

The Value of Polarimetry in the Coronagraph Field of View

Curt A de Koning



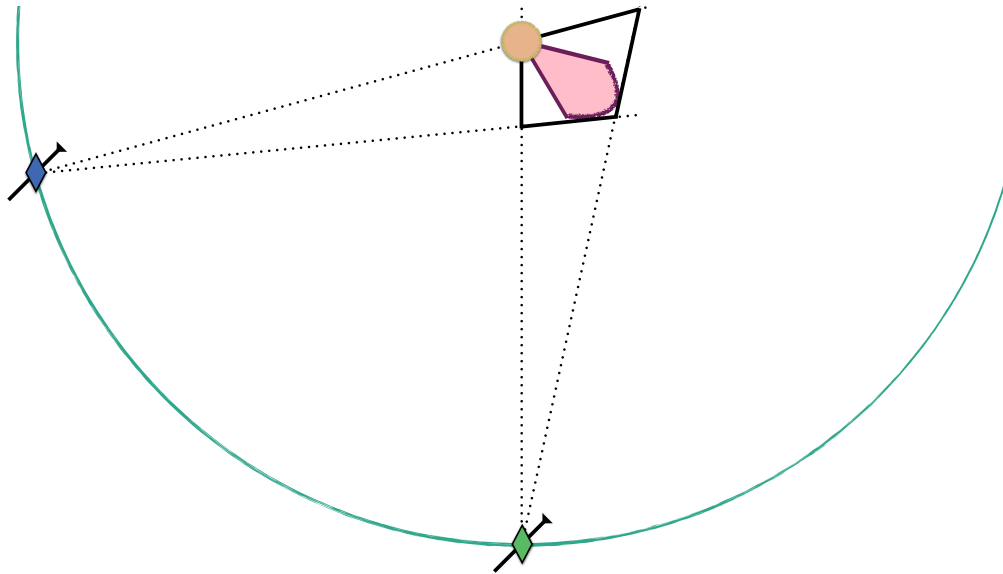
OPERATIONAL UTILITY

The Value of Polarimetry in the Coronagraph Field of View

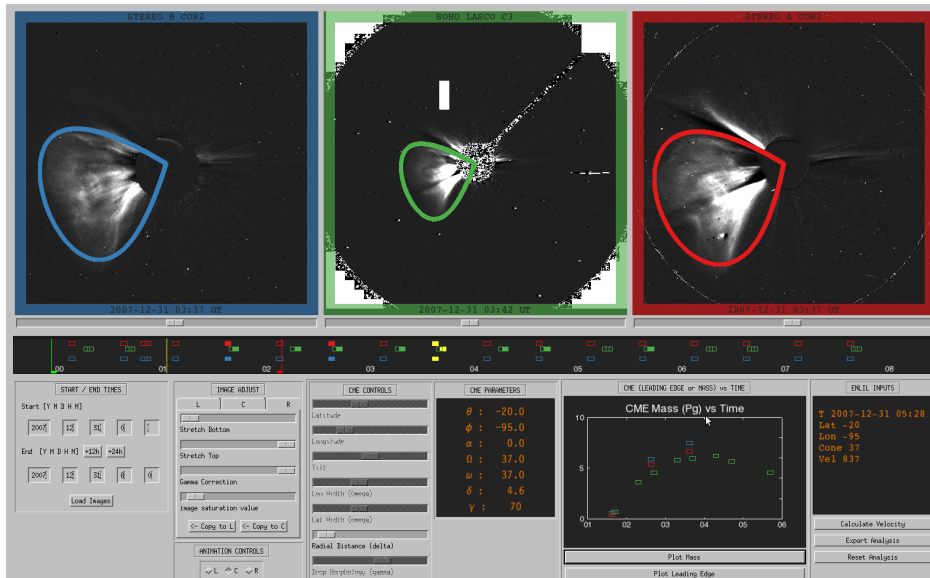
Curt A de Koning



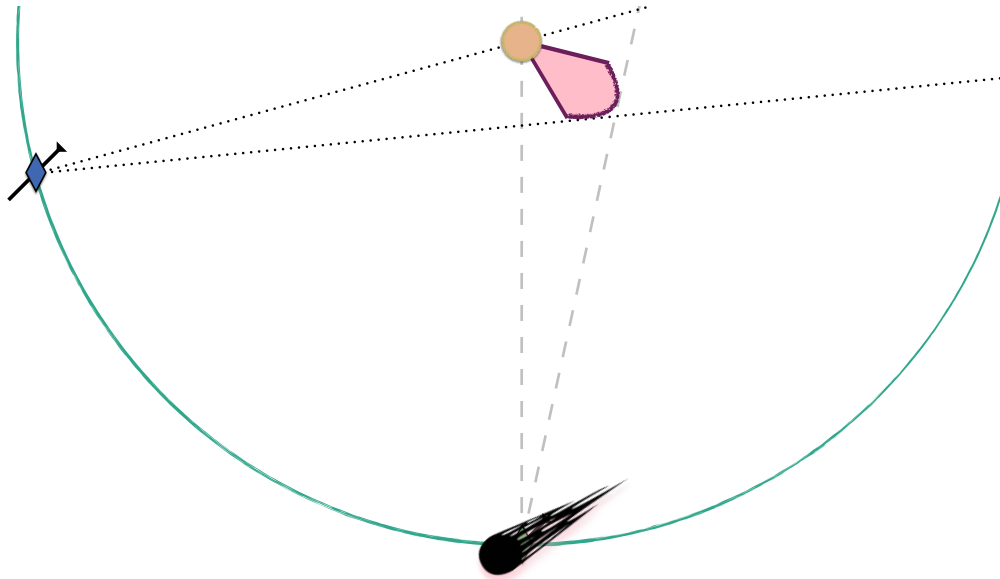
As long as there are two views ...



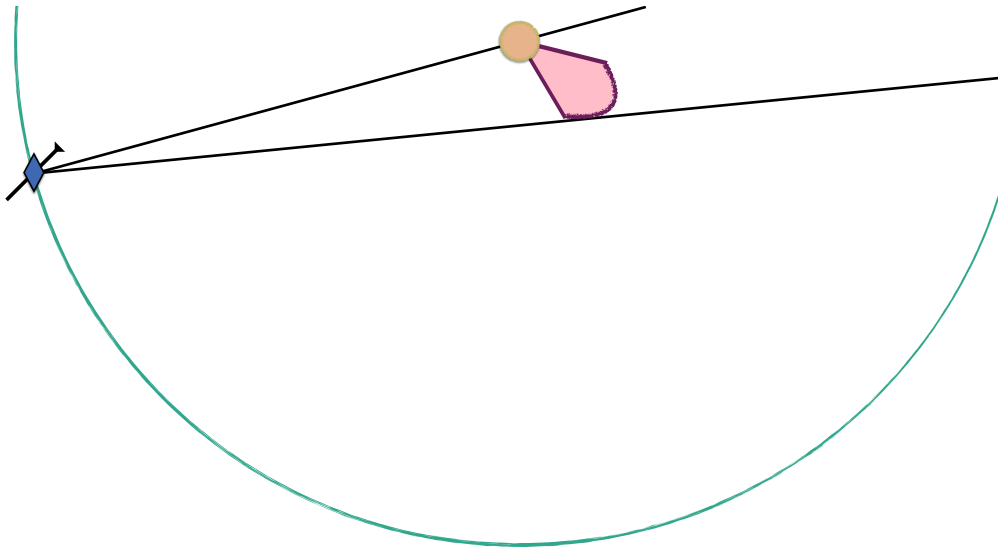
Any of the standard STEREO-era tools, such as SWPC CAT, can be used for CME reconstruction.



But, what if ...



But, what if ...





Operations must continue!

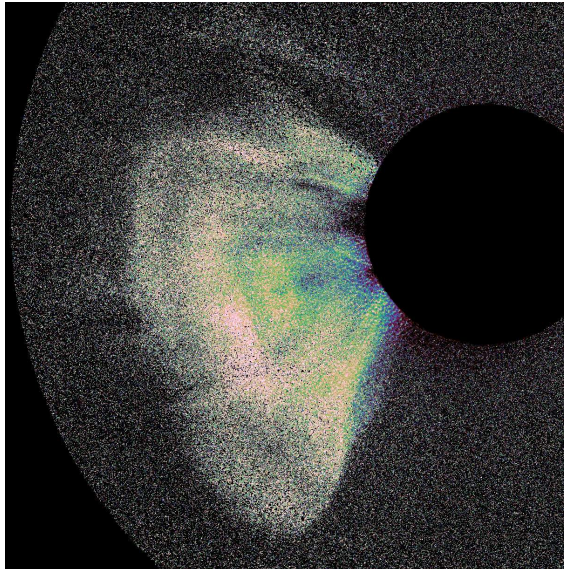
- ▶ The customer won't want excuses for a loss of service, they'll want continuity in forecasts.
- ▶ Need operational redundancy.



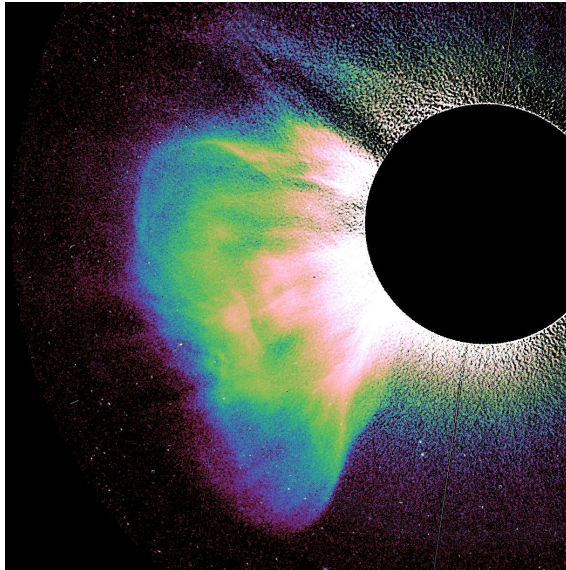
Operations must continue!

- ▶ The customer won't want excuses for a loss of service, they'll want continuity in forecasts.
- ▶ Need operational redundancy.
 - ⇒ Need polarimetry.

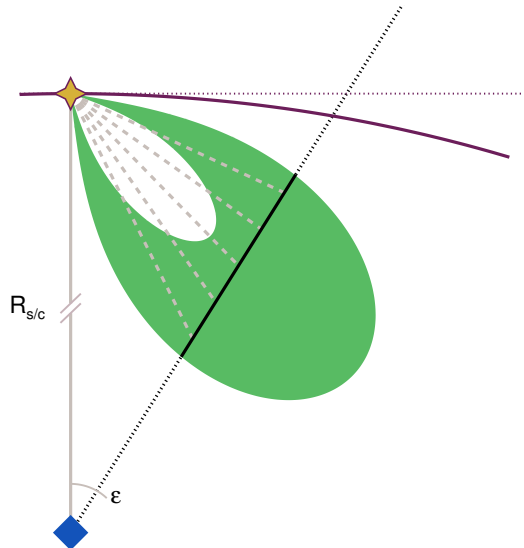
Percent Polarization



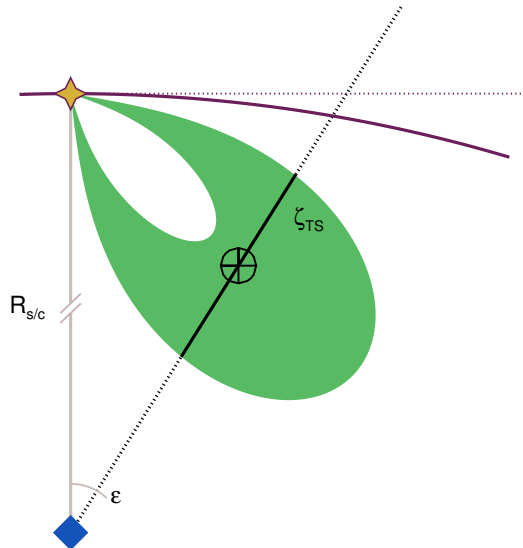
Total Brightness



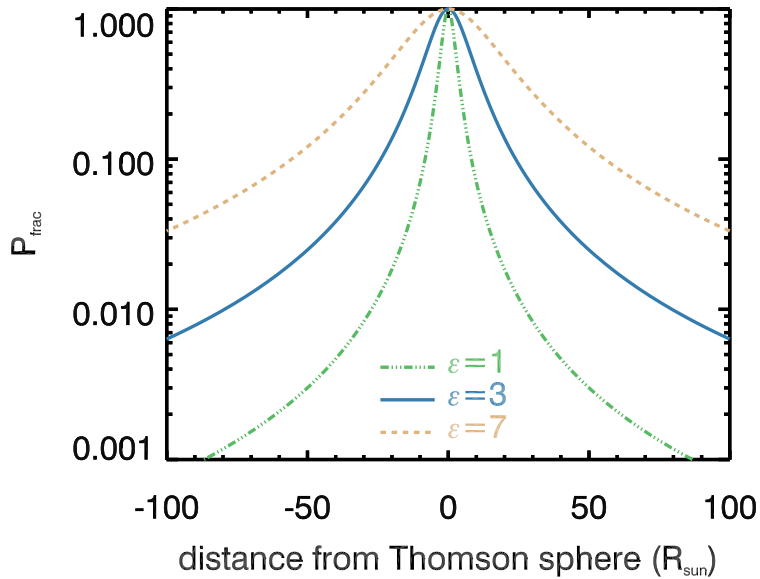
Point super-particle model



Point super-particle model



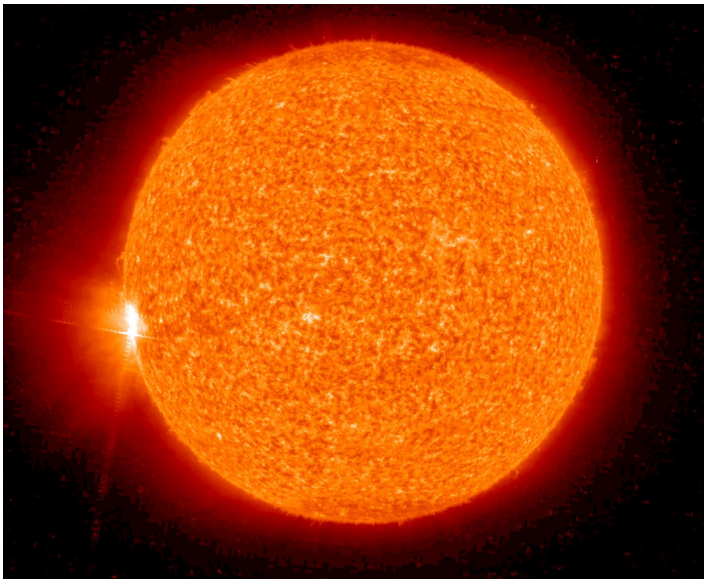
Fractional polarization \rightarrow
3D position



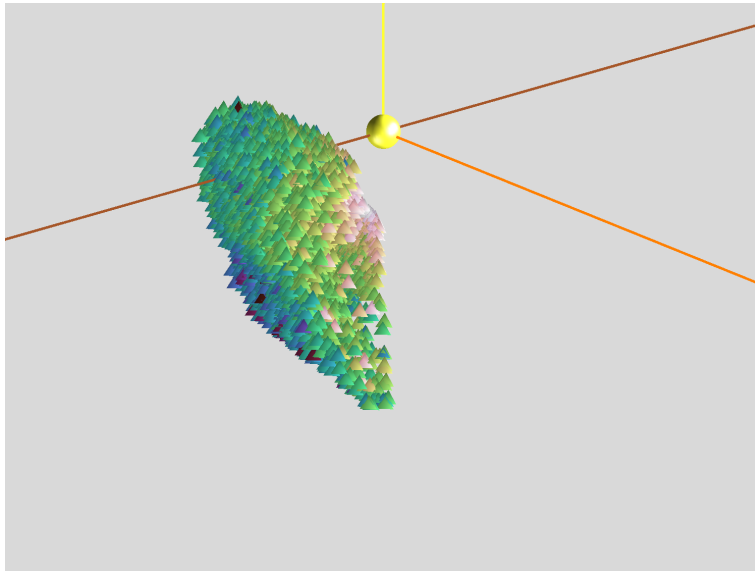
Solar surface observations

lat: 3–13° S

lon: 70–90° E

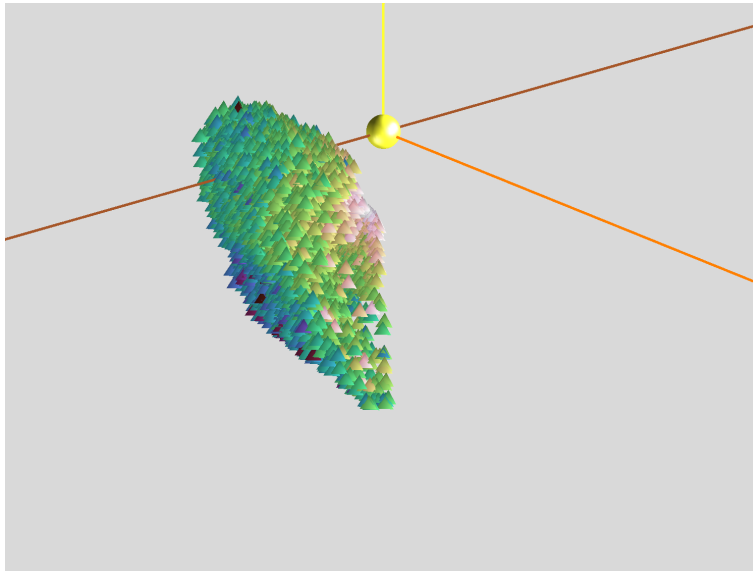


3D, pixel-by-pixel reconstruction of CME



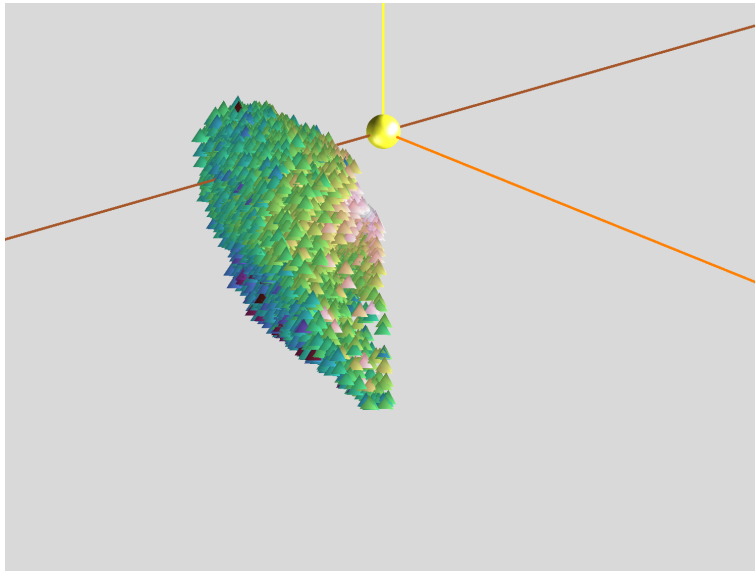
HEEQ lat: 16–21° S

HEEQ lon: 76–81° E



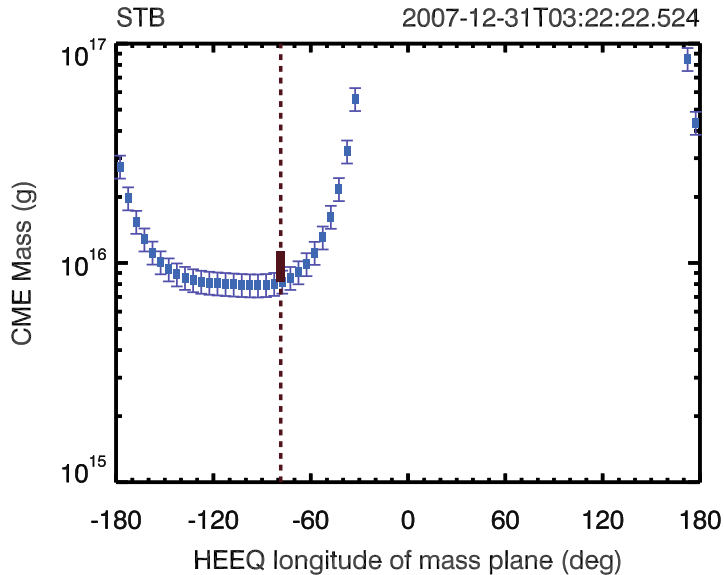
lat $\Omega_{1/2}$: 40–45°

lon $\Omega_{1/2}$: 32–41°



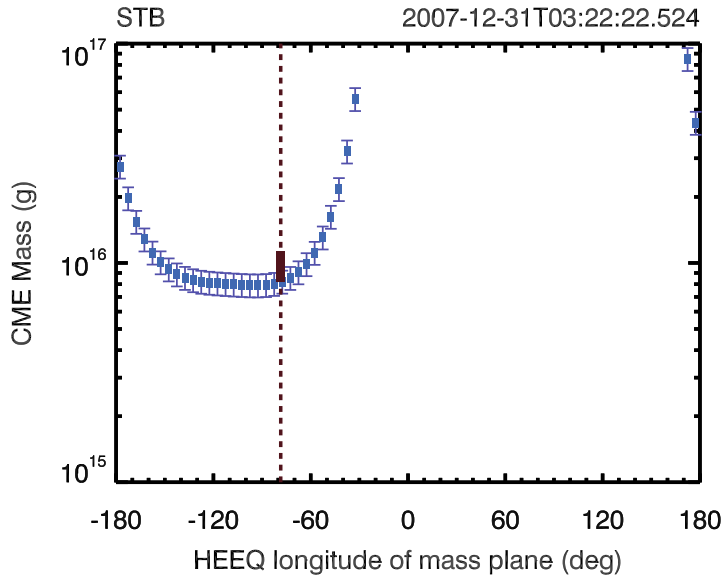
Mass of CME

sky-plane mass: 8.03×10^{15} g



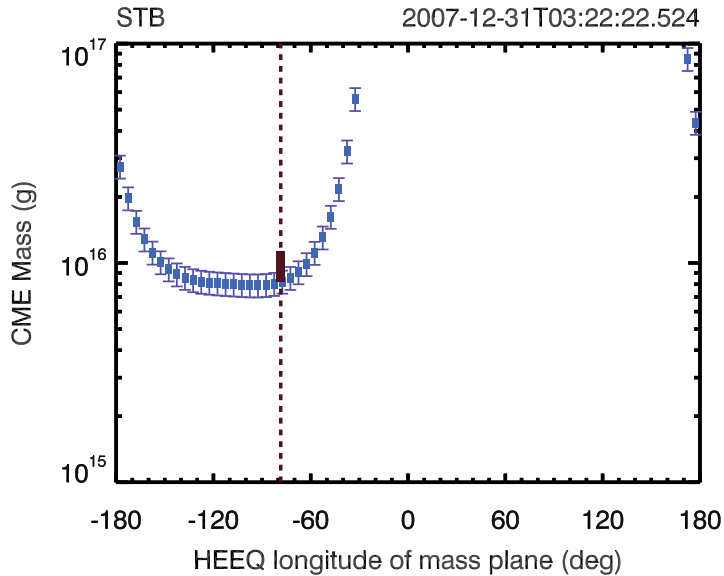
Mass of CME

deprojected mass: 8.23×10^{15} g



Mass of CME

3D mass: $8.19\text{--}11.3 \times 10^{15}$ g



Conclusion

- ▶ Using a single spacecraft, only, polarimetry (plus solar surface signatures) can be used to reconstruct the gross 3D properties of a CME:
 - direction,
 - width,
 - mass,
 - speed.

Conclusion

- ▶ A polarizing coronagraph can provide operational redundancy in the event of remote-sensing instrumentation failure on the other spacecraft.