

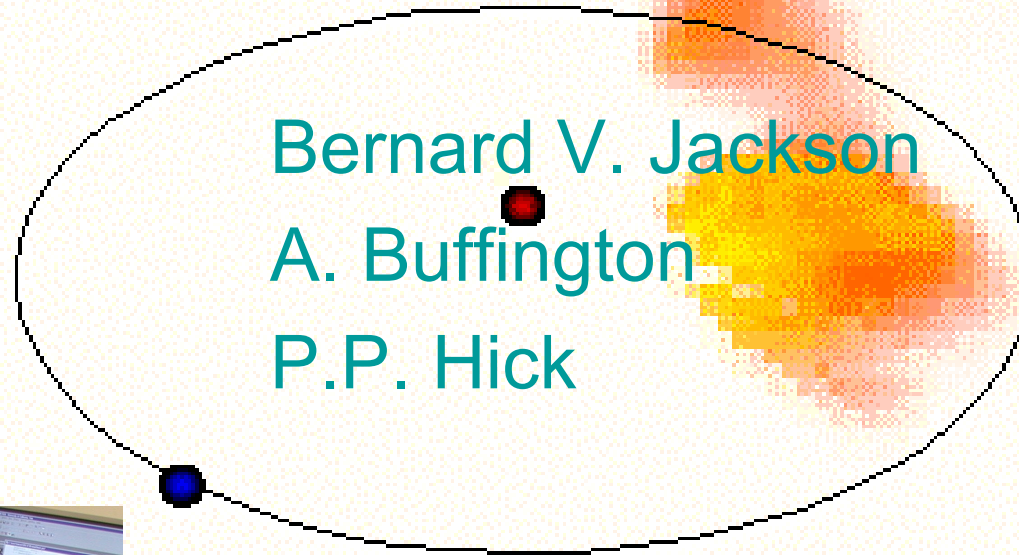
HELIOSPHERIC TOMOGRAPHY



Bernie



Andy



Bernard V. Jackson
A. Buffington
P.P. Hick



Paul



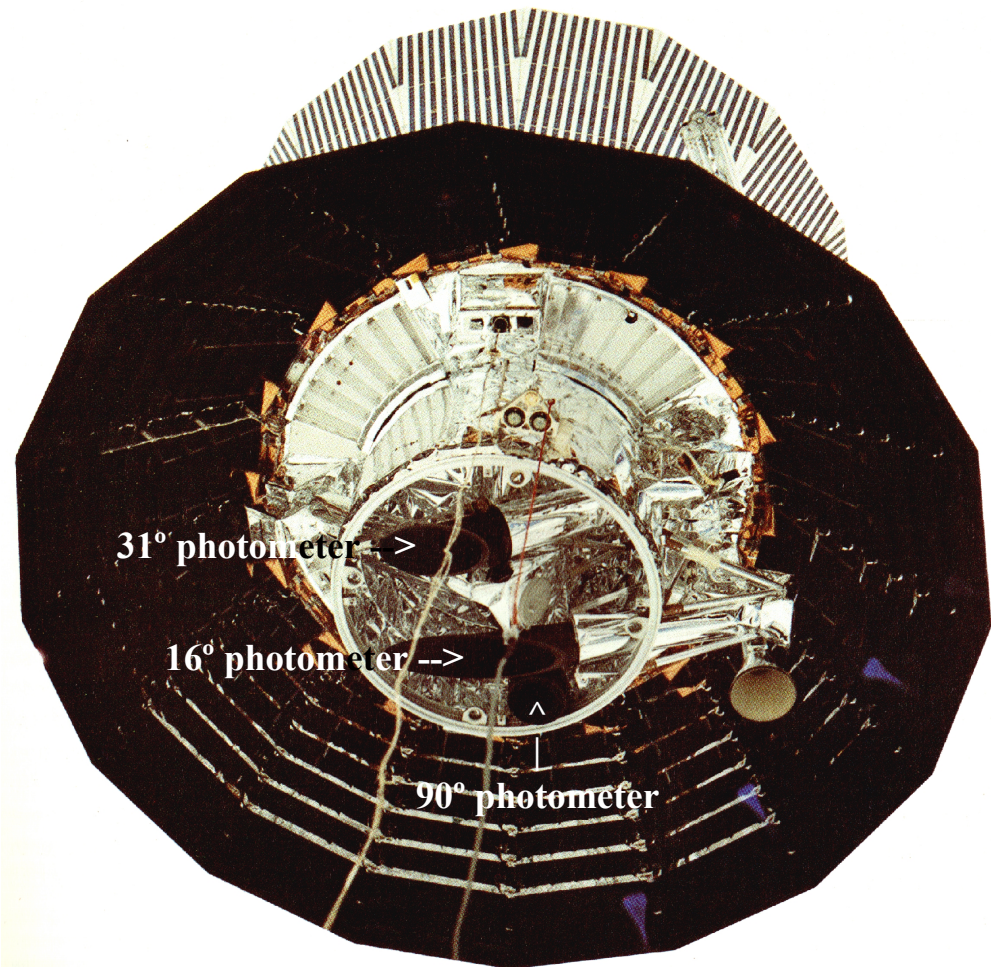
Tamsen Dunn

CASS/UCSD

HELIOSPHERIC TOMOGRAPHY

Motivation 1: The Helios Spacecraft Photometer Systems

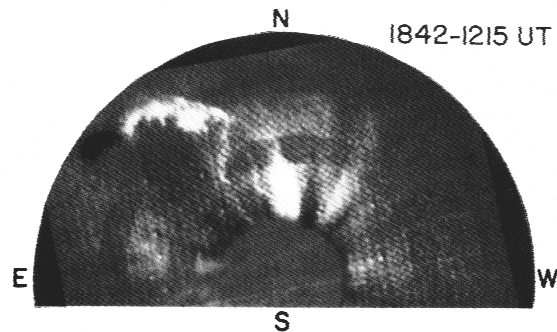
HELIOS
spacecraft:
the three
photometers
are shown
as tubes with
blackened ends.



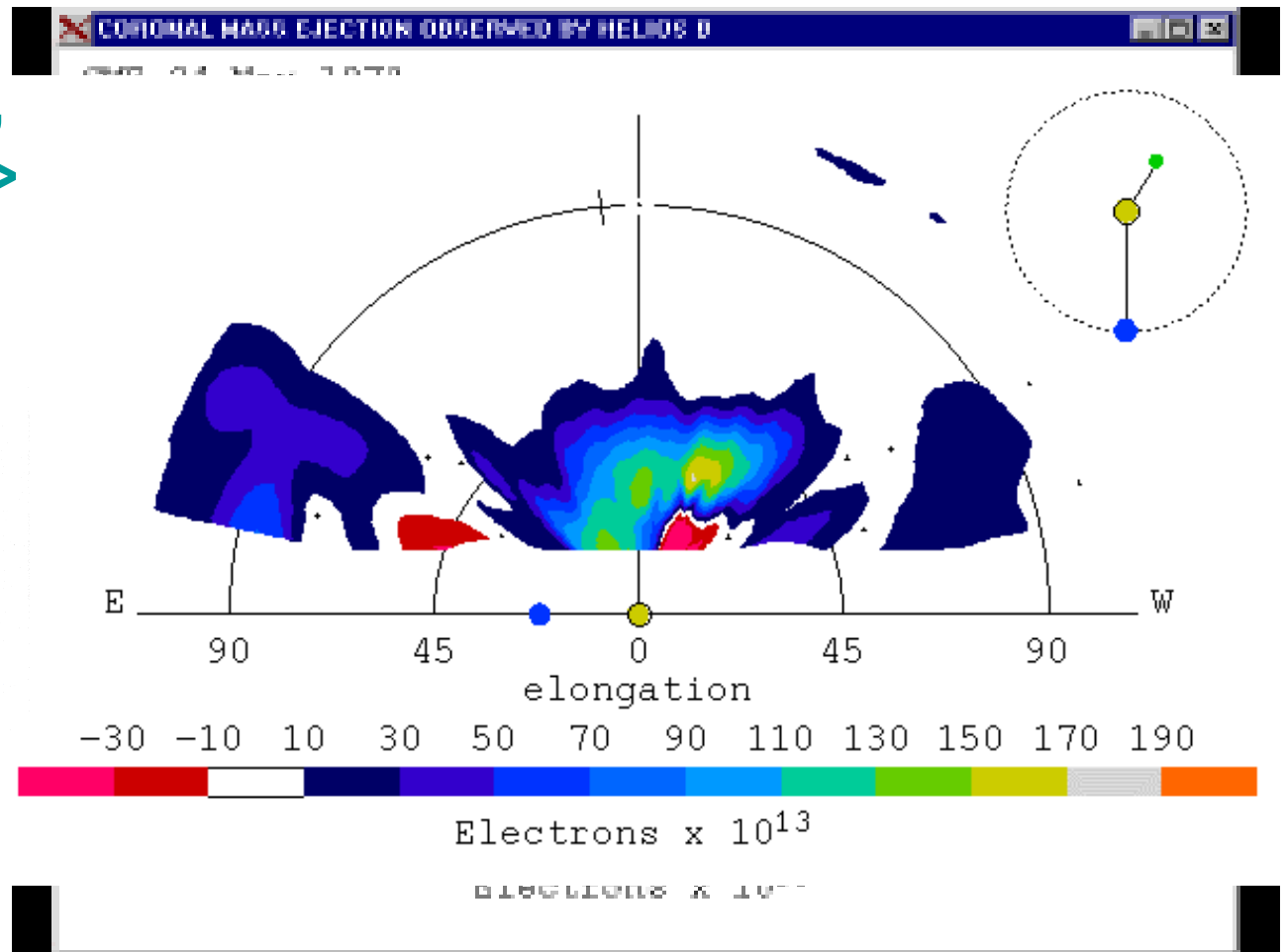
HELIOSPHERIC TOMOGRAPHY

Helios 2 Spacecraft Contour Image of the May 24 CME

HELIOS 2 spacecraft contour image. May 24, 1979 CME and Video -->



Solwind coronagraph difference image on May 24, 1979.



HELIOSPHERIC TOMOGRAPHY

Motivation: The Solar Mass Ejection Imager - SMEI

SMEI has been delivered to the Coriolis spacecraft for integration. Launch, next year.
AF / NASA Funding.



HELIOSPHERIC TOMOGRAPHY

Motivation: NASA's Solar Probe Heliospheric Imager

Proposal to orbit the Sun to within 4 solar radii of its surface.

SOLAR
PROBE



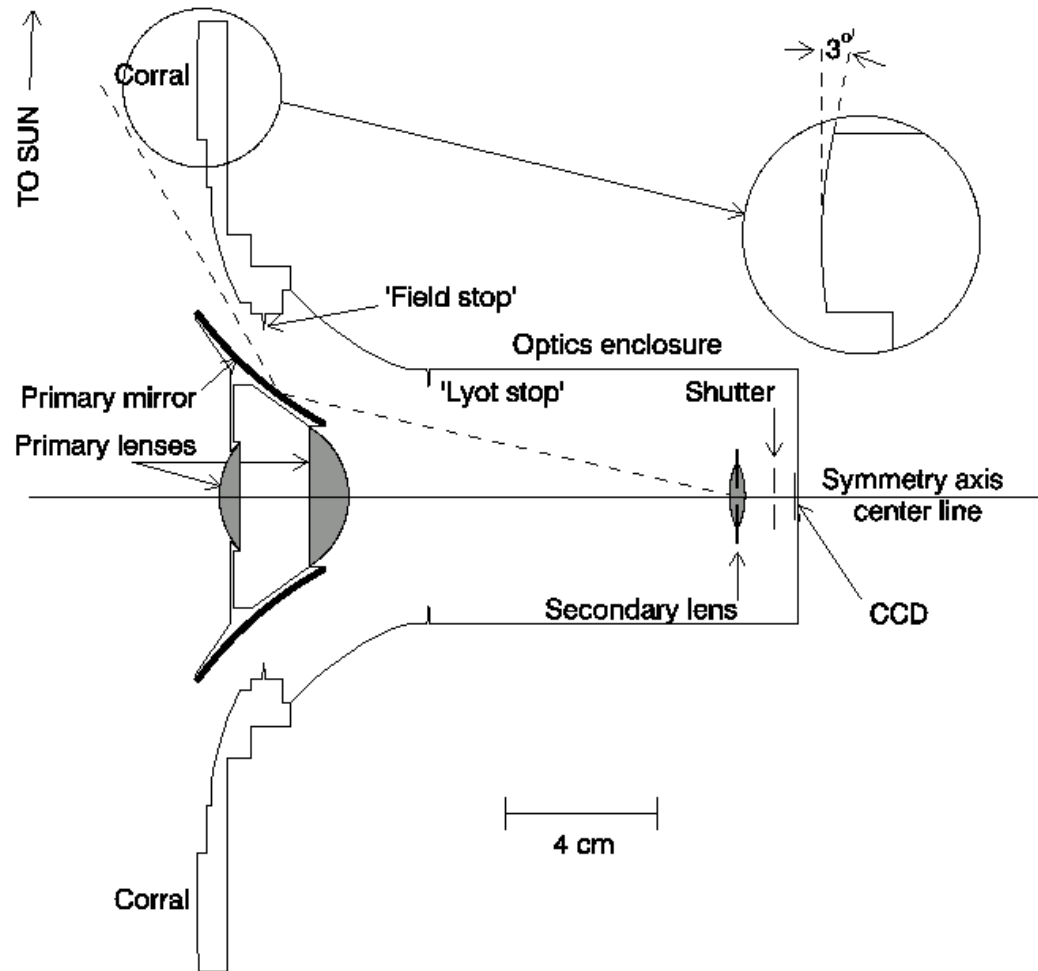
TO A STAR FOR A
NEW UNDERSTANDING
OF OUR RELATIONSHIP



HELIOSPHERIC TOMOGRAPHY

Heliospheric Imager Design

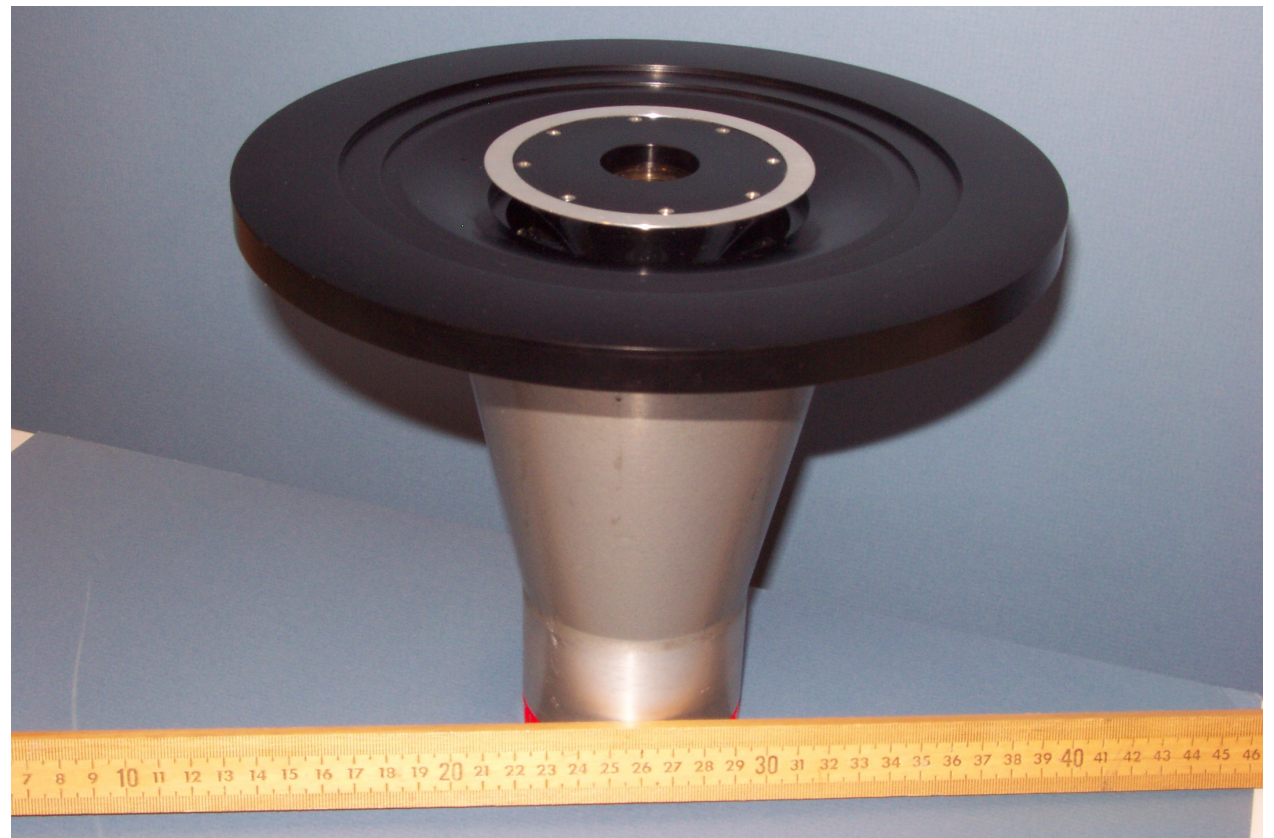
Solar Orbiter
heliospheric
imager
schematic.



HELIOSPHERIC TOMOGRAPHY

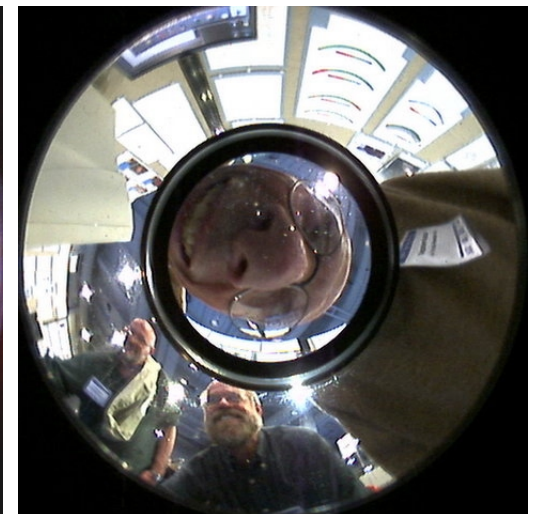
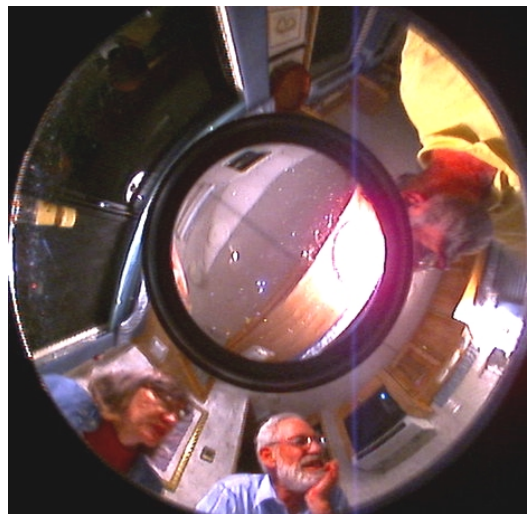
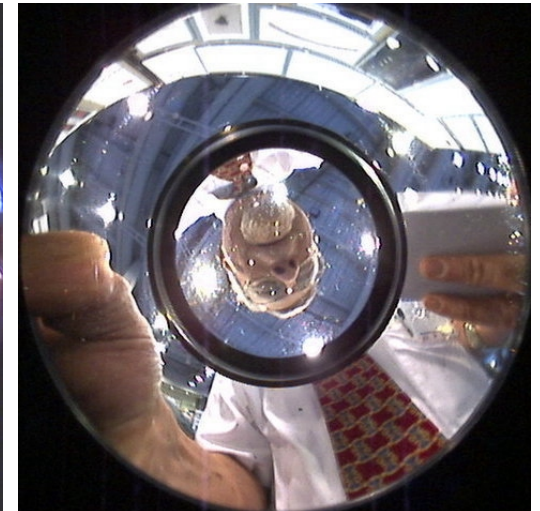
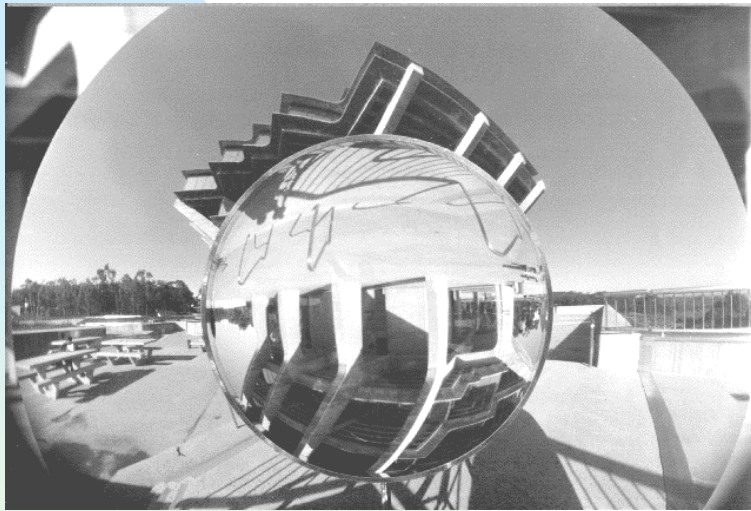
Heliospheric Imager Prototype

Solar Orbiter
heliospheric
imager optical
prototype.



HELIOSPHERIC TOMOGRAPHY

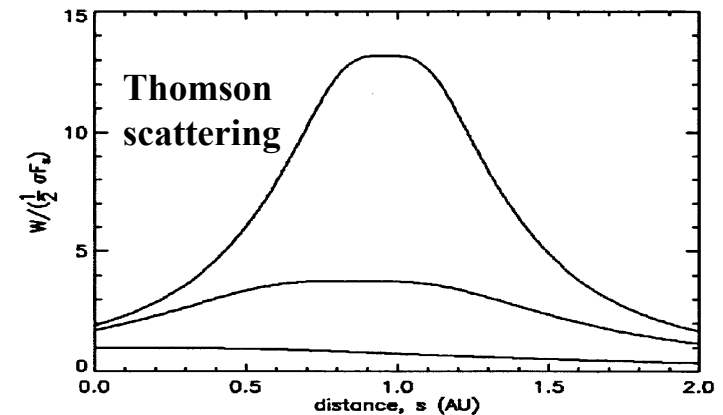
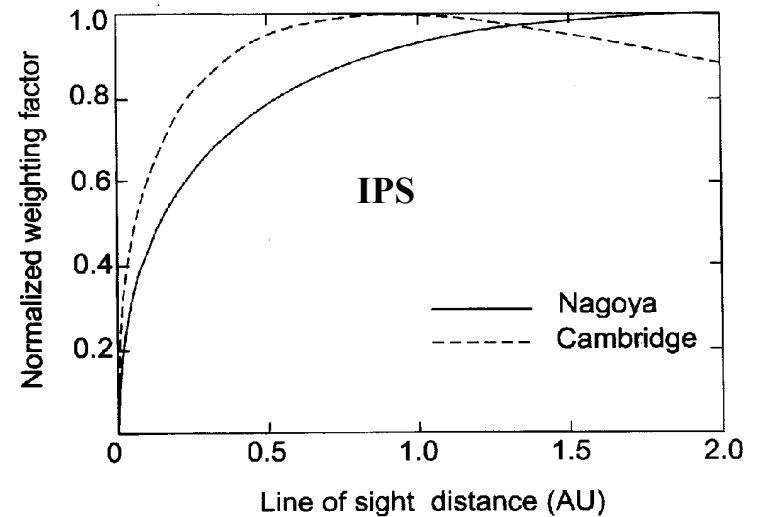
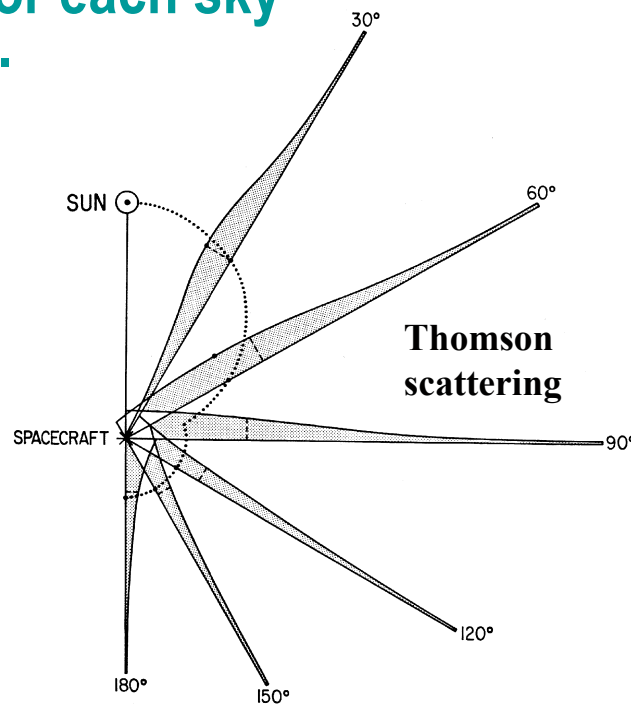
Solar Orbiter heliospheric imager optical prototype Images



HELIOSPHERIC TOMOGRAPHY

Current Heliospheric C.A.T. Analyses

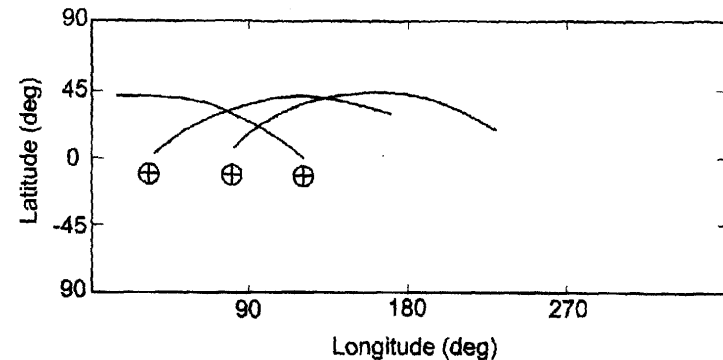
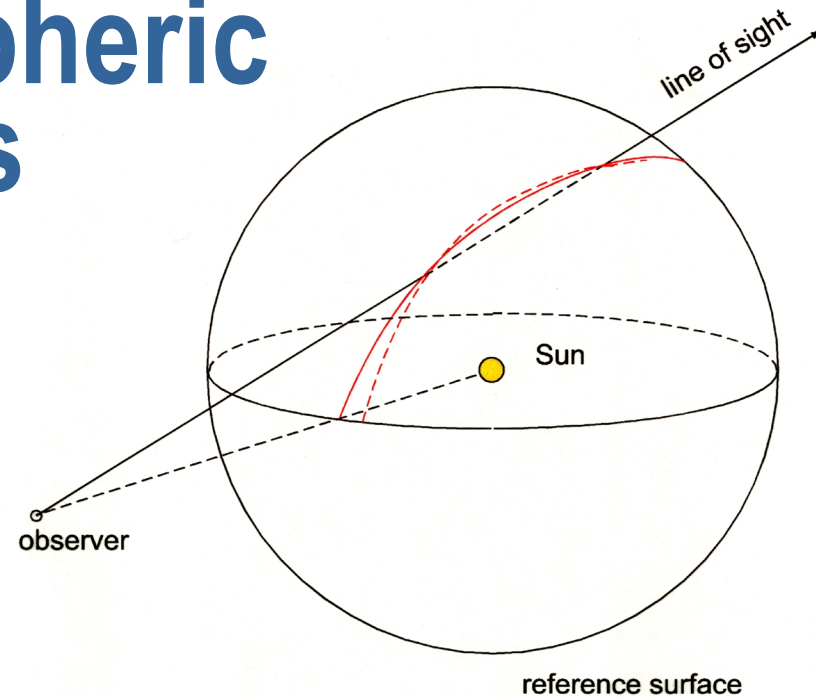
Line of sight weighting values for each sky location.



HELIOSPHERIC TOMOGRAPHY

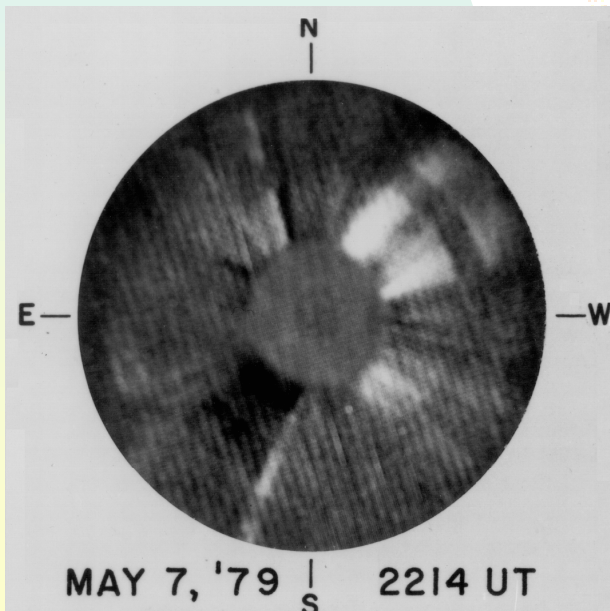
Current Heliospheric C.A.T. Analyses

Line of sight “crossed” components on a reference surface. Corotational projections on the reference surface are shown.

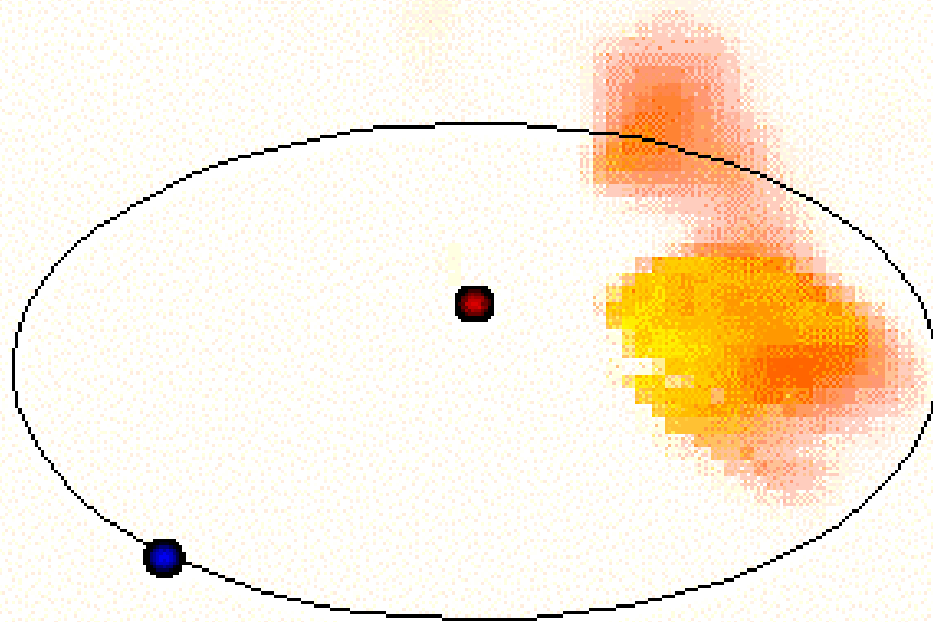


HELIOSPHERIC TOMOGRAPHY

Time-Dependent Tomographic Analysis Technique Reconstruction



Solwind coronagraph difference image on May 7, 1979.

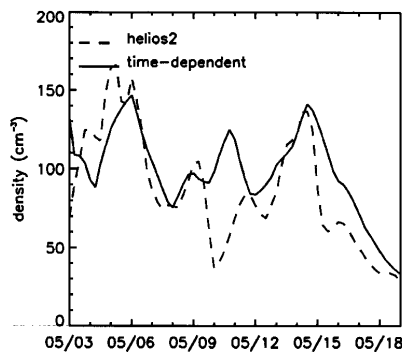


May 7 CME at
12 UT May
10, 1979

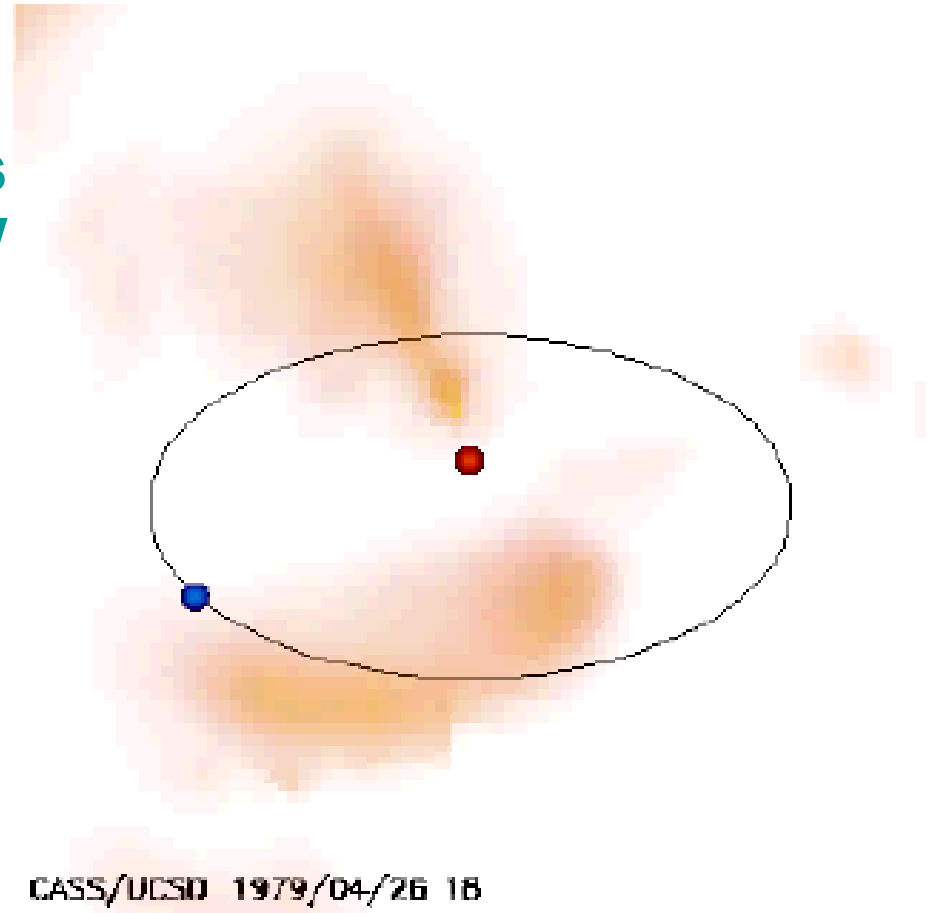
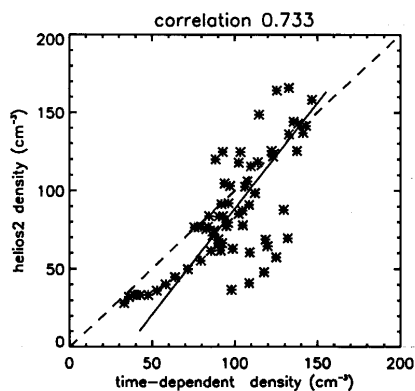
CASS/UCSD 1979/05/10 12

HELIOSPHERIC TOMOGRAPHY

Time-Dependent Tomographic Analysis Technique Reconstruction



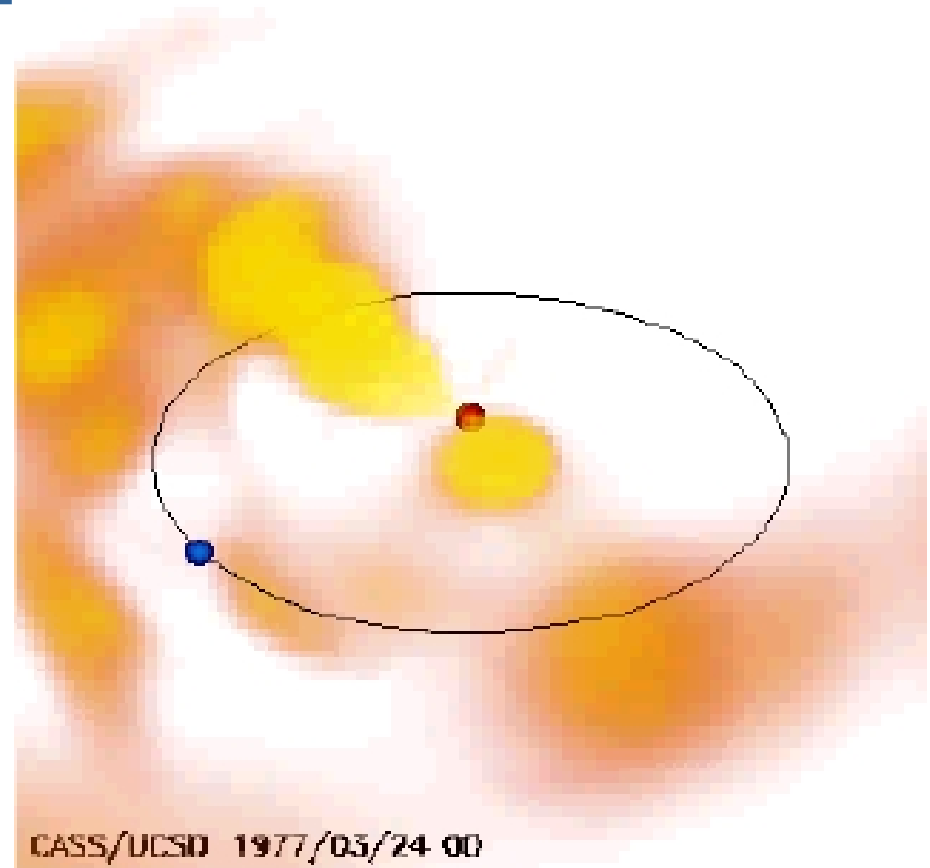
April 26, 1979 -
June 6, 1979 Helios
2 video and density
time series
comparison time-
dependent model
with Helios 2
spacecraft *in situ*
observations.



HELIOSPHERIC TOMOGRAPHY

Time-Dependent Tomographic Analysis Technique Reconstruction

Helios 1 and 2 Carrington
Rotation 1653 density
reconstruction video. The
Time series correlation is
0.86 for the time-dependent
model comparison with
Helios 2 spacecraft *in situ*
observations for the
duration of the video.



HELIOSPHERIC TOMOGRAPHY

Current IPS Heliospheric Analysis

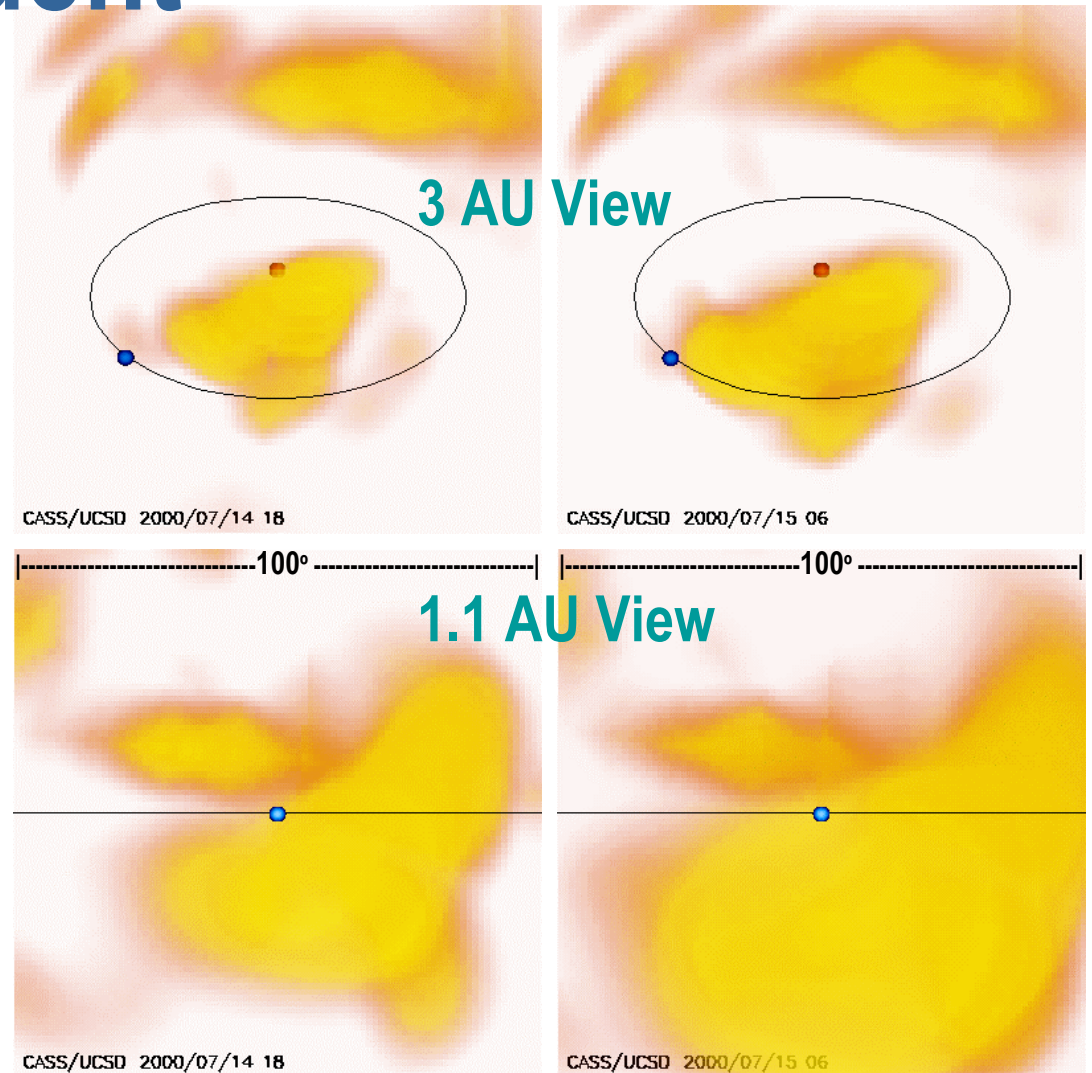
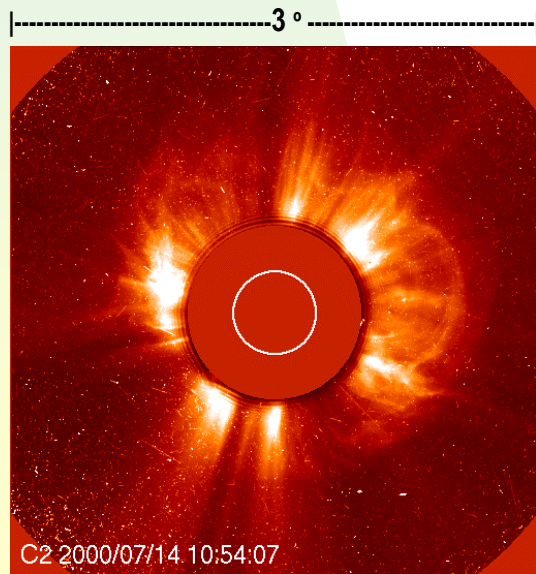
(<http://stesun5.stelab.nagoya-u.ac.jp/index-e.html>)

STELab
IPS array
near Fuji
(1500 m²)



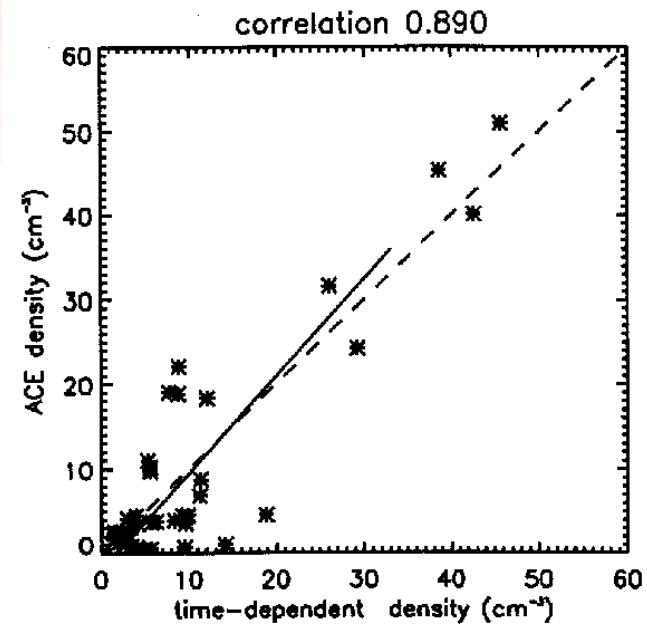
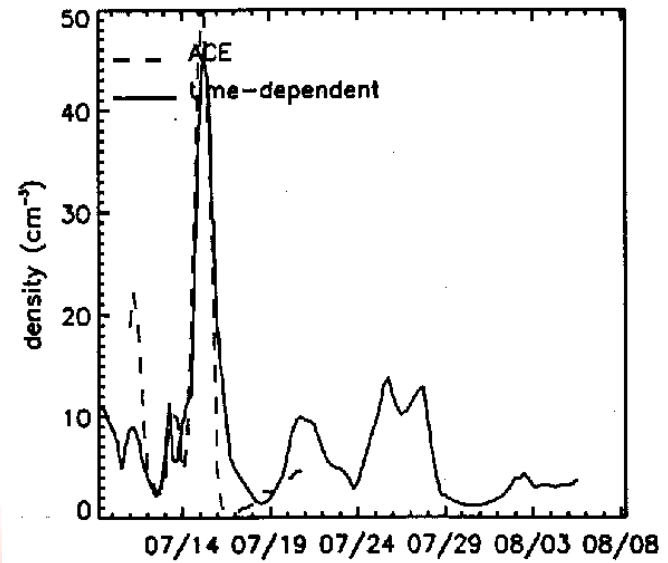
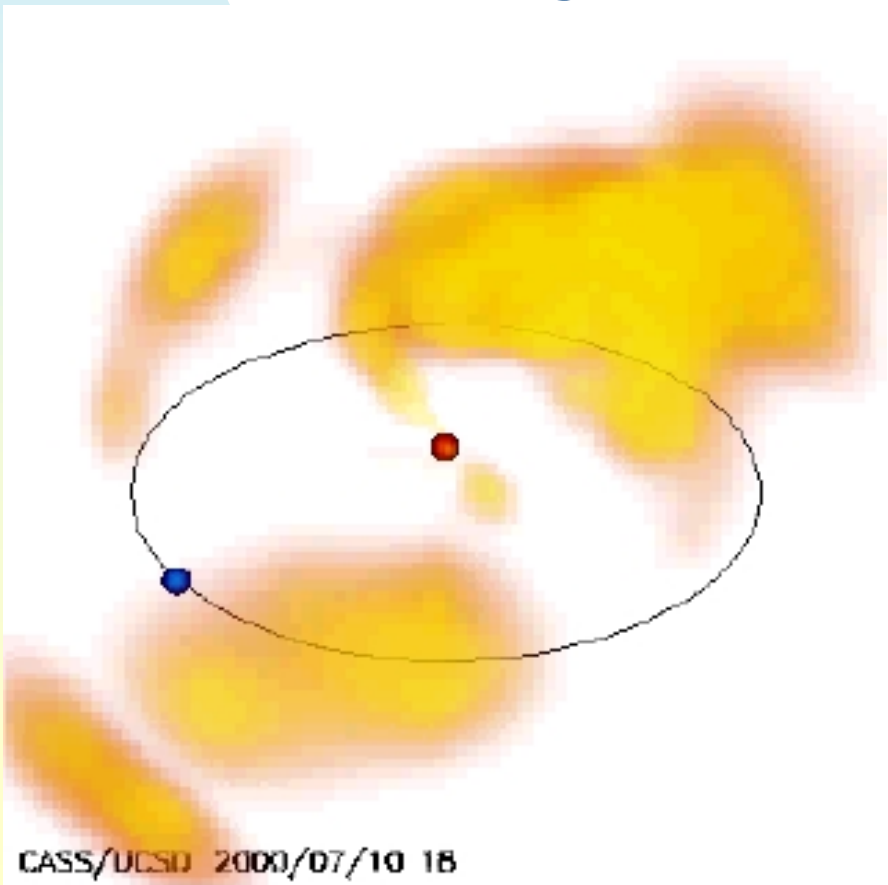
HELIOSPHERIC TOMOGRAPHY

Time-Dependent Heliospheric C.A.T. Analysis



HELIOSPHERIC TOMOGRAPHY

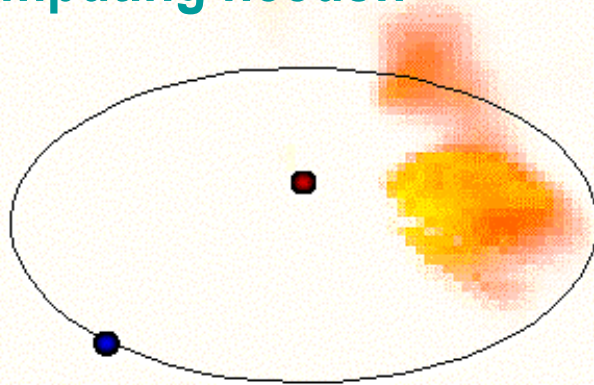
Time-Dependent Heliospheric C.A.T. Analysis



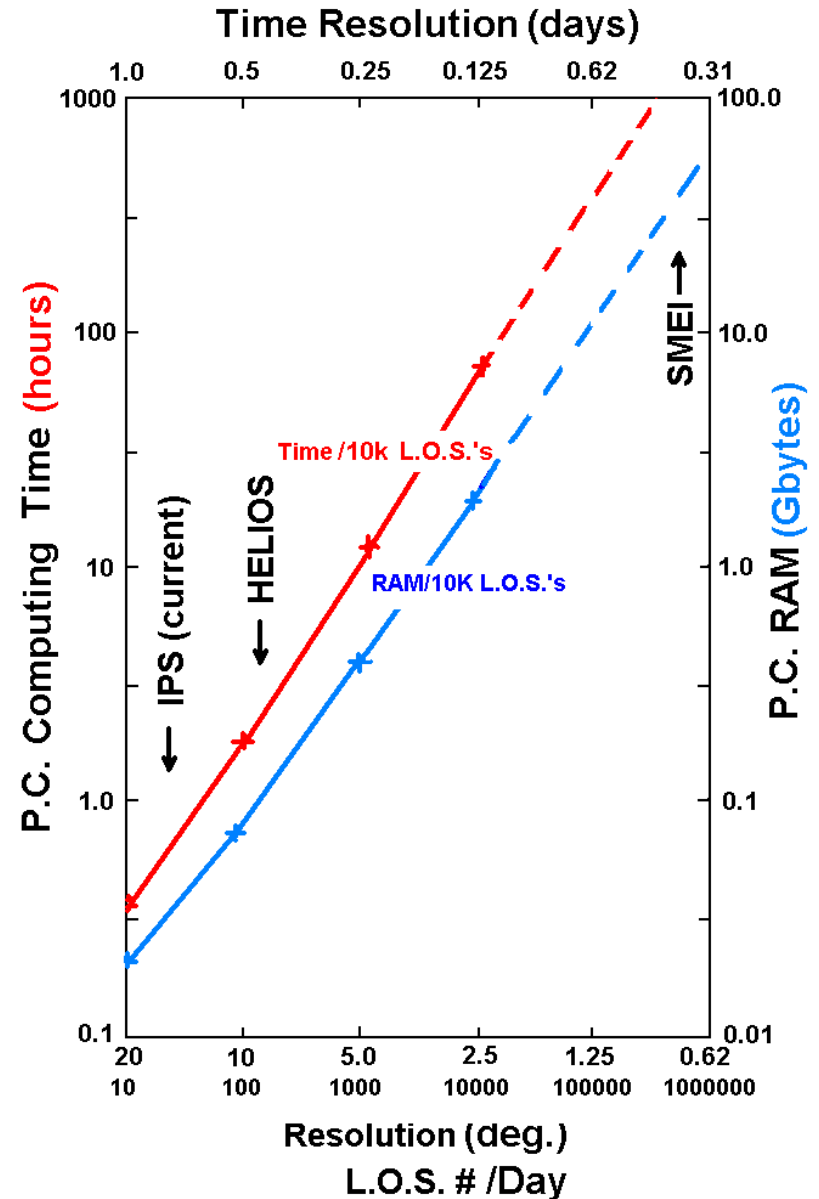
HELIOSPHERIC TOMOGRAPHY

Future

- 1000 times more data than Helios!
- 10 times the resolution in all coordinates
- at least 10^4 times the computing needs!!



CASS/UCSD 1979/05/10 12



HELIOSPHERIC TOMOGRAPHY

Summary

- We are currently able to do a pretty accurate job using our time-dependent tomography technique and Helios photometer observations.
- Heliospheric imagers SMEI and others will provide nearly 1000 times more data than Helios. This will provide density reconstruction with an ~ 1 -hour time cadence and 1° by 1° latitude - longitude resolution *IF* the means can be found to analyze the data (real-time?).

