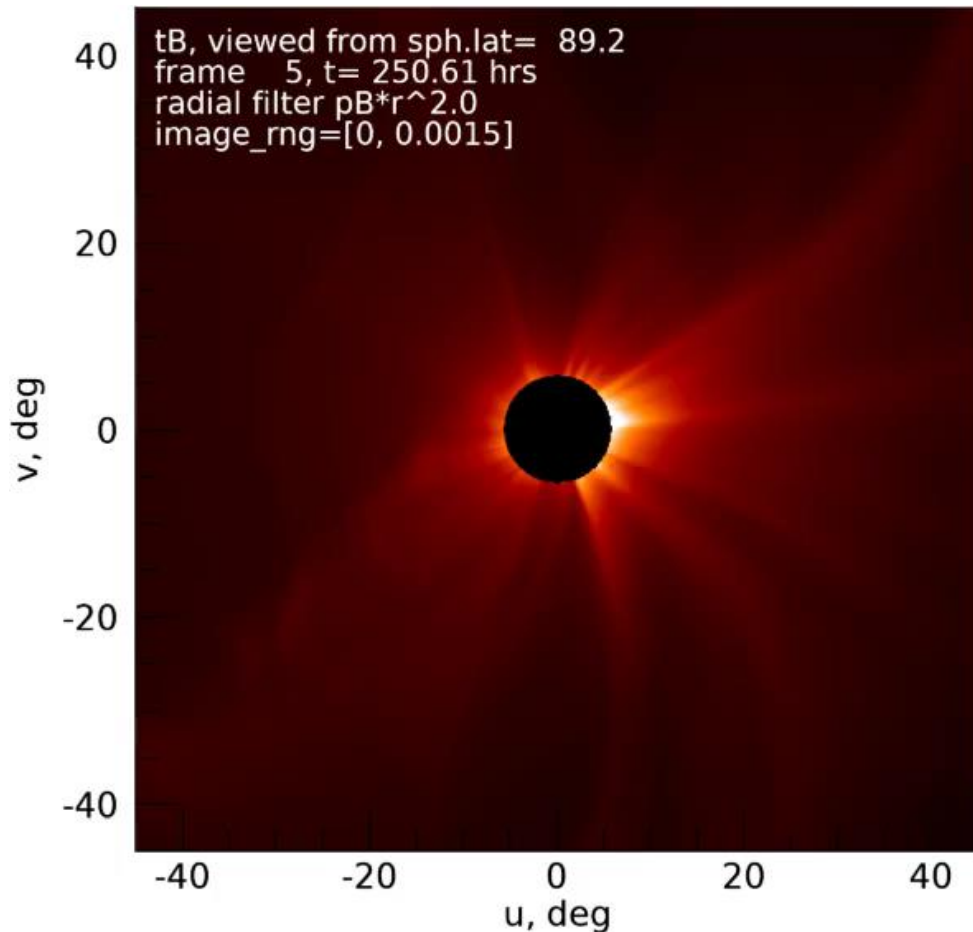
Intro: what I'm trying to do



Objective: use tB/pB to figure out the position of the front of the CME

Intro: what I'm trying to do

Illustration: CME0 from the “CME Challenge v2.0”, an open dataset of synthetic CMEs based on GAMERA simulations



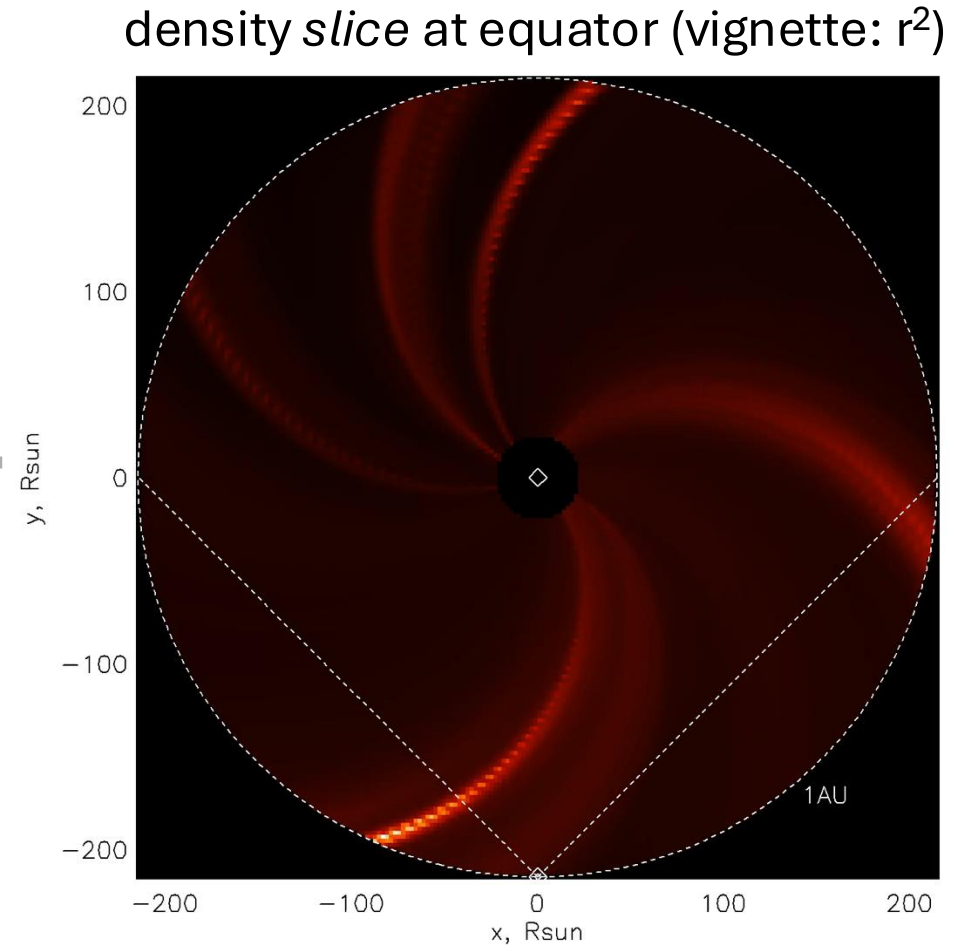
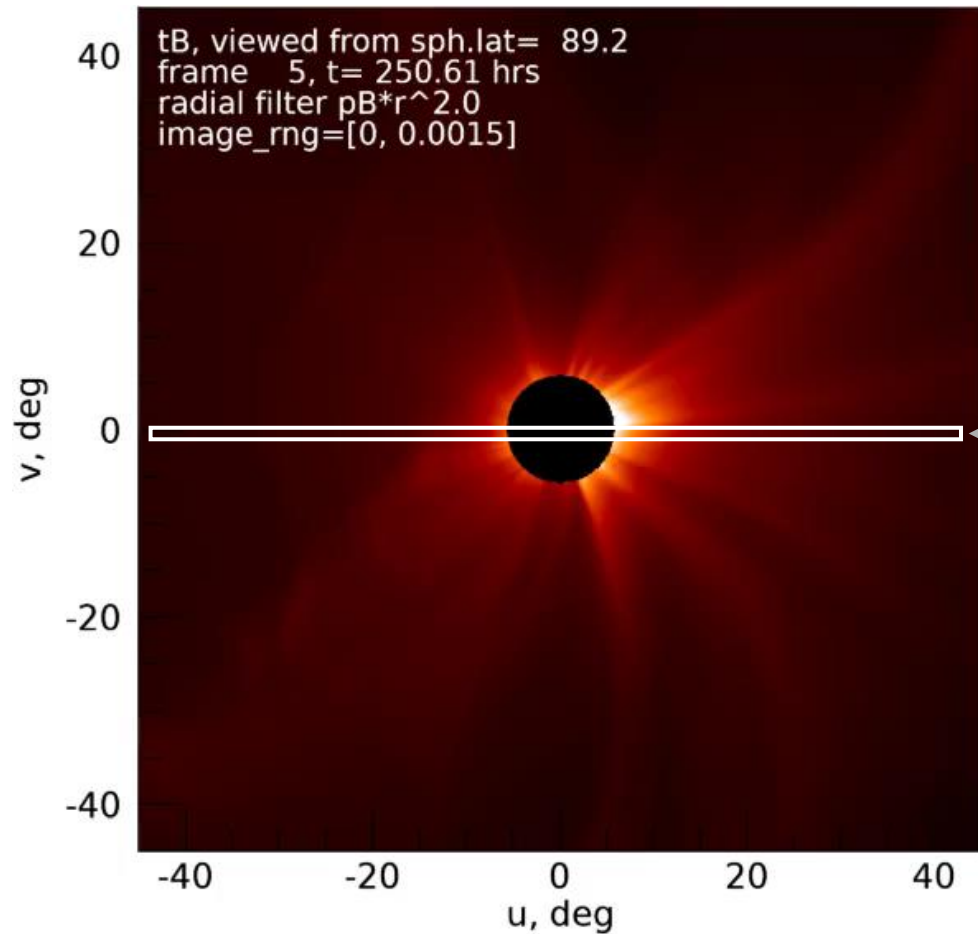
(this isn't a model of the event in question! I'll use this to illustrate the geometry in general)



https://download.hao.ucar.edu/pub/punch/cme_challenge_v2/

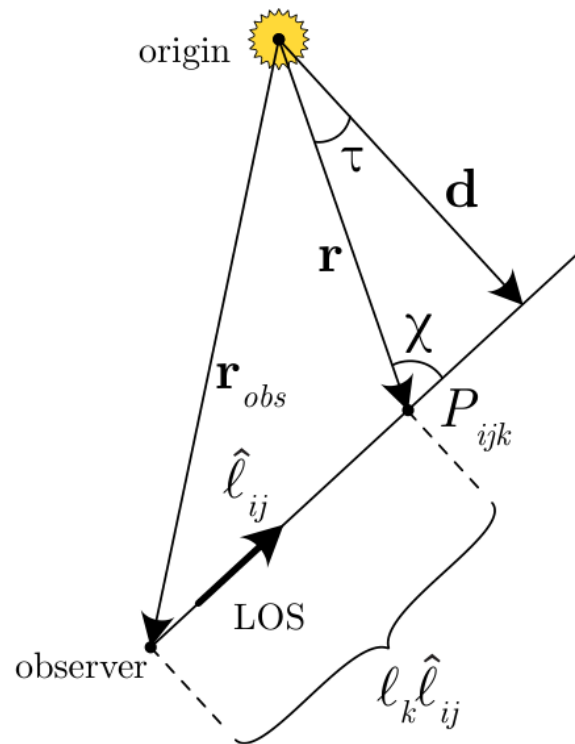
Intro: what I'm trying to do

Consider an equatorial slice of density:

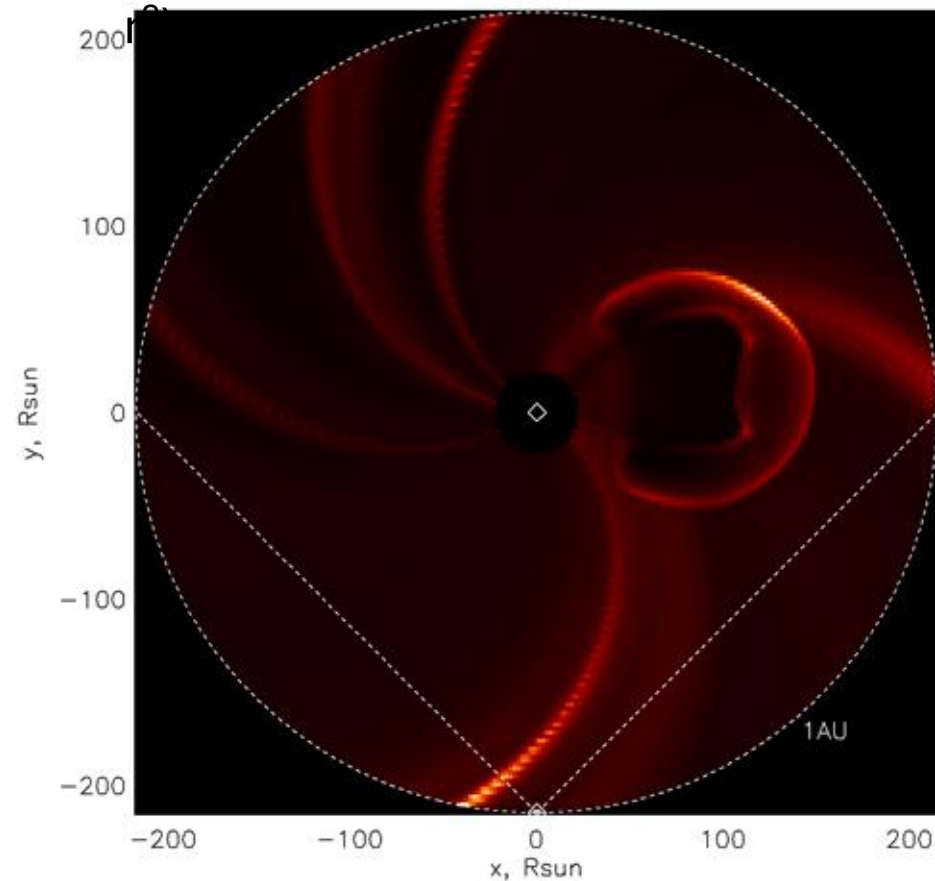


Intro: what I'm trying to do

- Consider a particular line of sight. Both tB and pB are line-of-sight integrals of density, but with different weighting – their ratio can help us determine angle τ

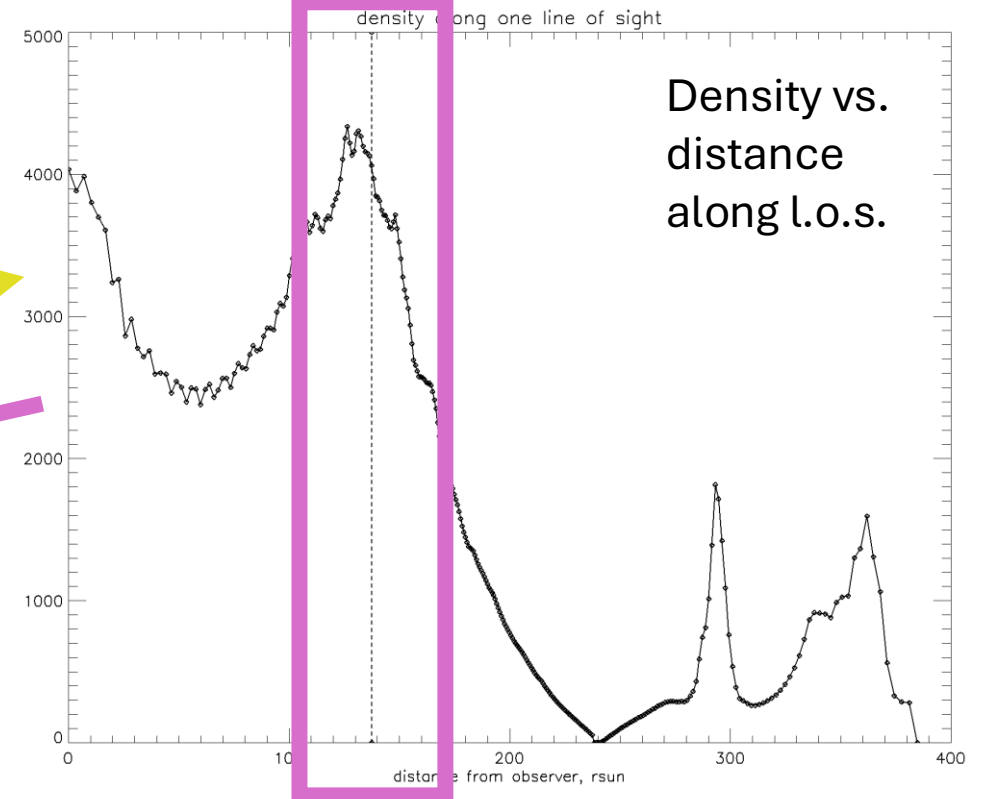
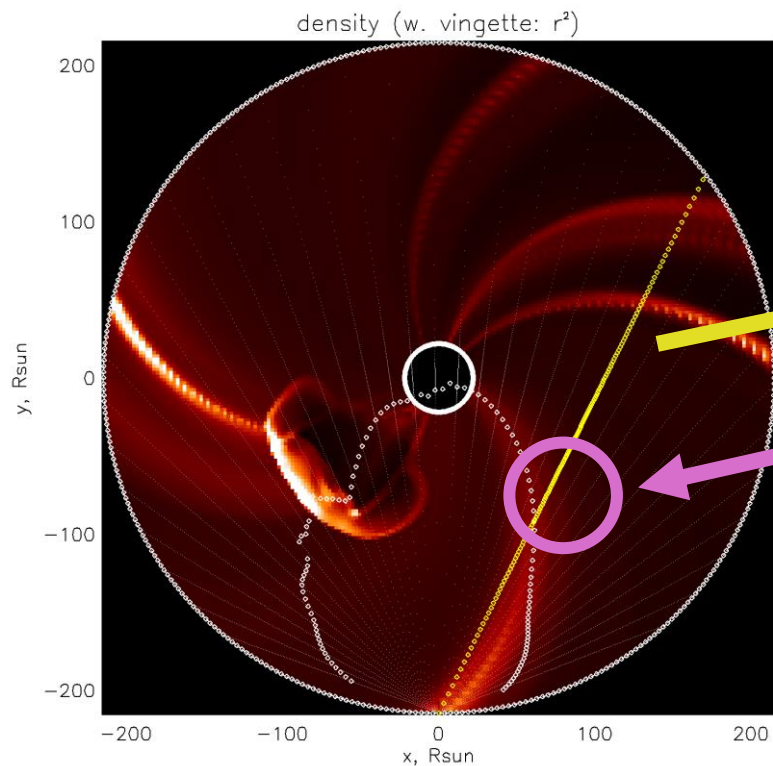


density slice at equator (vignette:



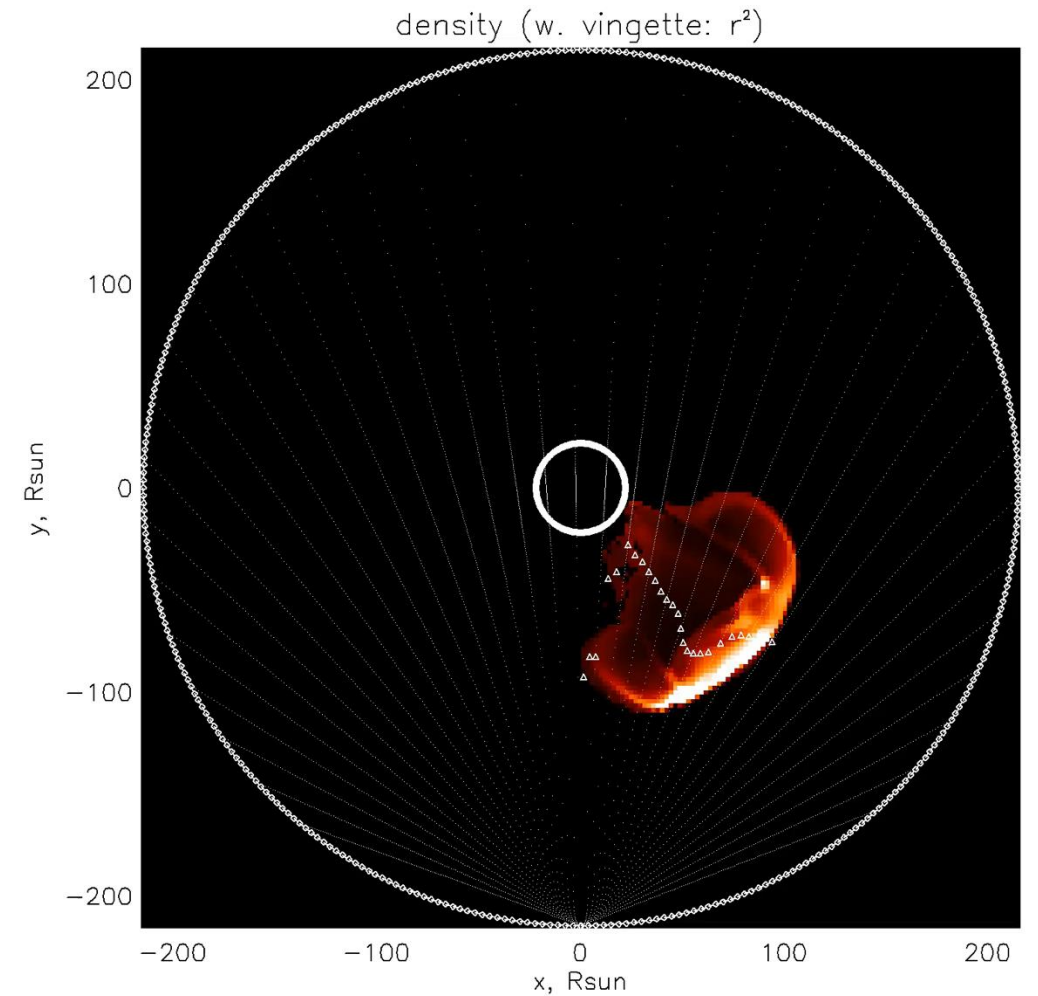
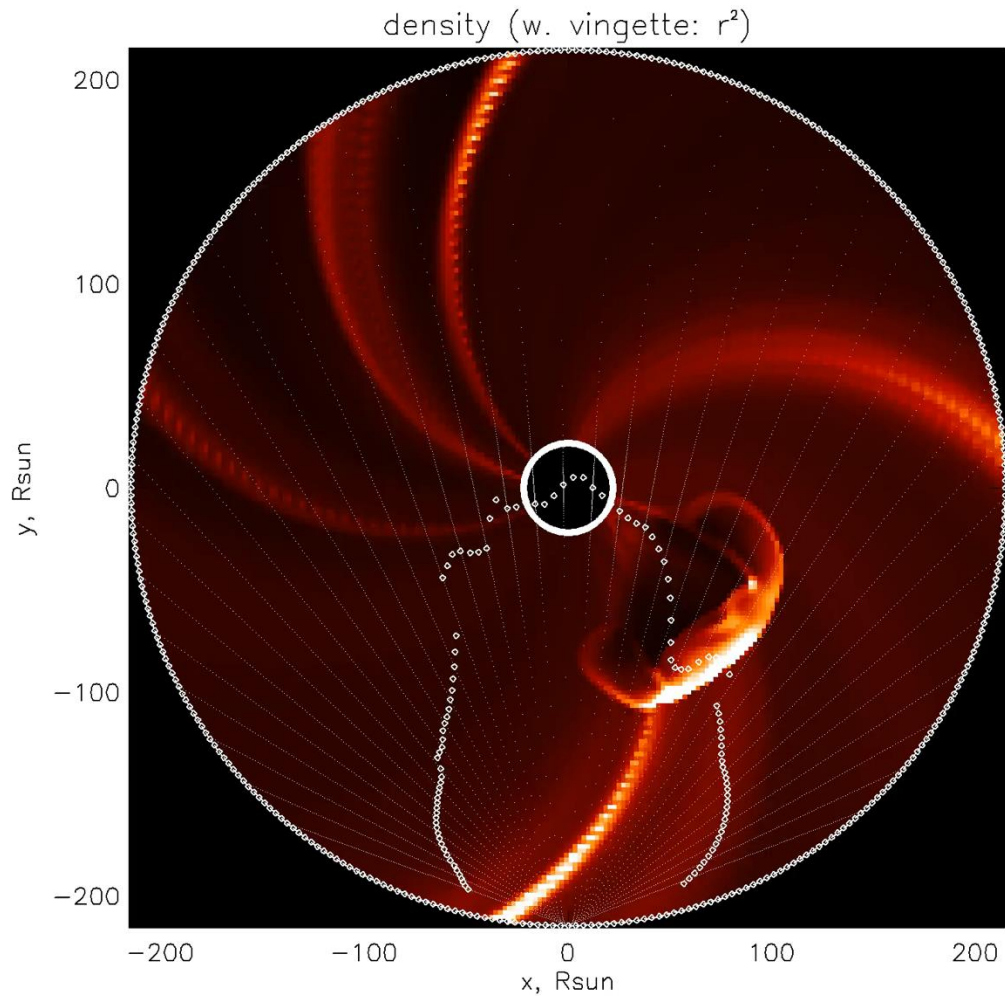
Intro: what I'm trying to do

- Consider a particular line of sight. Both tB and pB are line-of-sight integrals of density, but with different weighting – their ratio can help us determine angle τ
- ...if we're looking at point source. Or, of center-of-mass τ if we're looking at something bigger



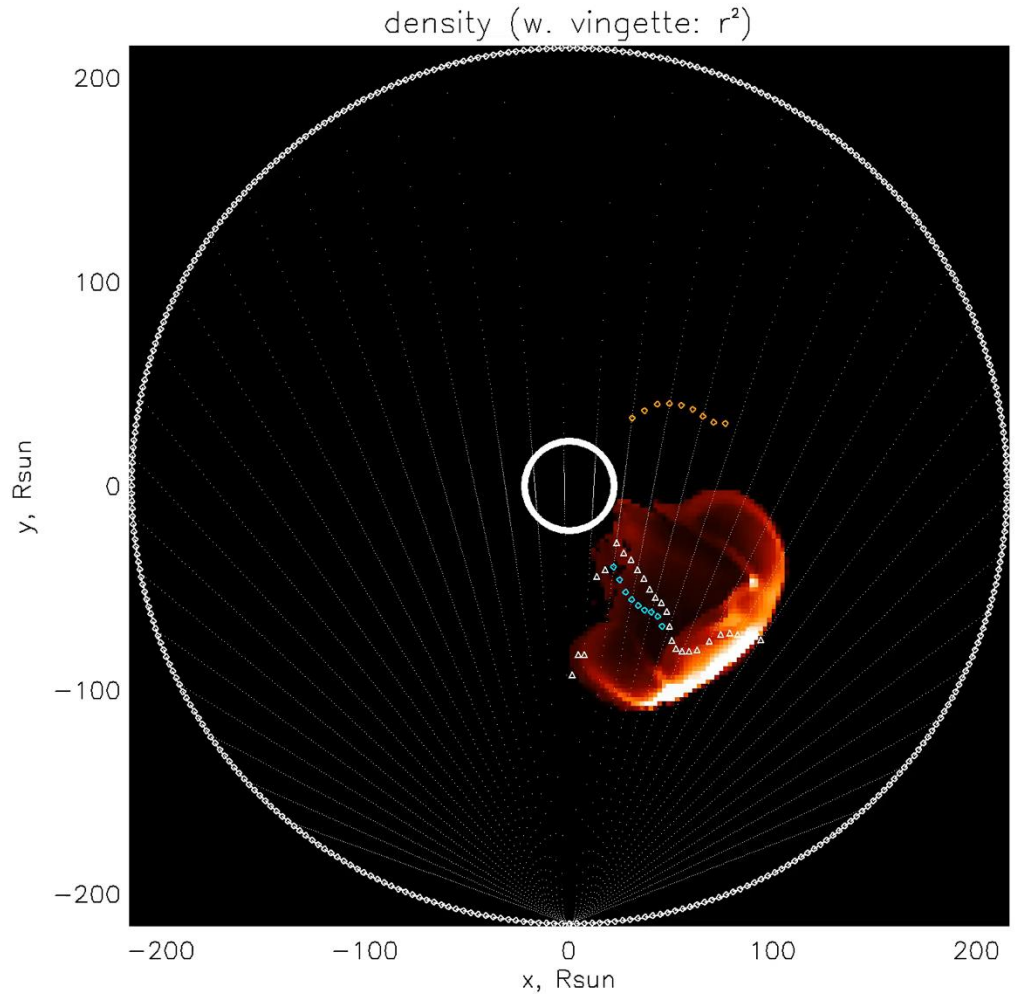
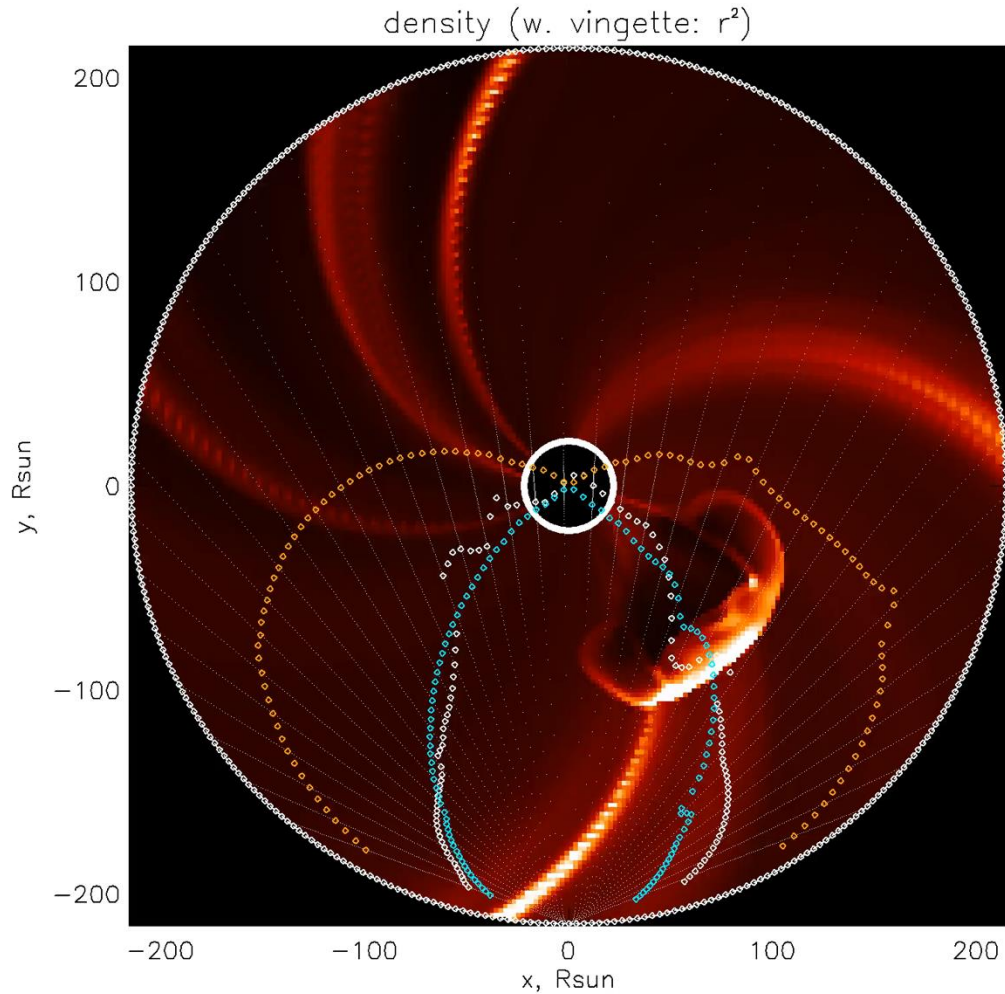
Intro: what I'm trying to do

- What should the center of mass look like? Derived from simulation:



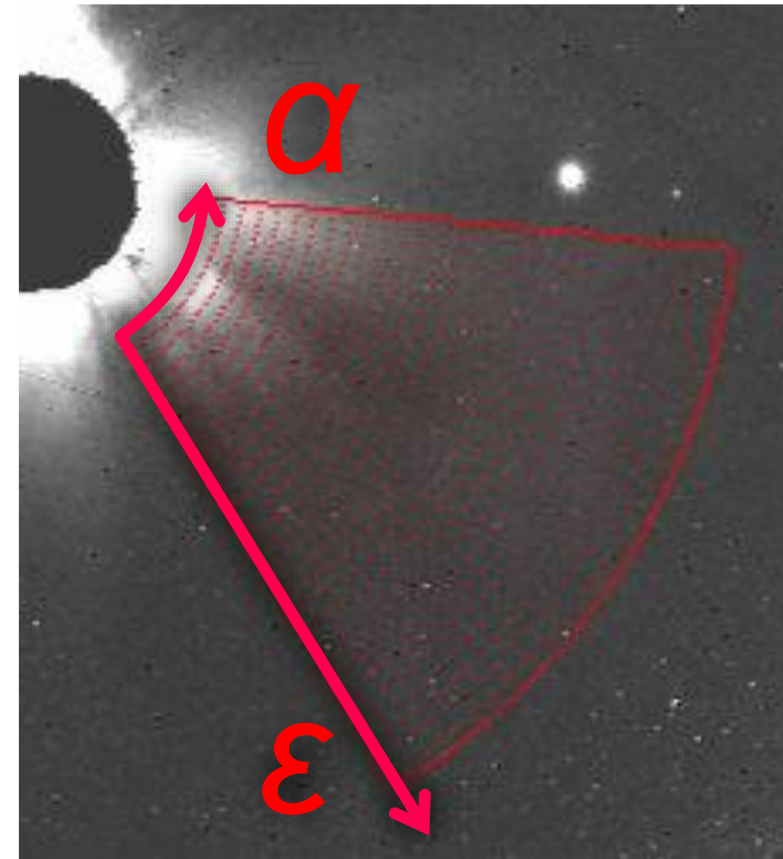
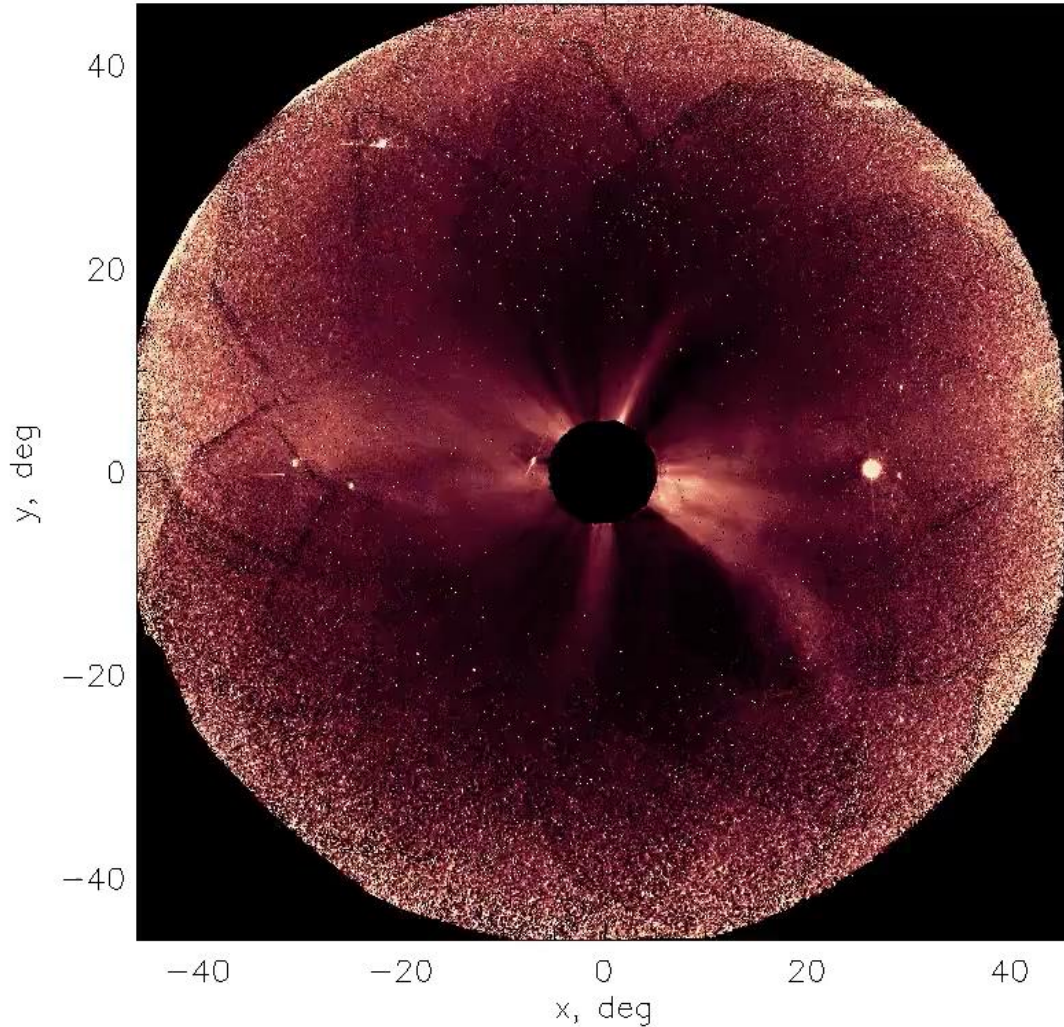
Intro: what I'm trying to do

- ...and derived from tB/pB ratio (two solutions shown with blue and orange; true center of mass with white)



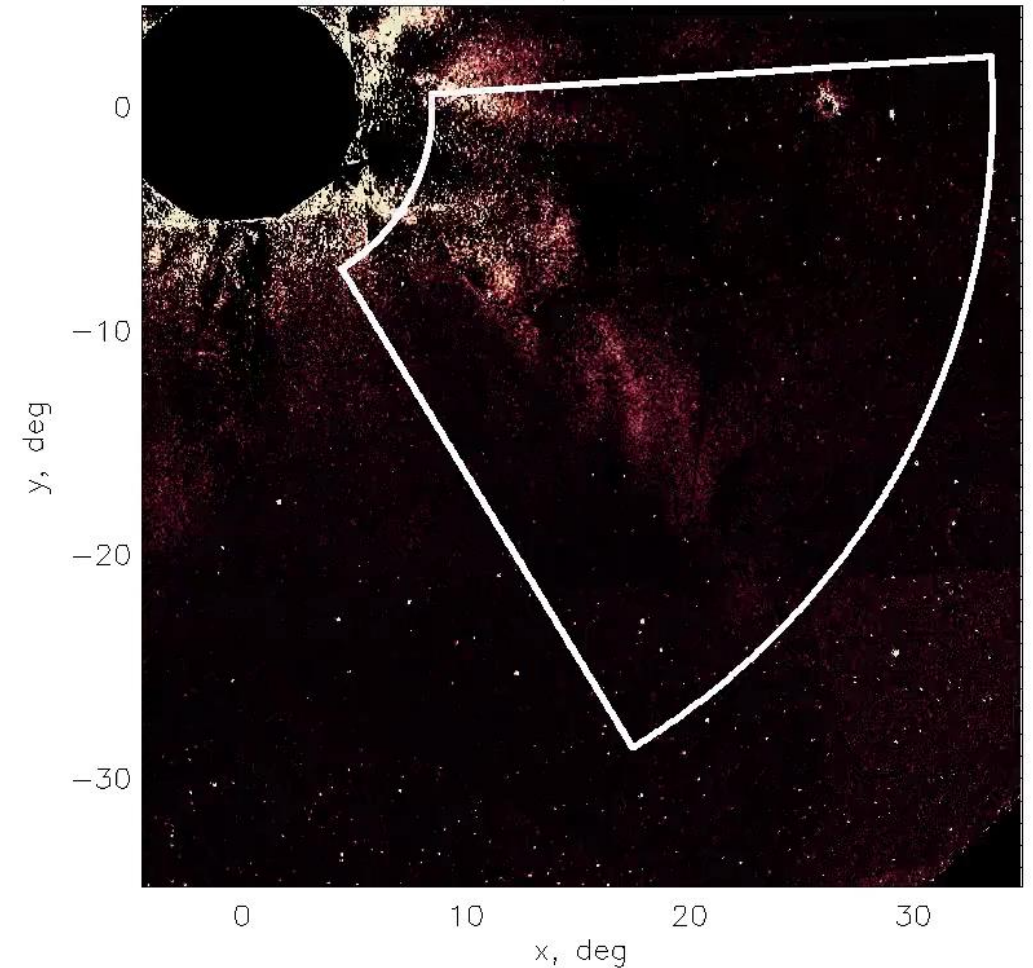
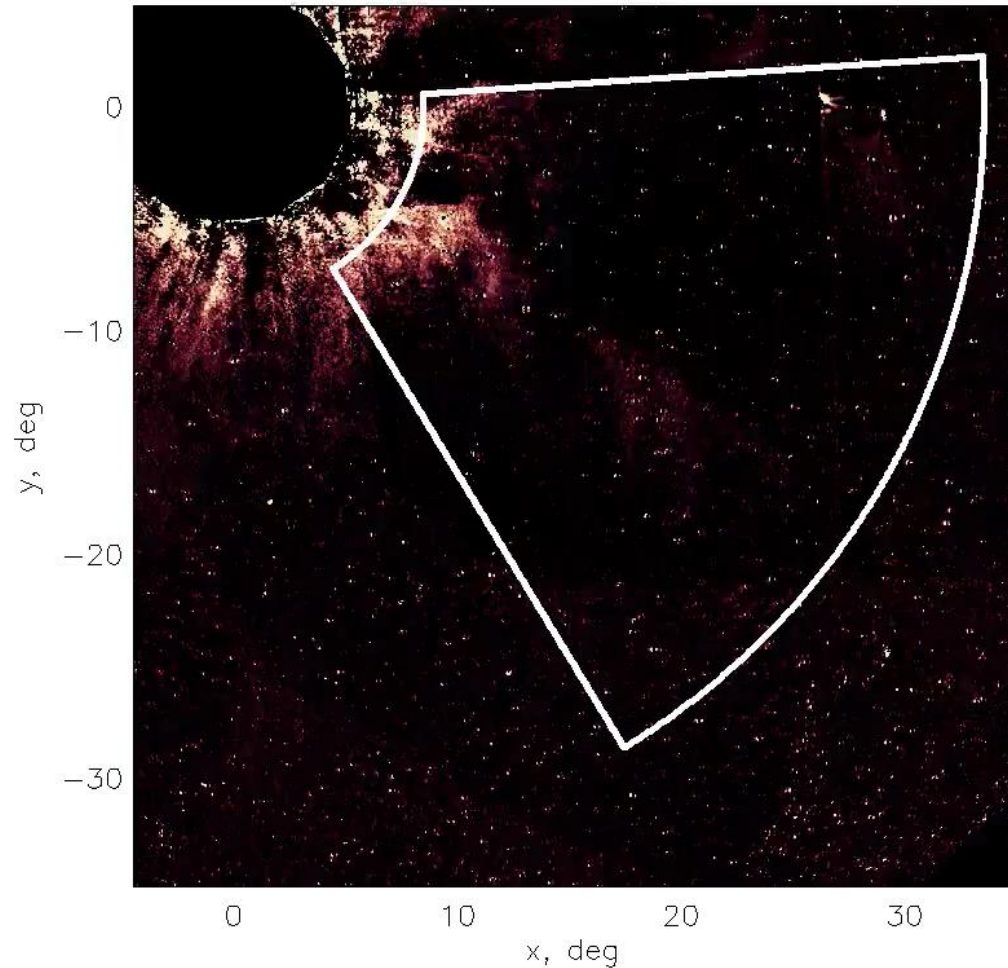
...going back to the PUNCH event on 2025-09-23

2025-09-22T00:16:00.000 | tB | data version: PAMv0k



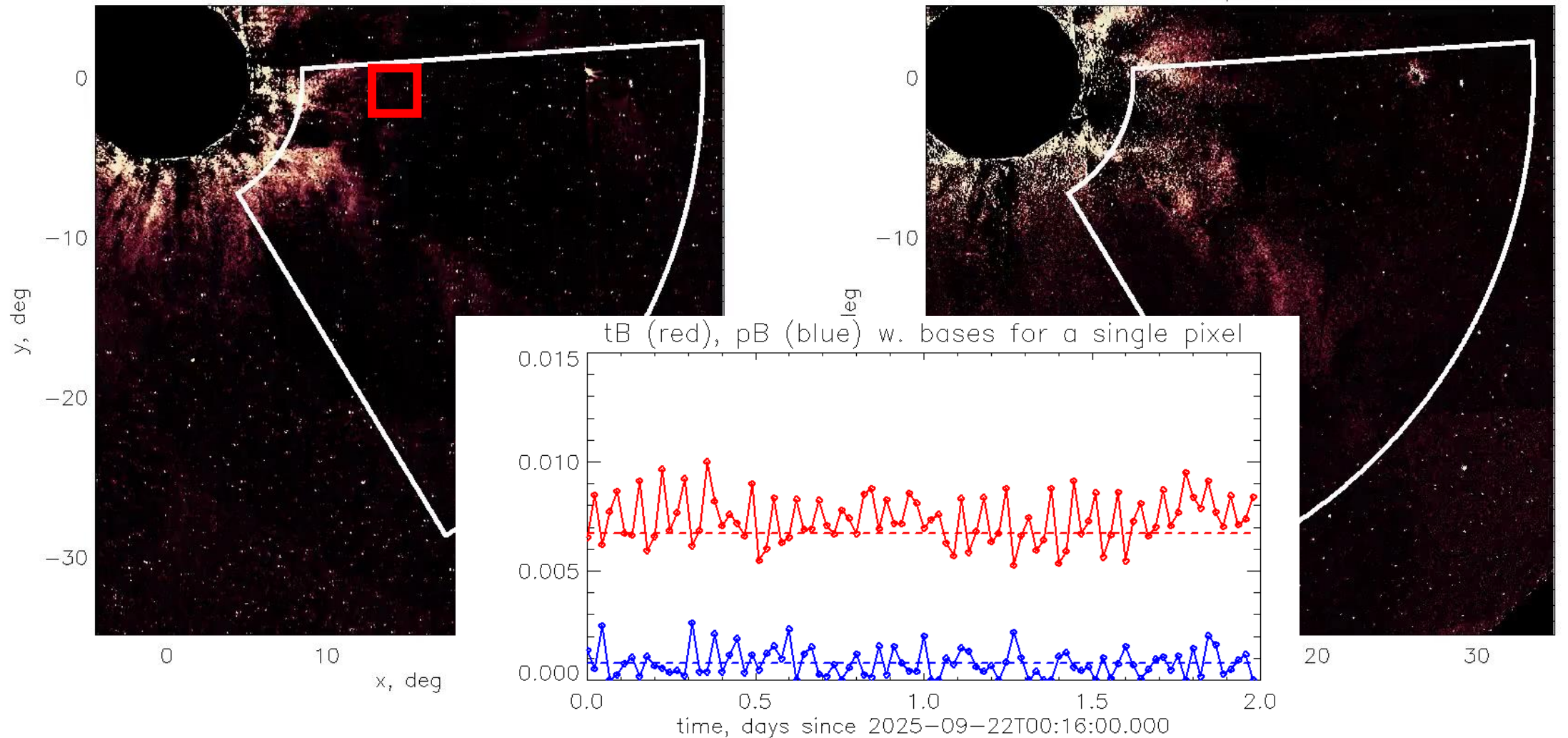
...going back to the PUNCH event on 2025-09-23

2025-09-22T00:16:00.000 | tB-base | data version: PAMv 2025-09-22T00:16:00.000 | pB-base | data version: PAMv



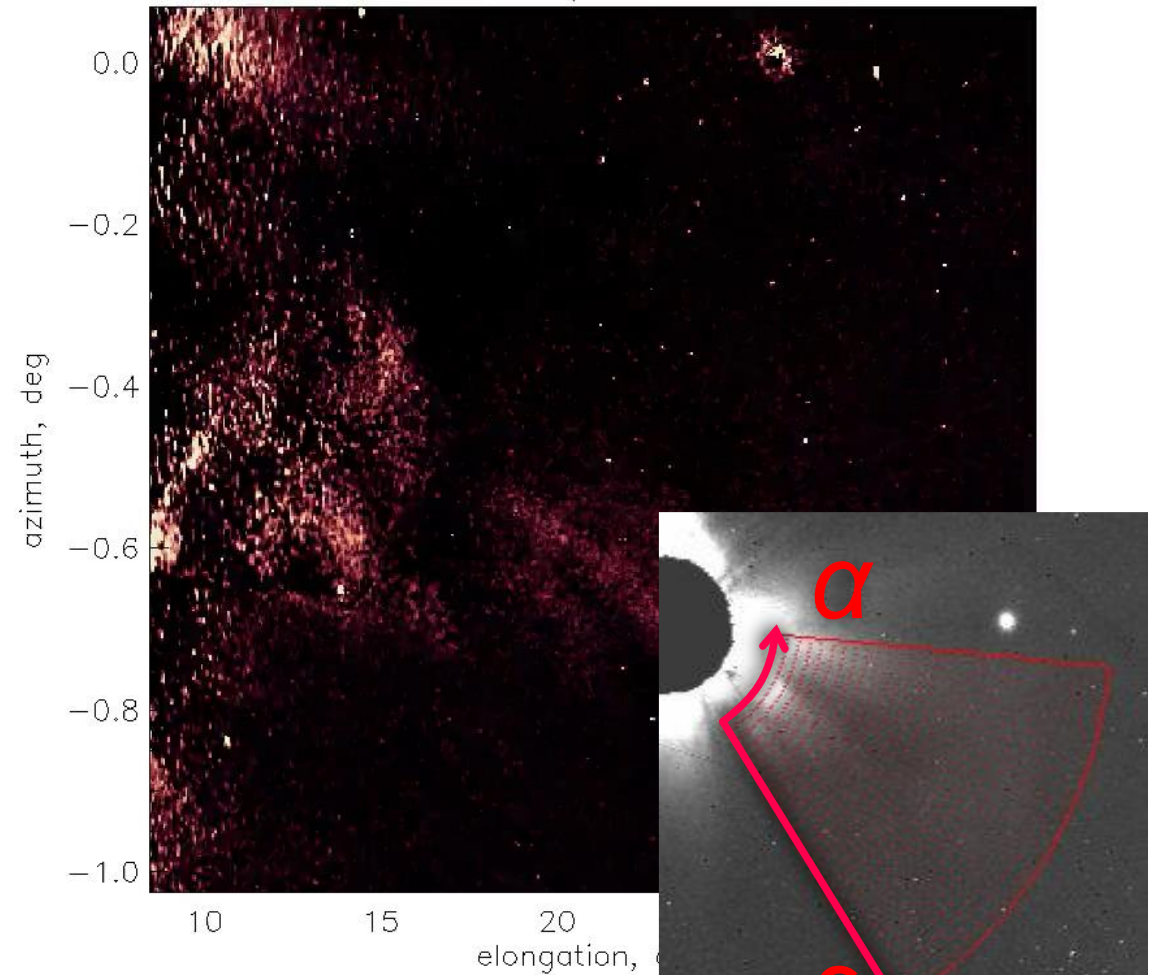
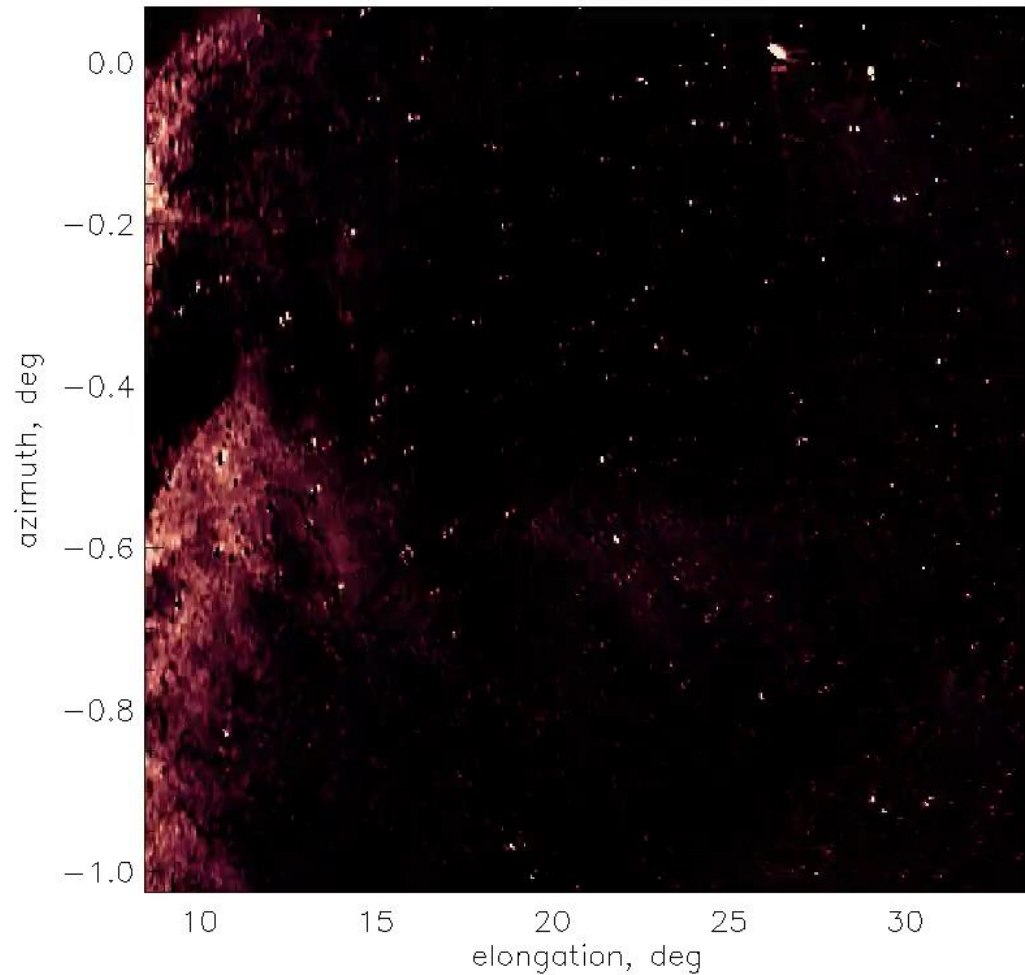
...going back to the PUNCH event on 2025-09-23

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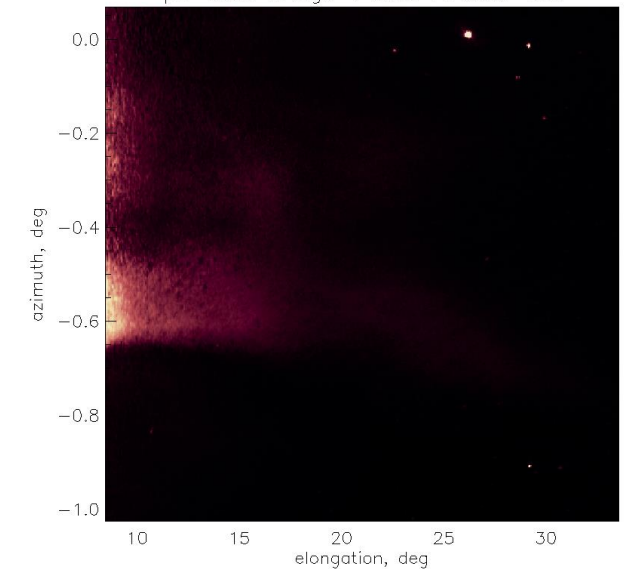
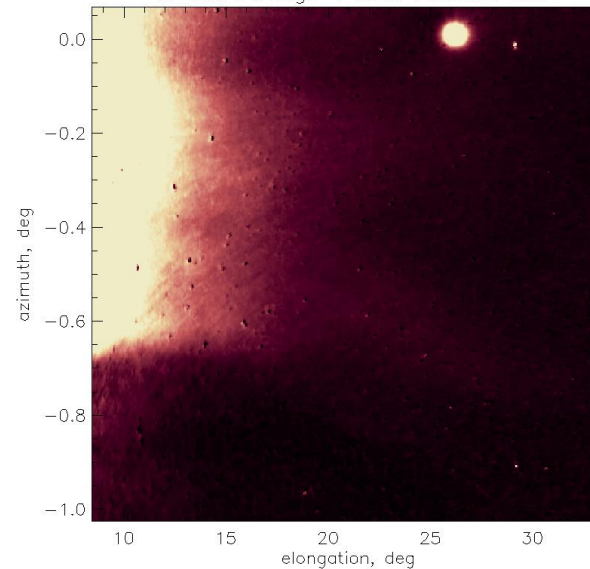
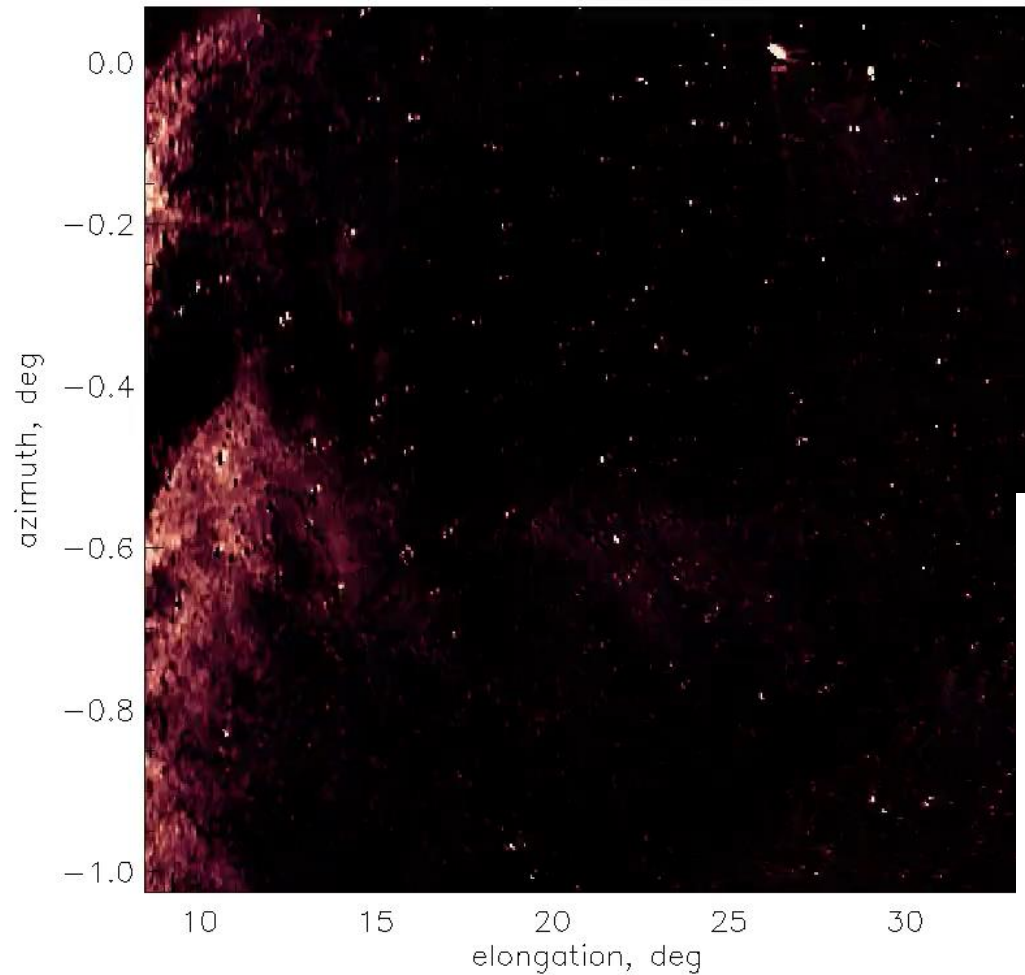
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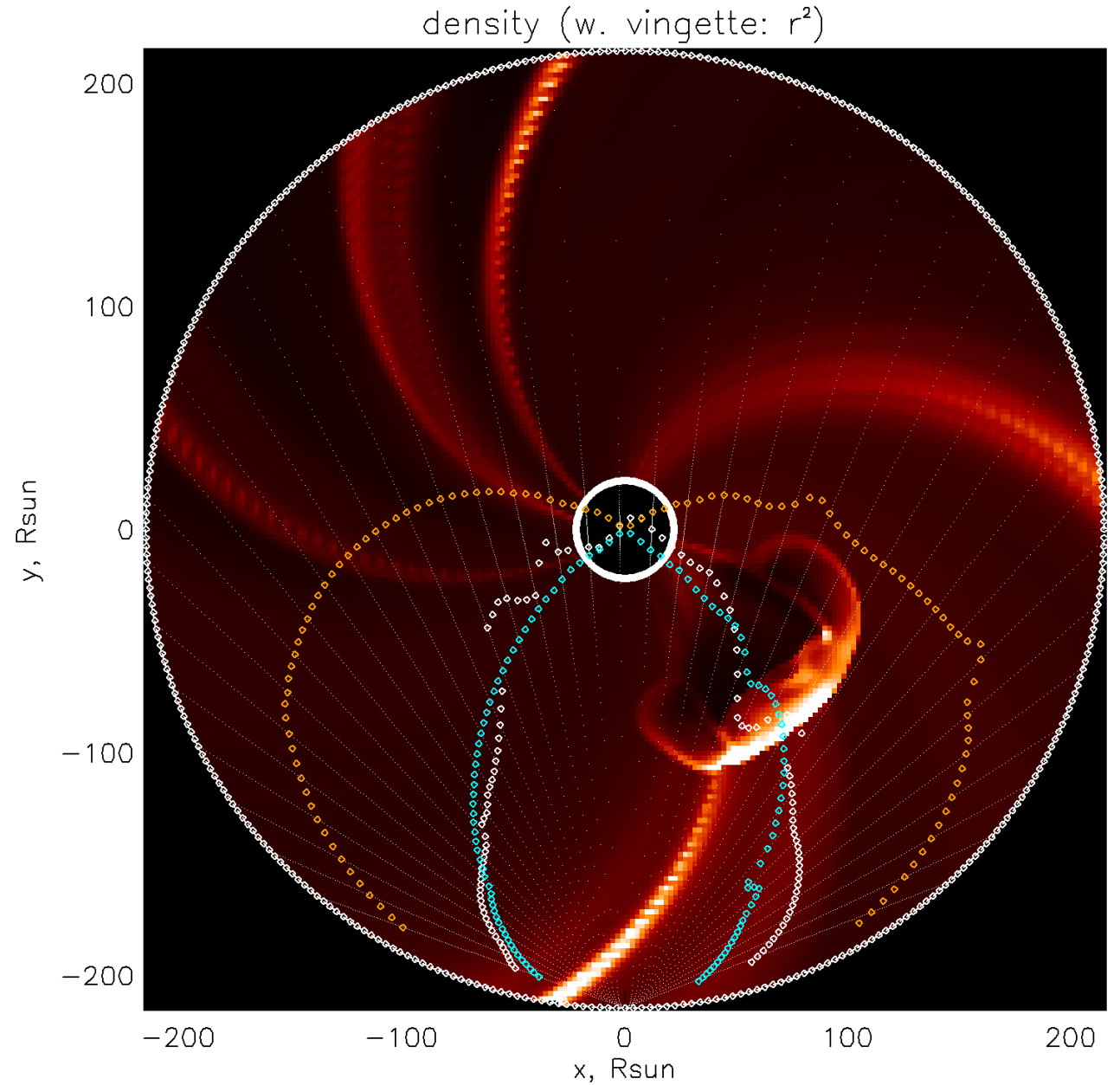
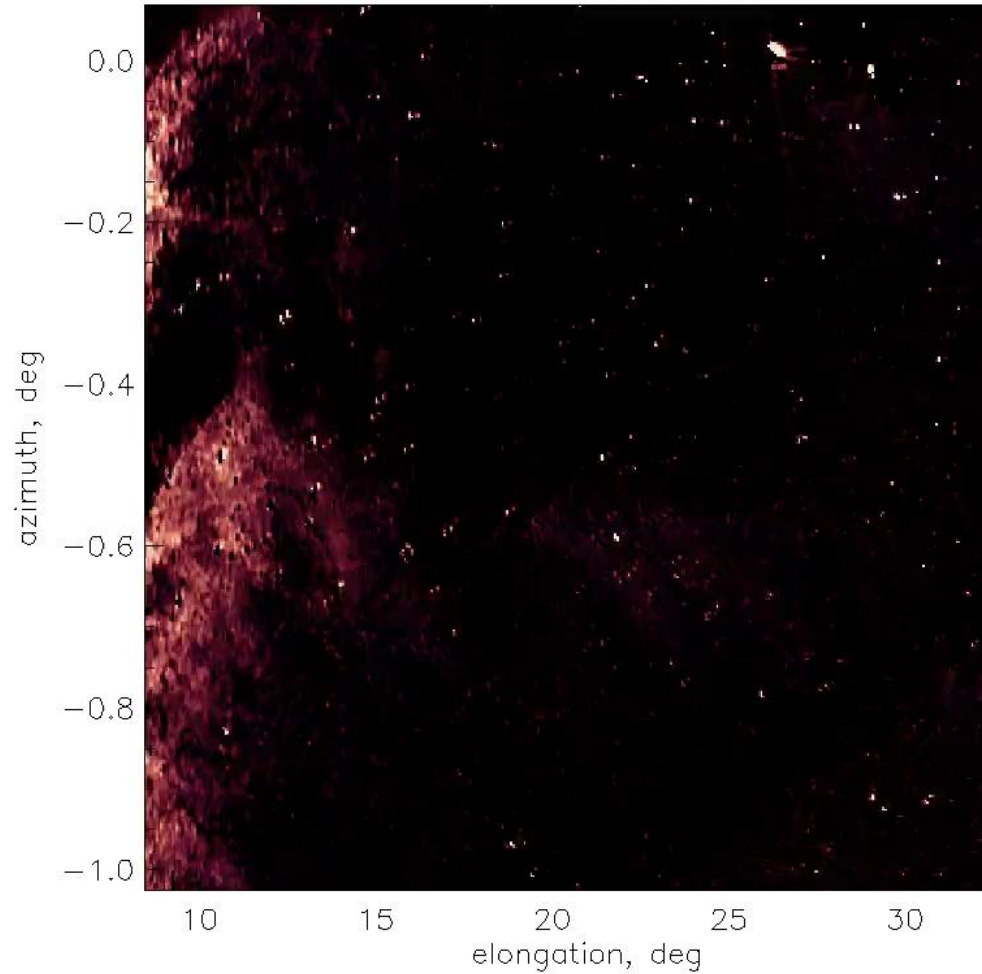
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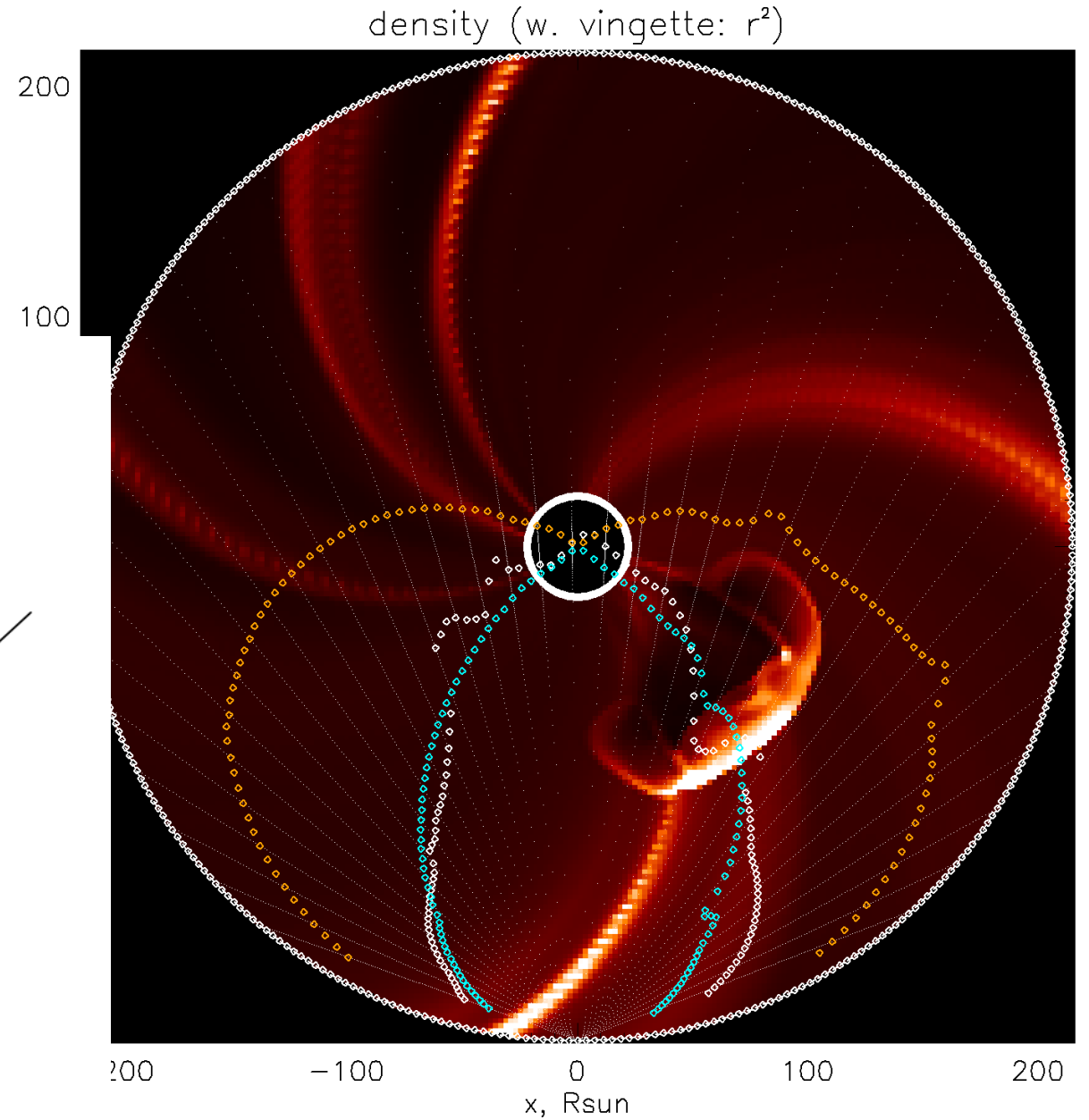
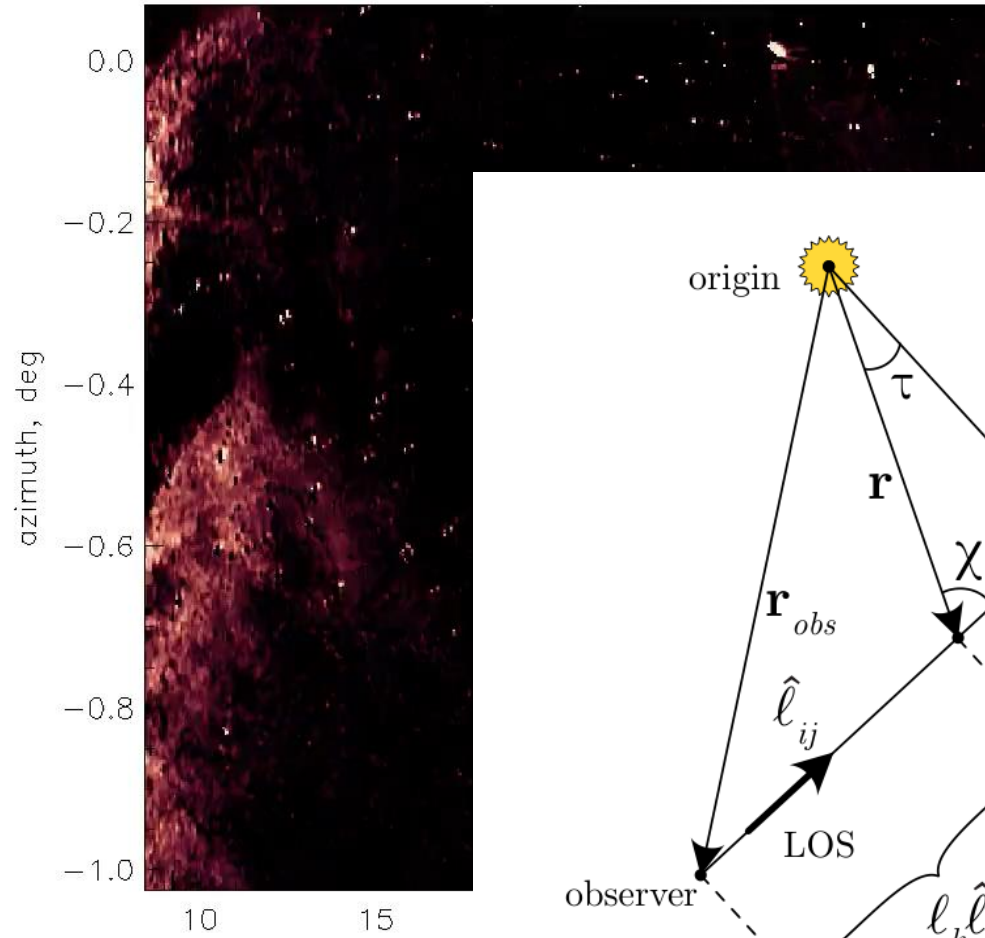
...going back to the PU

2025-09-22T00:16:00.000 | tB-base | data versio



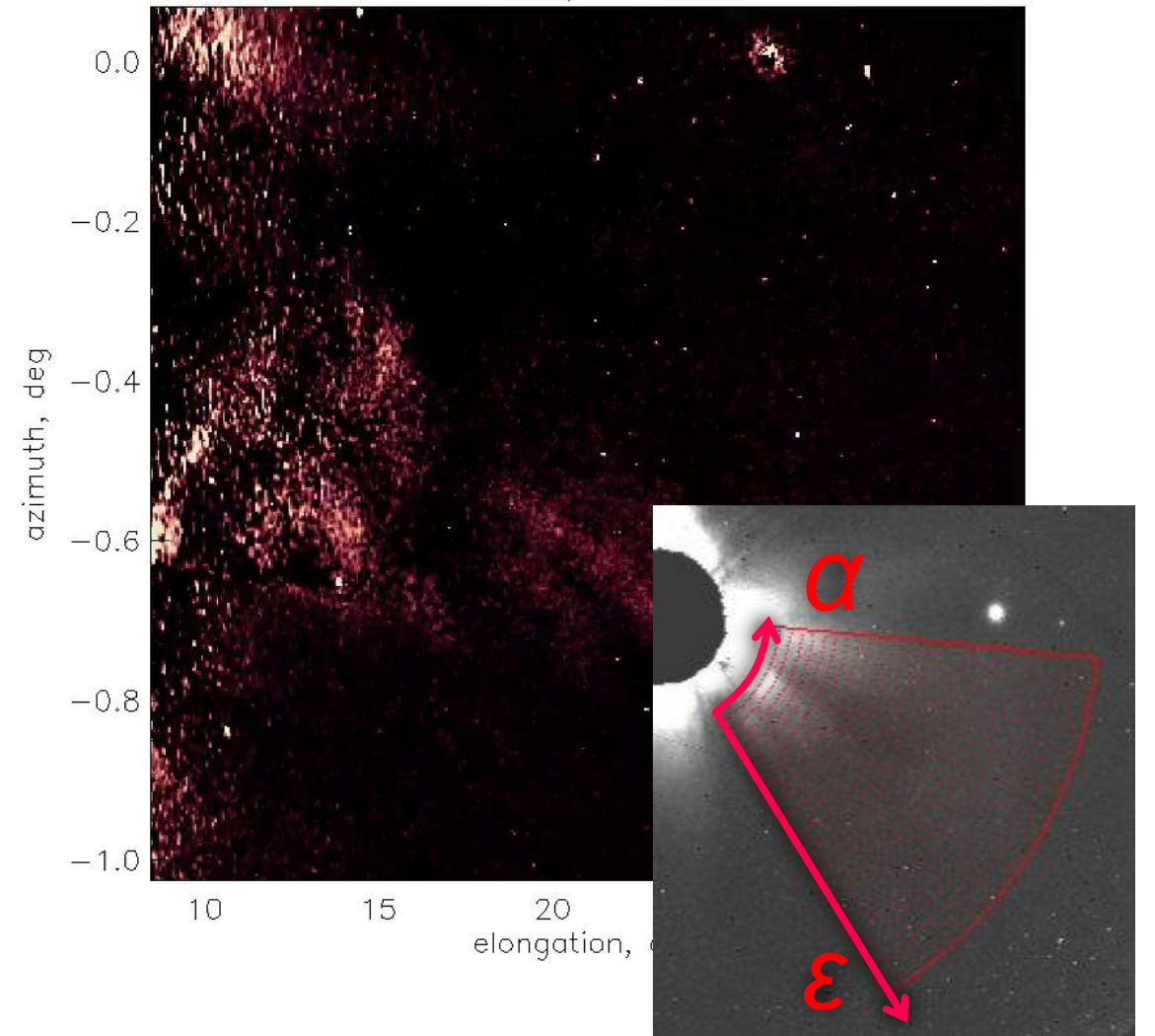
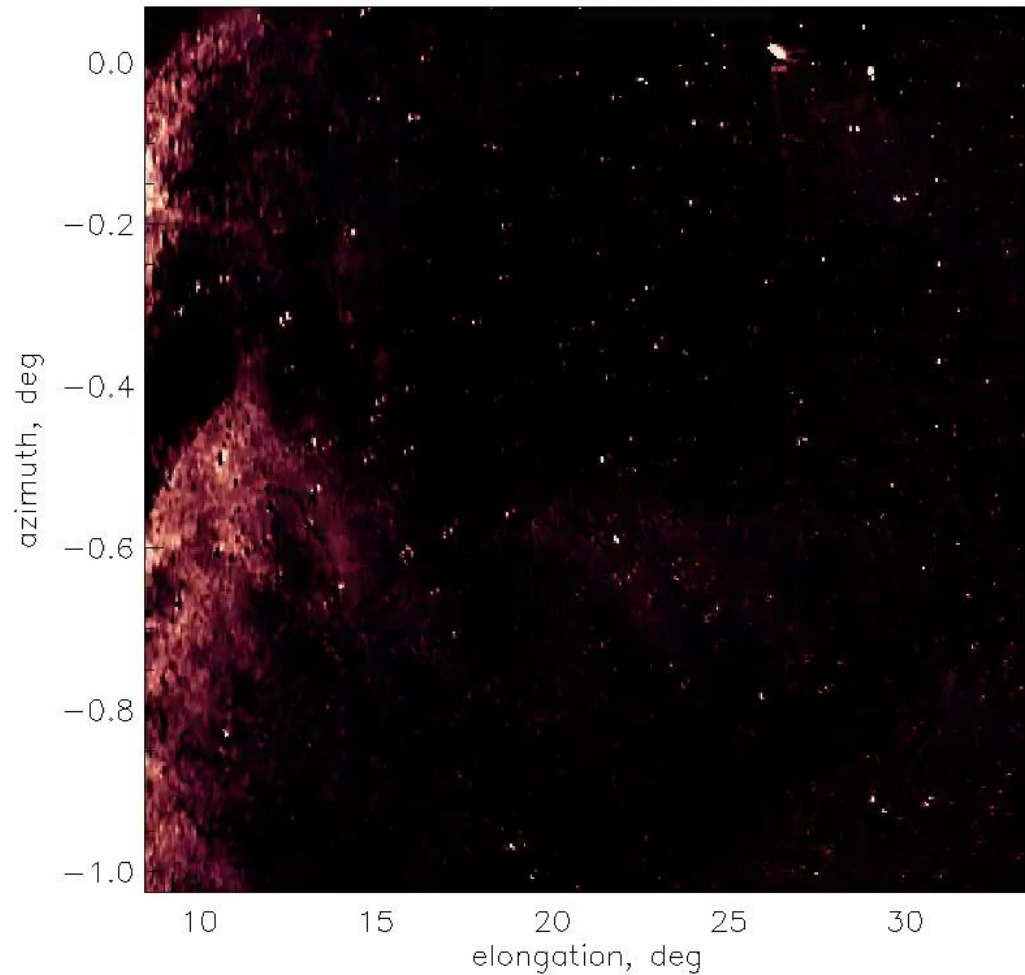
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2025-09-22T00:16:00.000 | tB-base | data versio



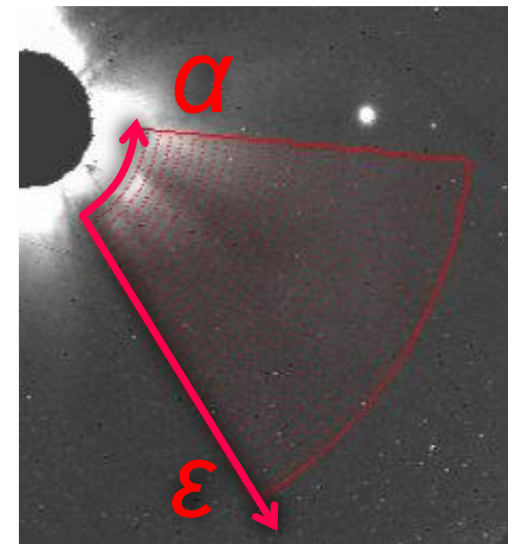
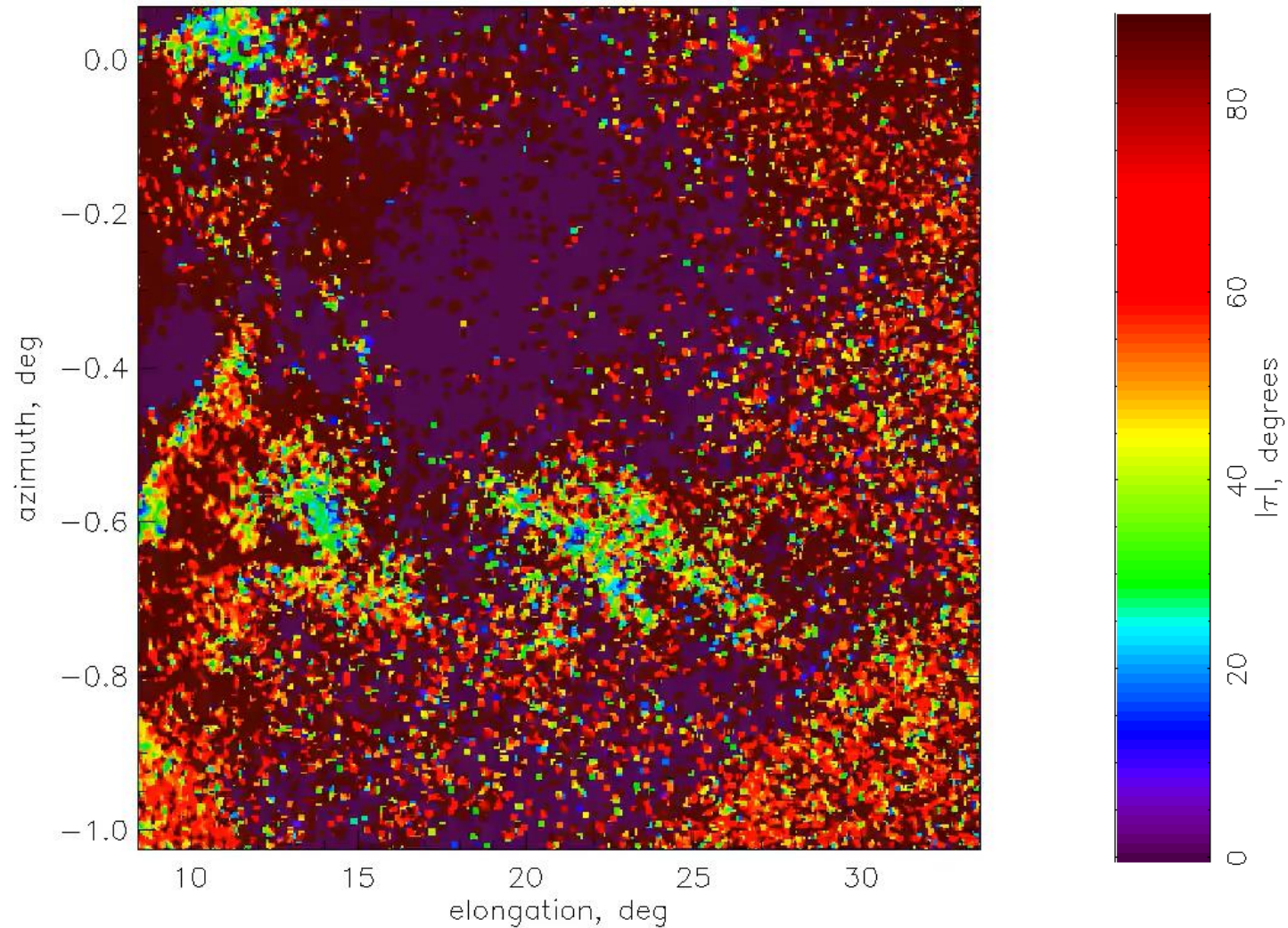
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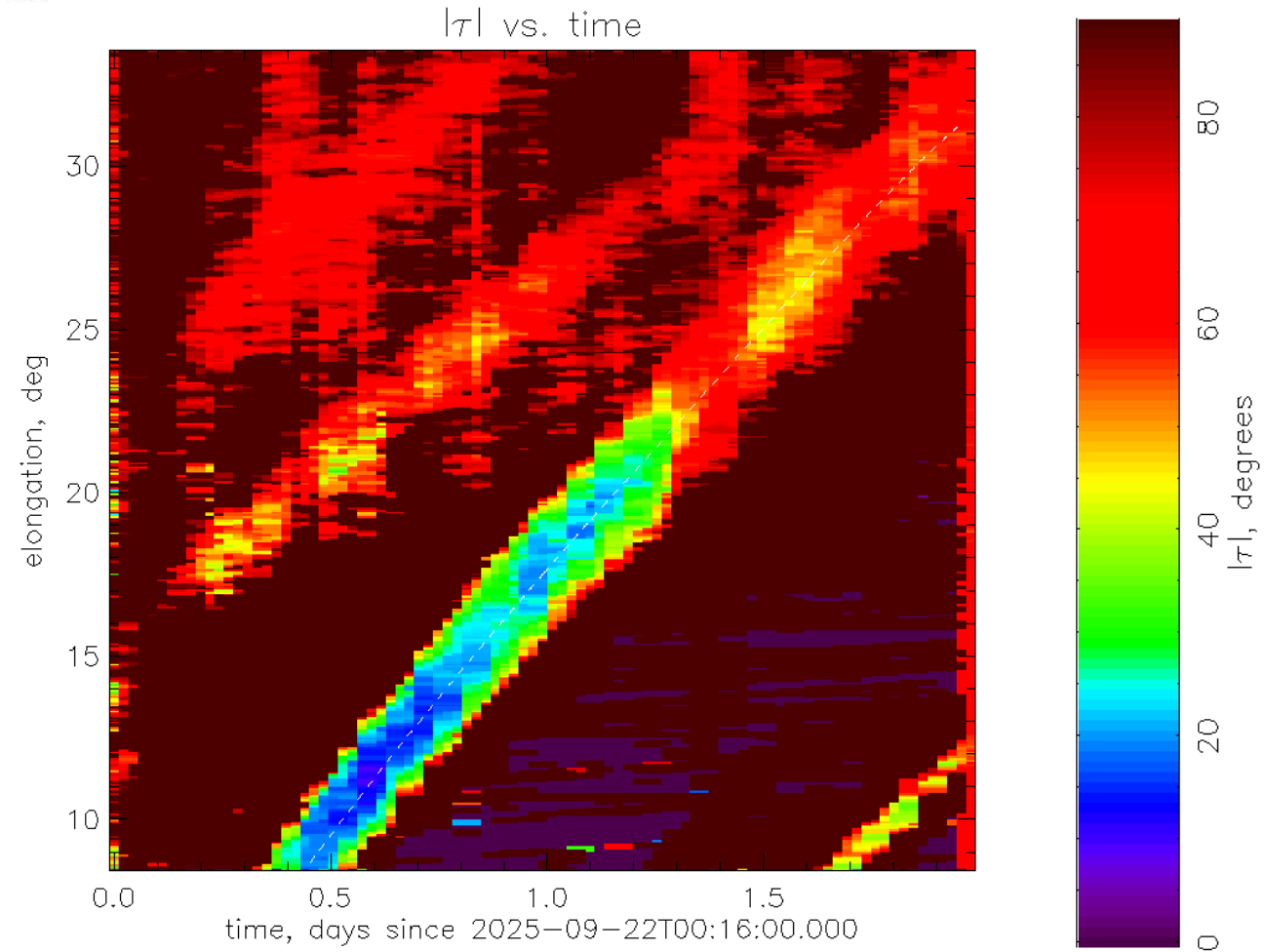
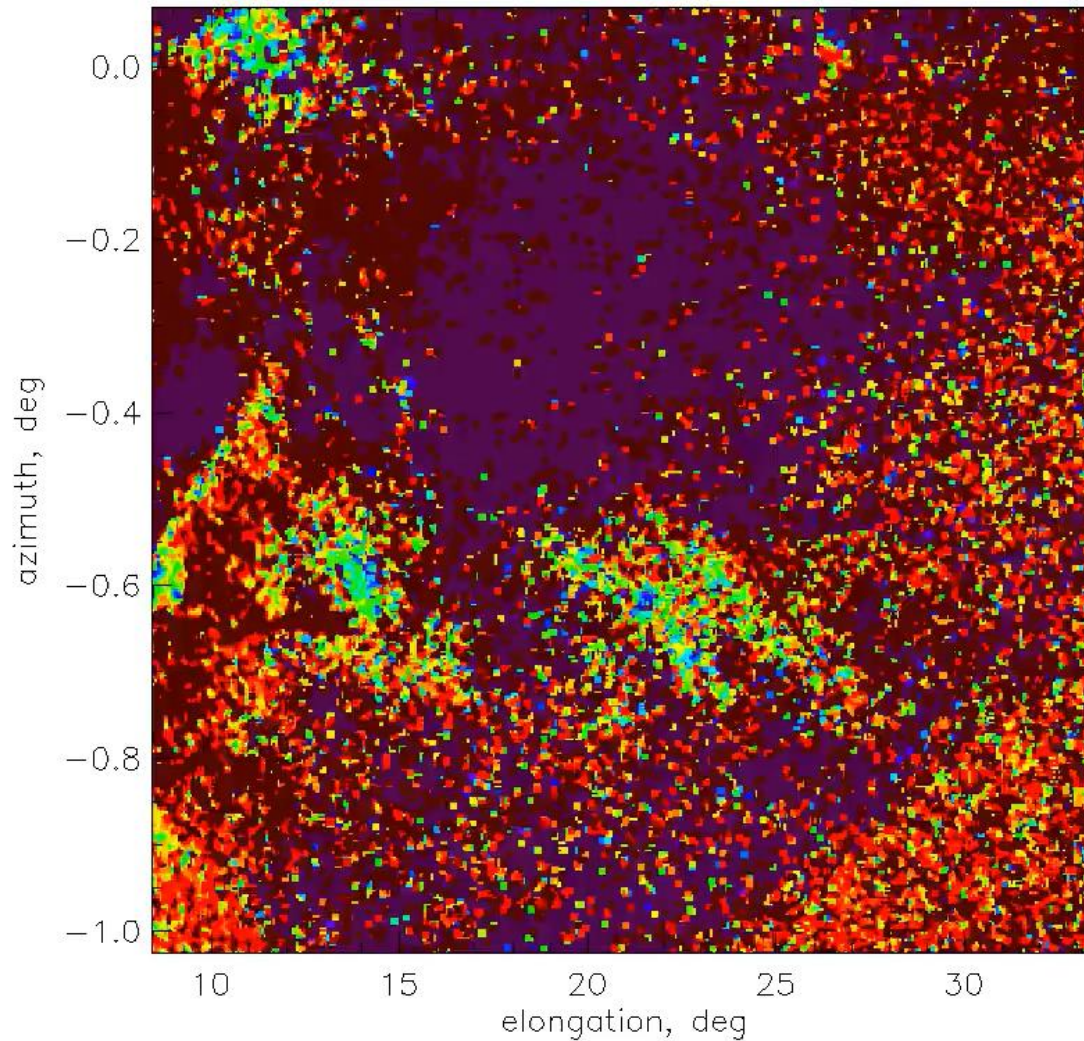
...going back to the PUNCH event on 2025-09-23

2025-09-22T00:16:00.000 | $|\tau|$ | data version: PAMv0k

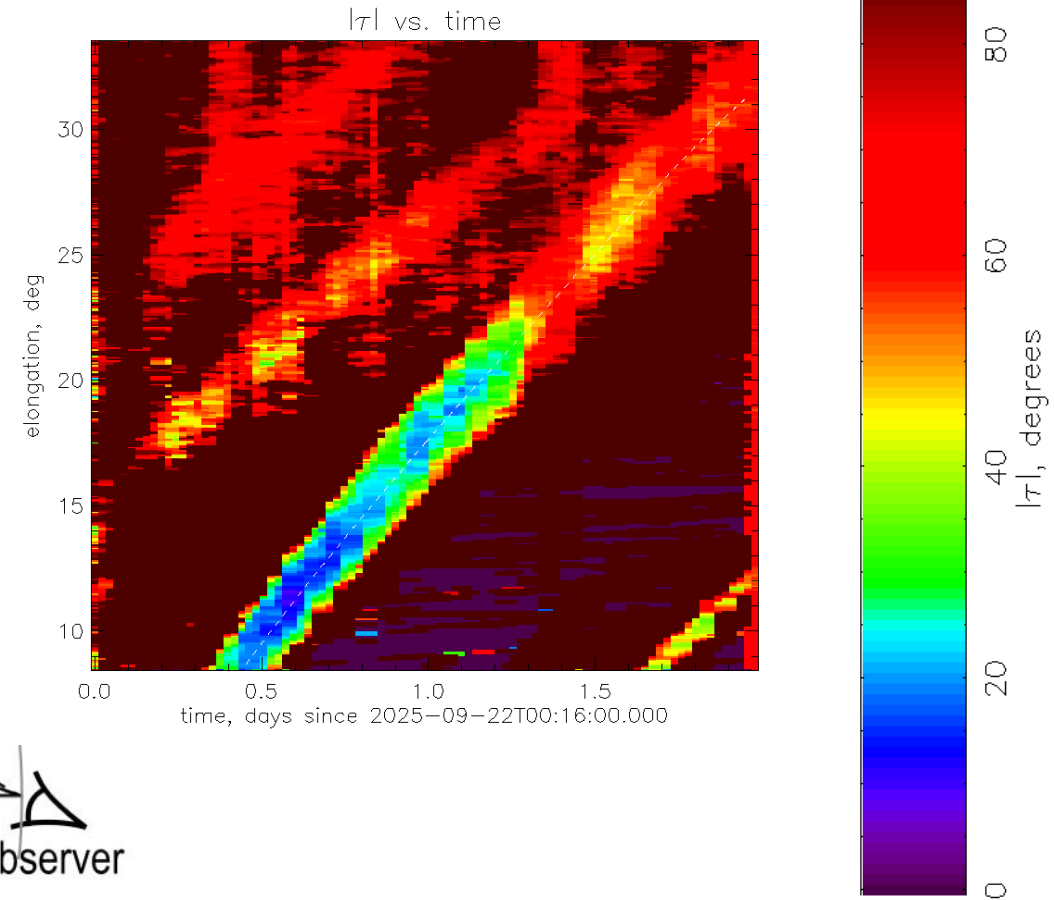
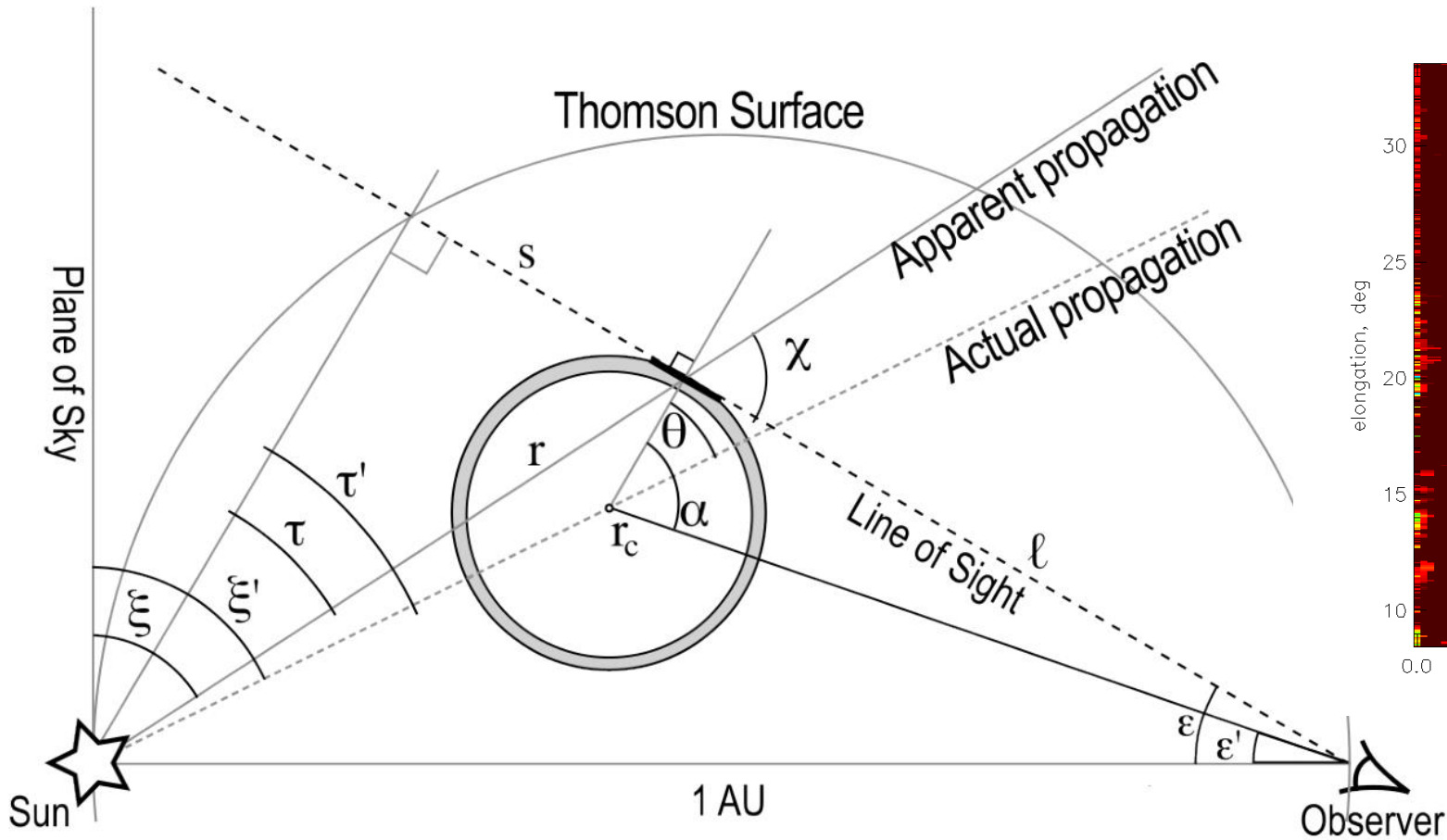


...going back to the PUNCH event on 2025-09-23

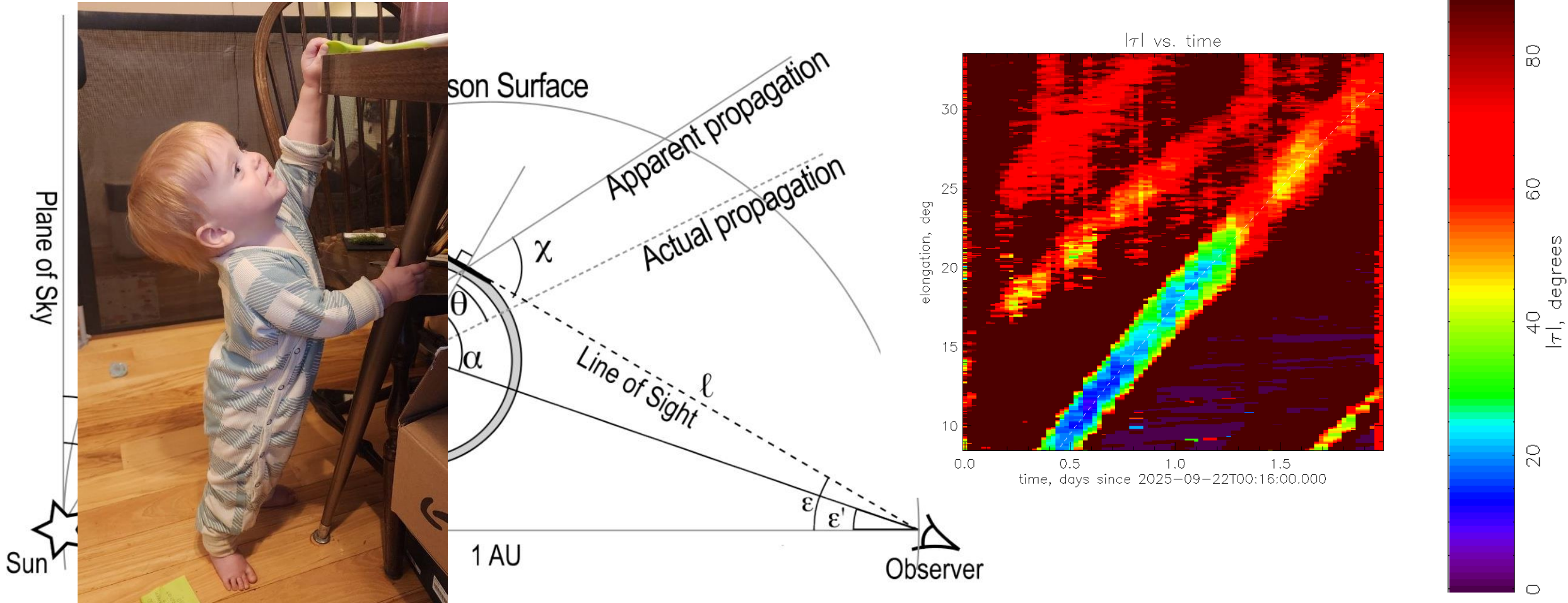
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...going back to the PUNCH event on 2025-09-23



...going back to the PUNCH event on 2025-09-23



“baby steps”! Go Lucie go! Go PUNCH!