

OBSERVATIONS OF STREAMERS AND PSEUDOSTREAMERS

Laurel Rachmeler
PROBA2 Science Center Team
Royal Observatory of Belgium
22 November 2013



INTRODUCTION TO PROBA2

PRoject for On-Board Autonomy



ESA'S PROBA2 PROGRAM

4 science instruments: SWAP, LYRA, TPMU, DSLP

17 platform technology experiments

launched November 2, 2009



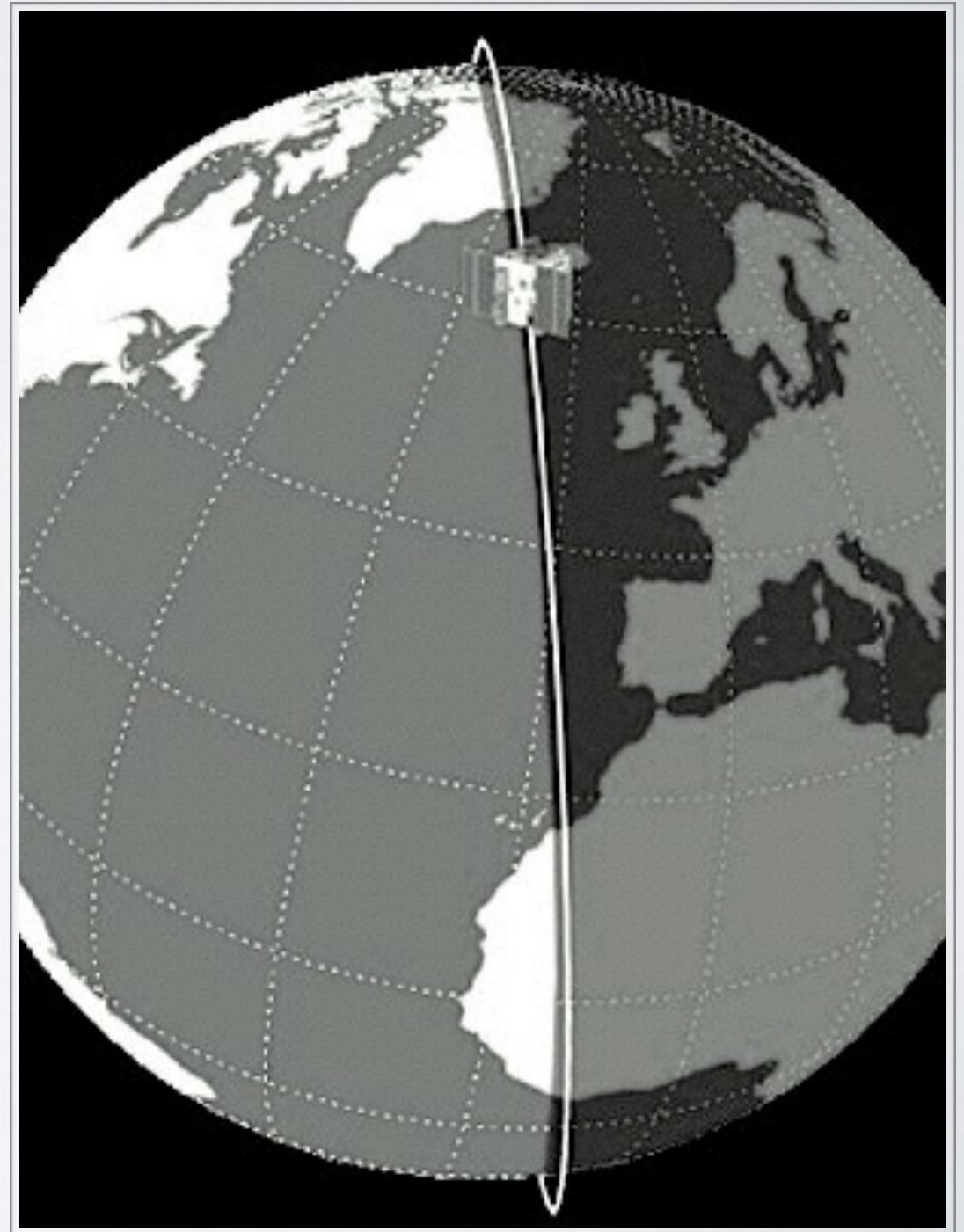
PROBA2 INSTRUMENTATION

Sun **W**atcher with **A**ctive Pixel System & Image **P**rocessing

ORBIT

Polar Sun-Synchronous

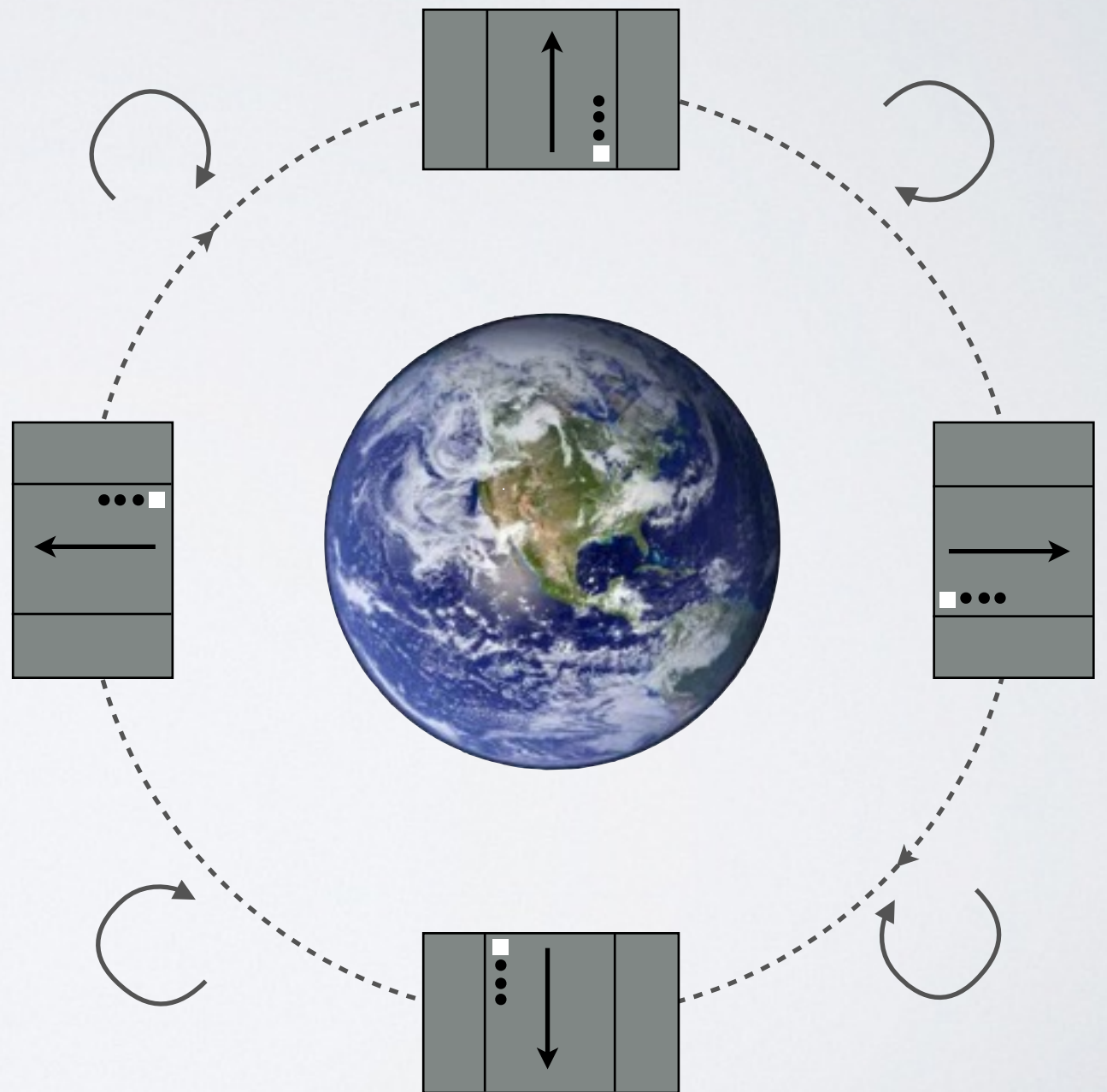
725 km altitude



ORBIT

≈ 90 minute period

Large Angle Rotations
(LAR) every 20
minutes





PROBA2 SCIENCE CENTER

Data processed & stored at ROB
Available in real time +30 min

SWAP

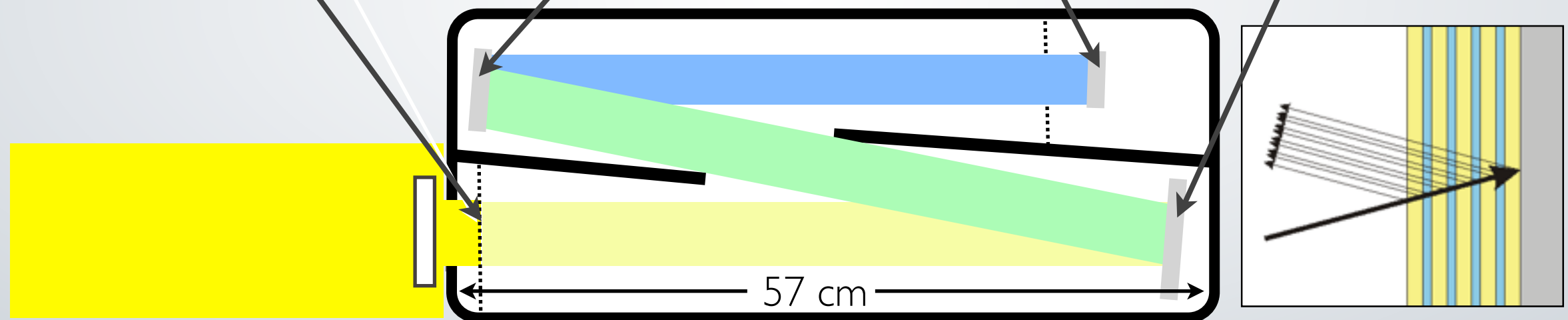
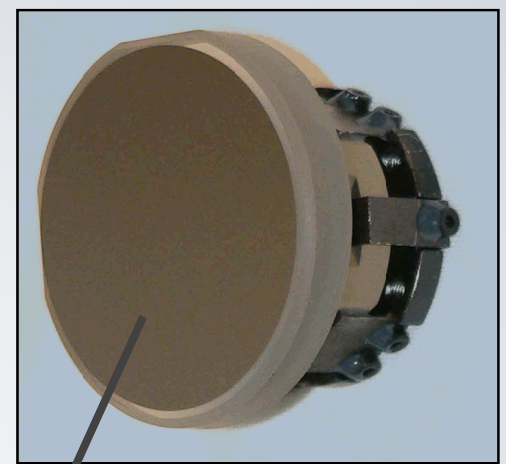
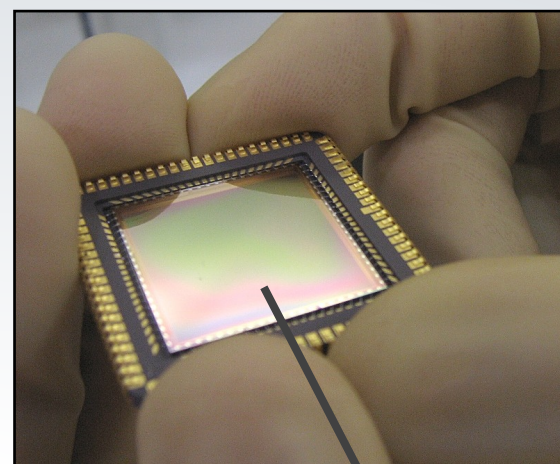
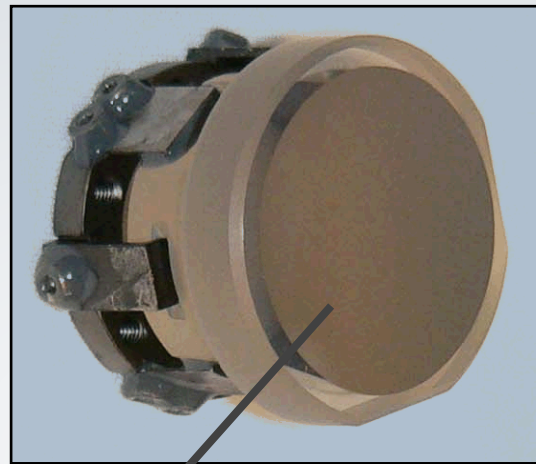
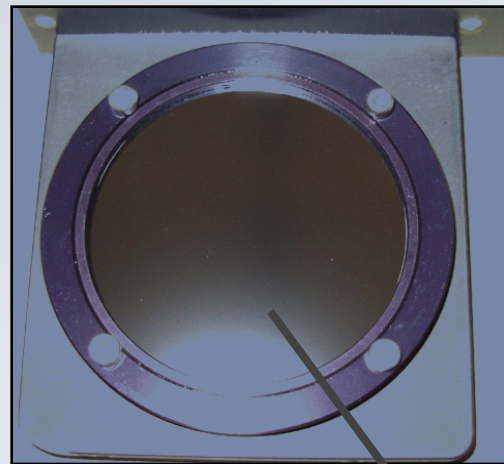
Sun **W**atcher with **A**ctive Pixel System & Image **P**rocessing
PI: Daniel Seaton

foil filter
on mesh grid
(heat + visible)

Spherical secondary
mirror with
multi-layer coating

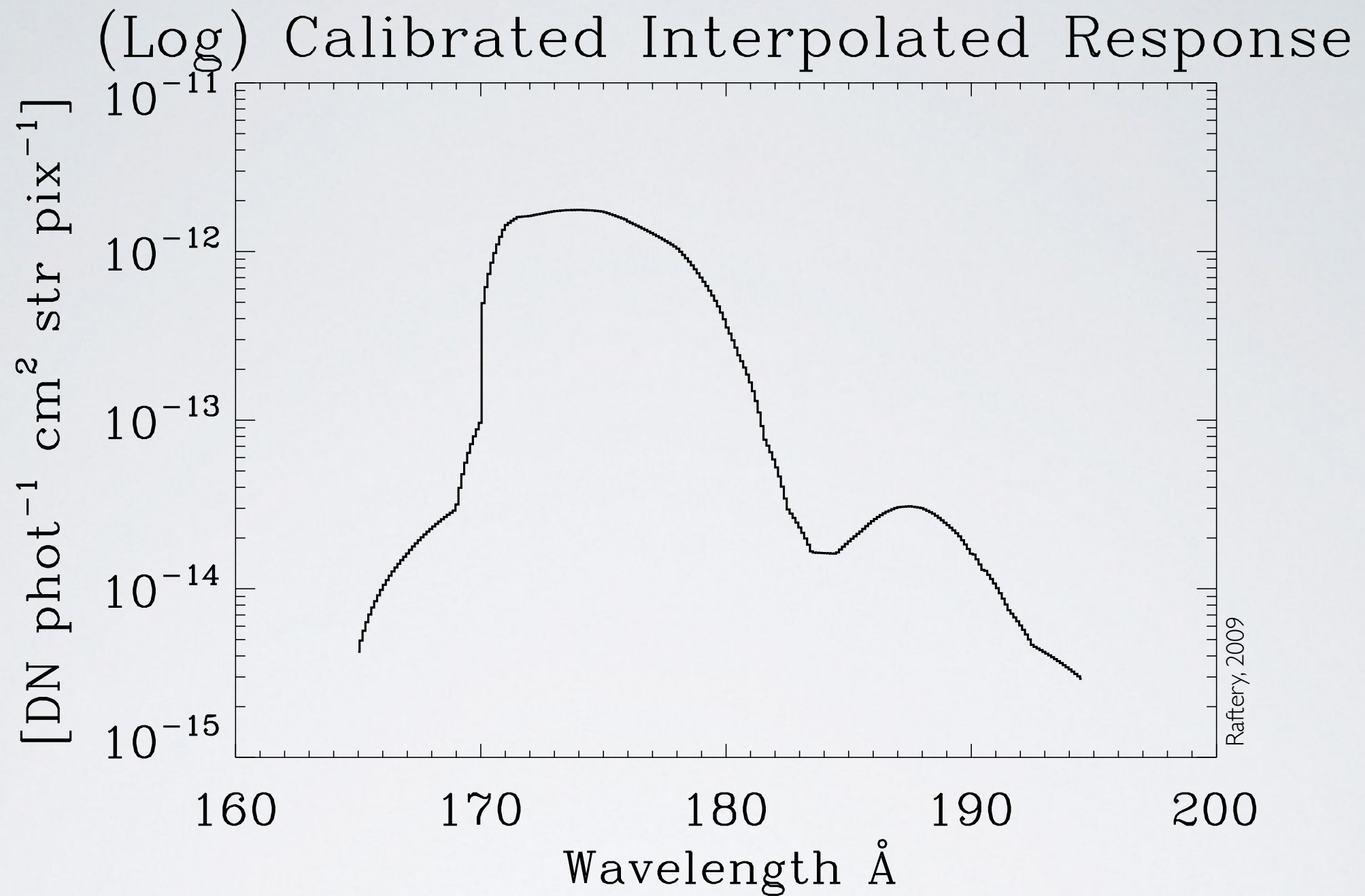
CMOS APS
coated detector

Elliptical primary
mirror with
multi-layer coating



OPTICAL PATH

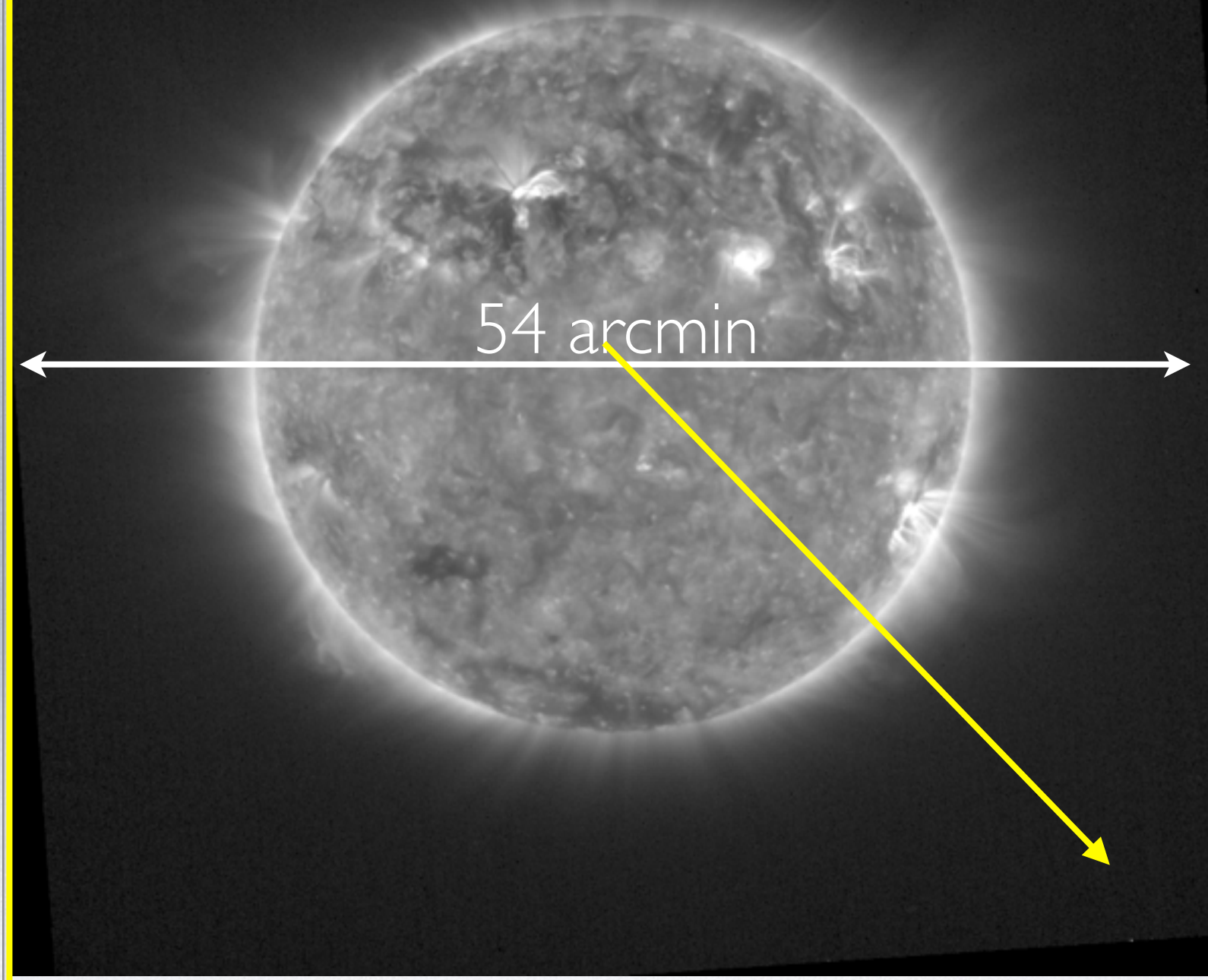
Off-Axis Ritchey-Chrétien Scheme



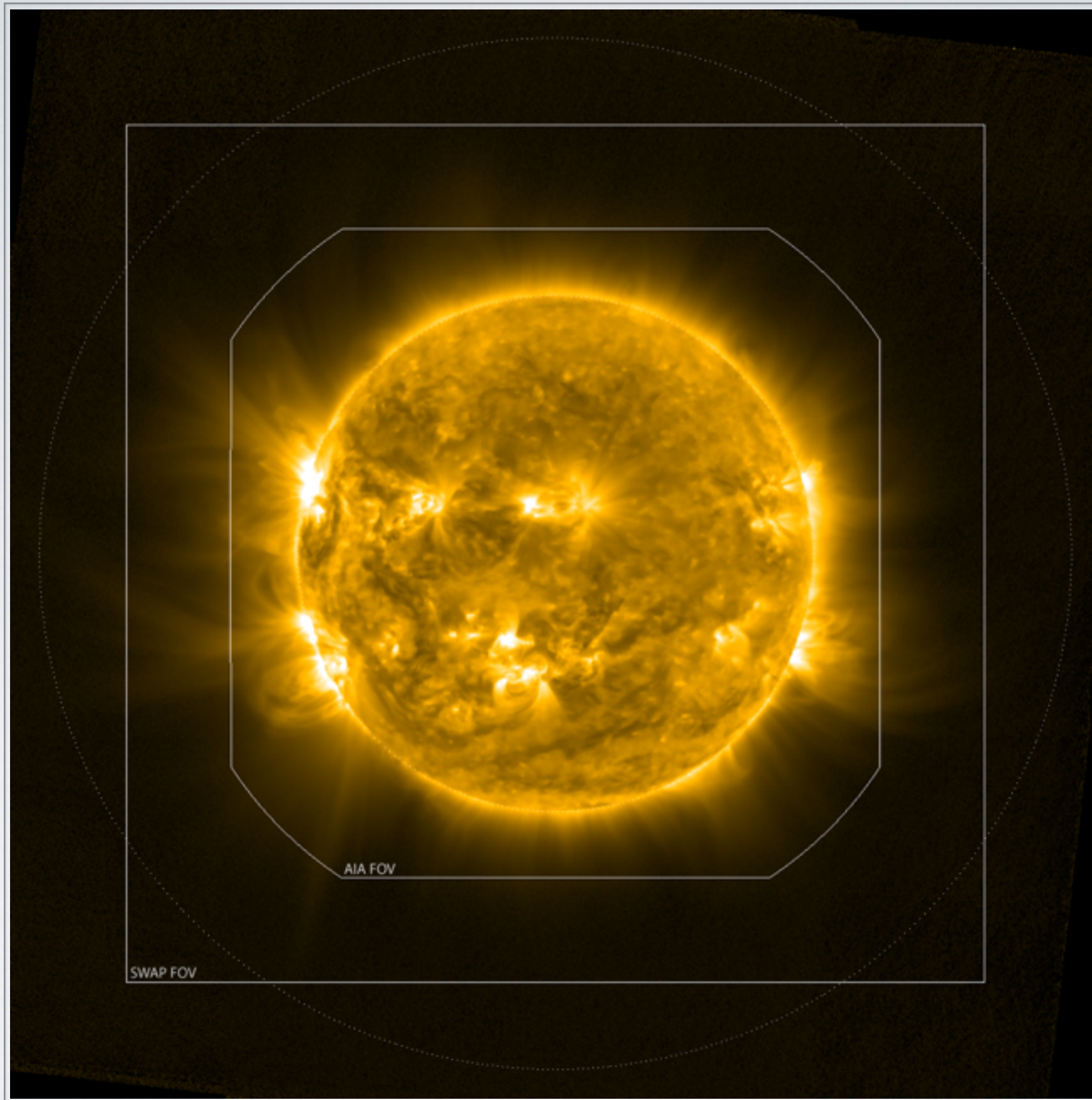
SPECTRAL RESPONSE

Measured with Synchrotron Beam at BESSY

Up to 1 degree off-pointing



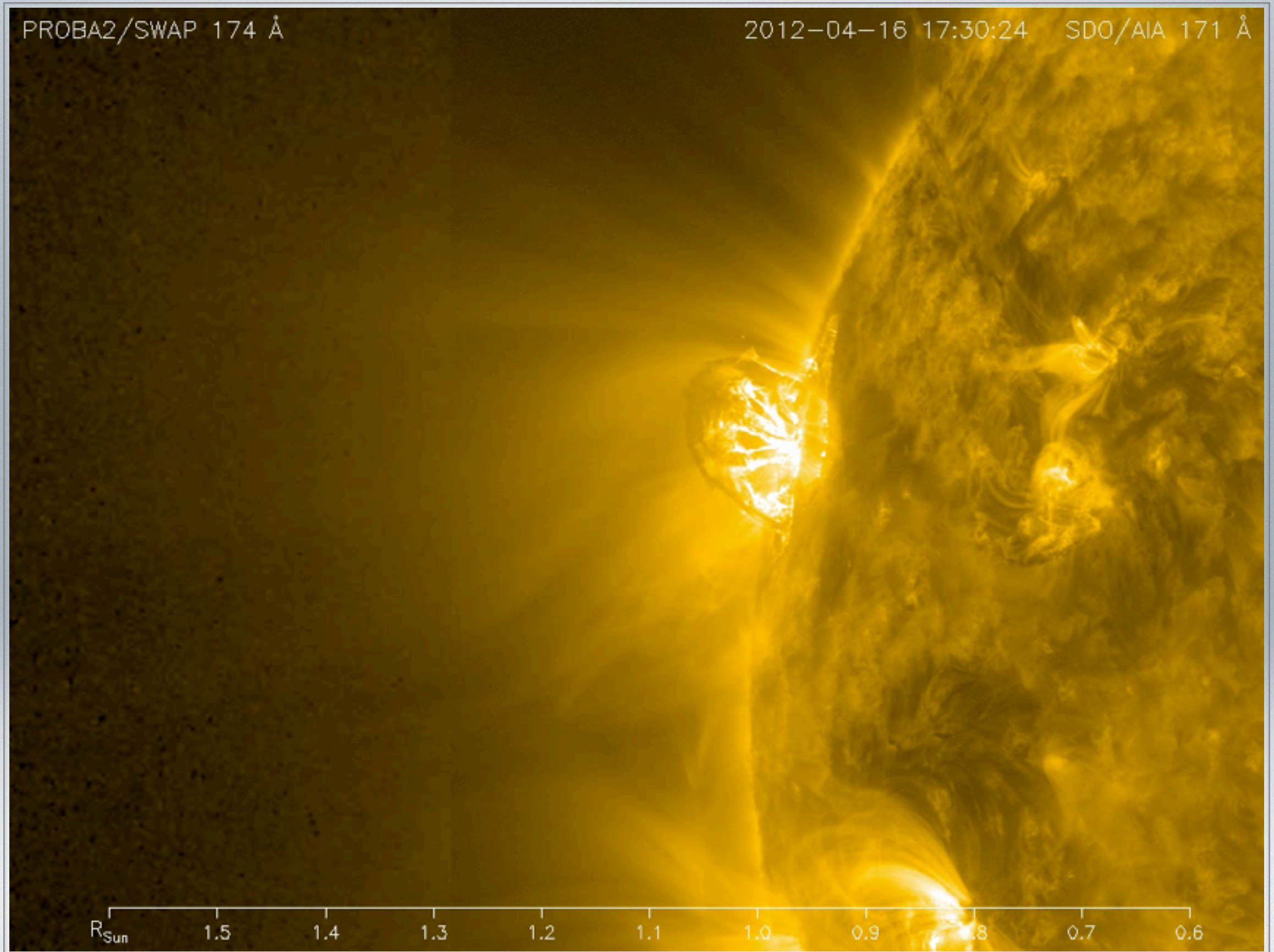
SWAP VS. AIA



FOV COMPARISON

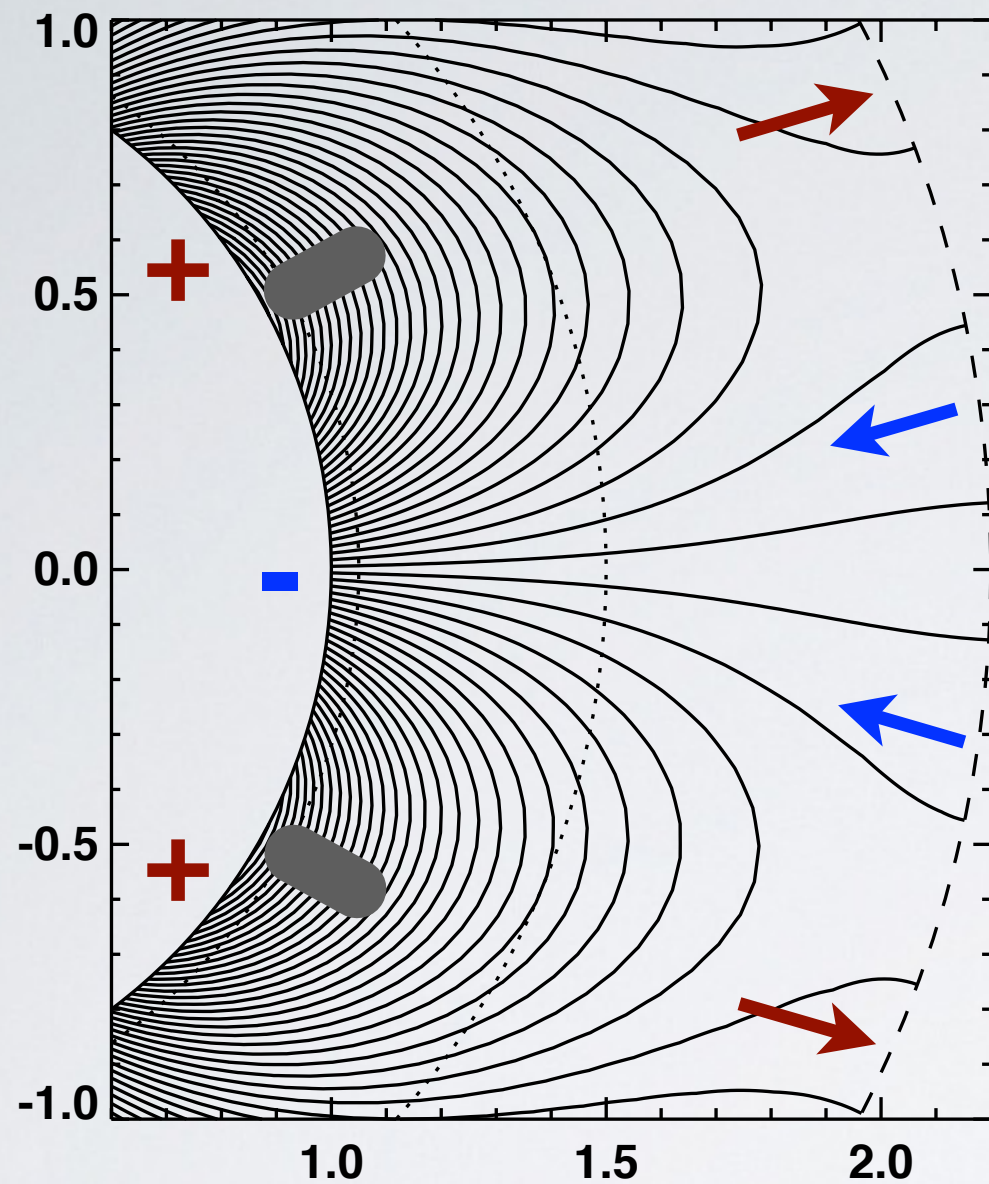
PROBA2/SWAP 174 Å

2012-04-16 17:30:24 SDO/AIA 171 Å

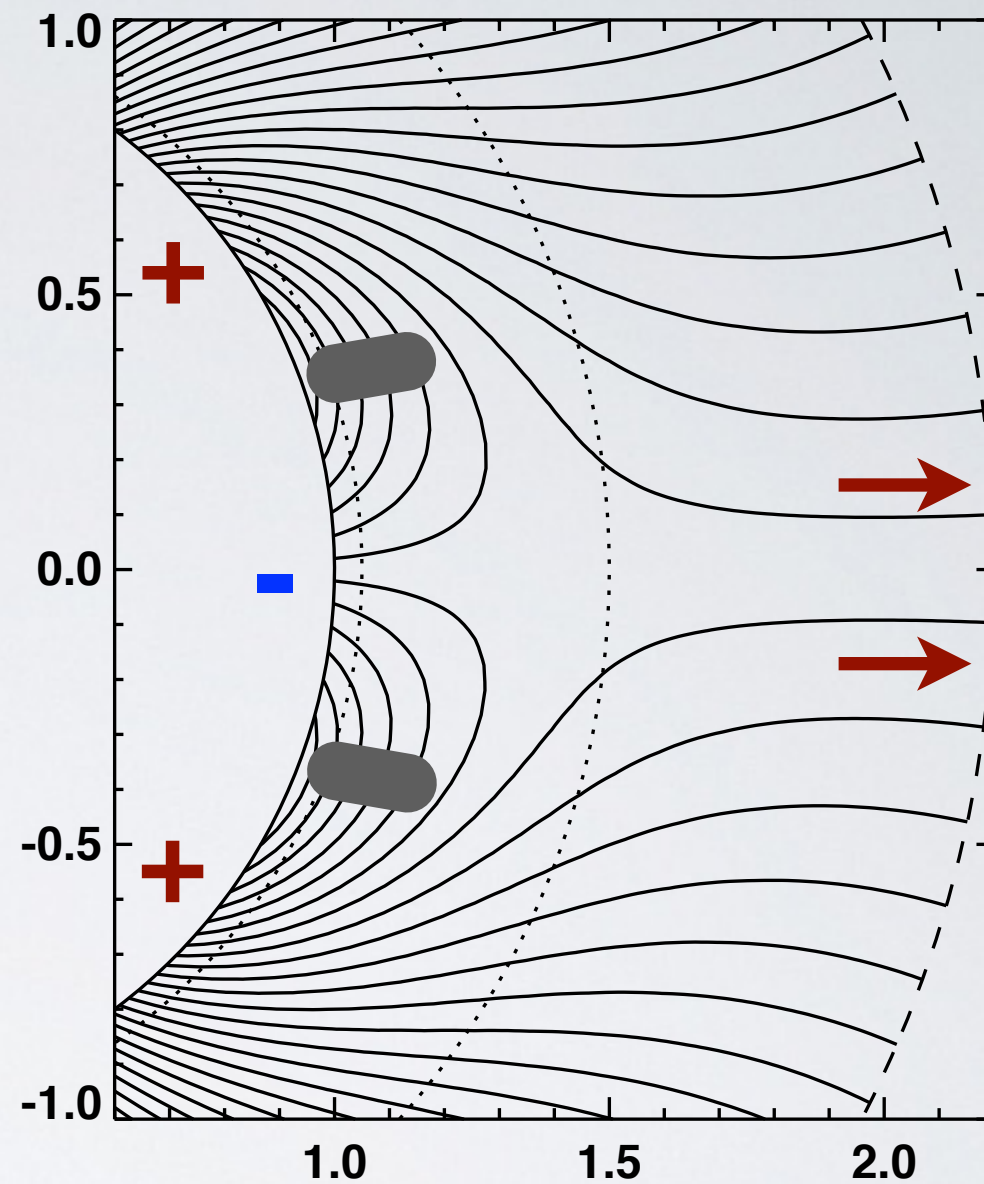


SWAP & AIA ERUPTION

CURRENT RESEARCH: STREAMER MORPHOLOGY



DOUBLE
HELMET
STREAMER

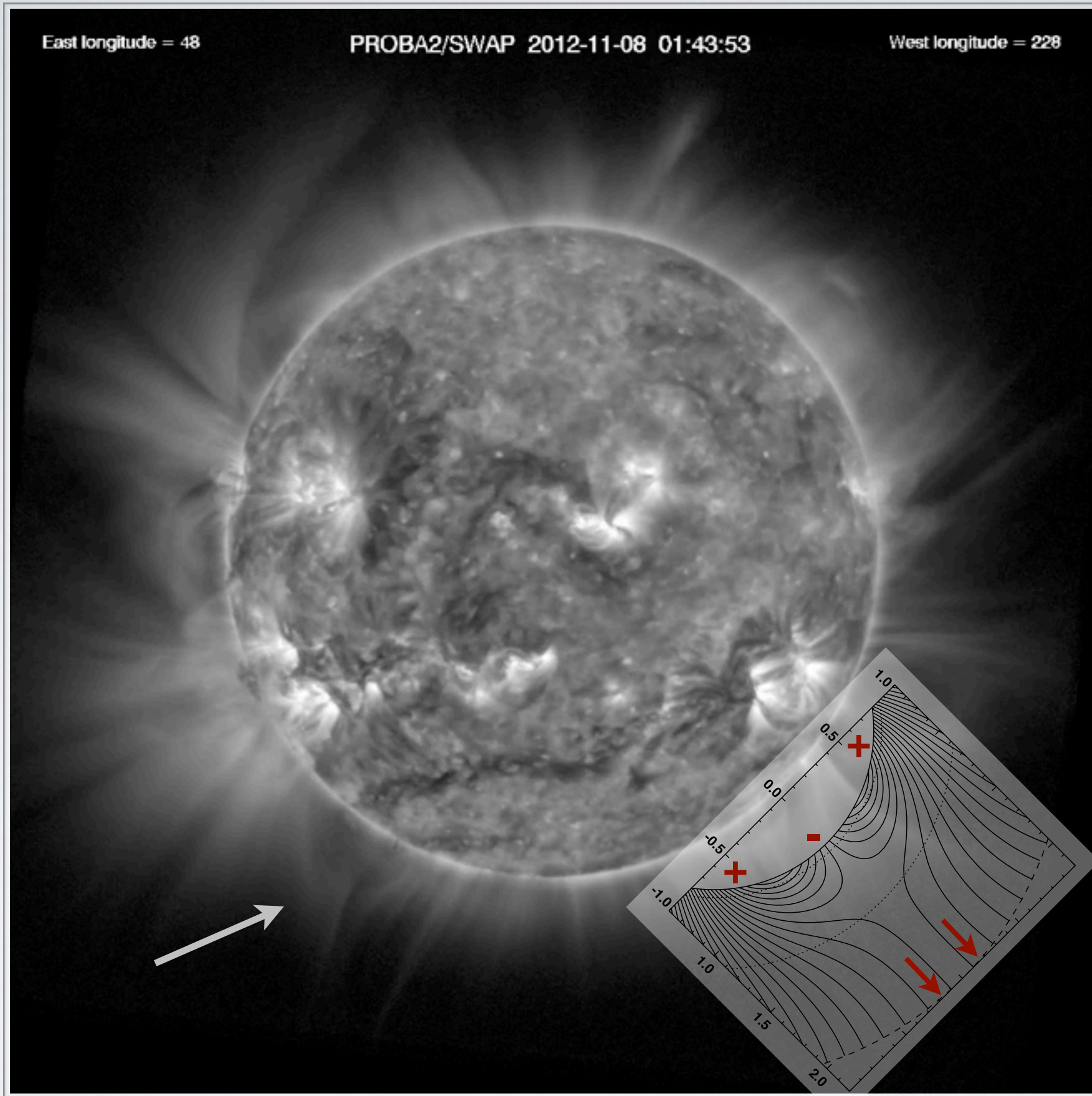


PSEUDO-
STREAMER

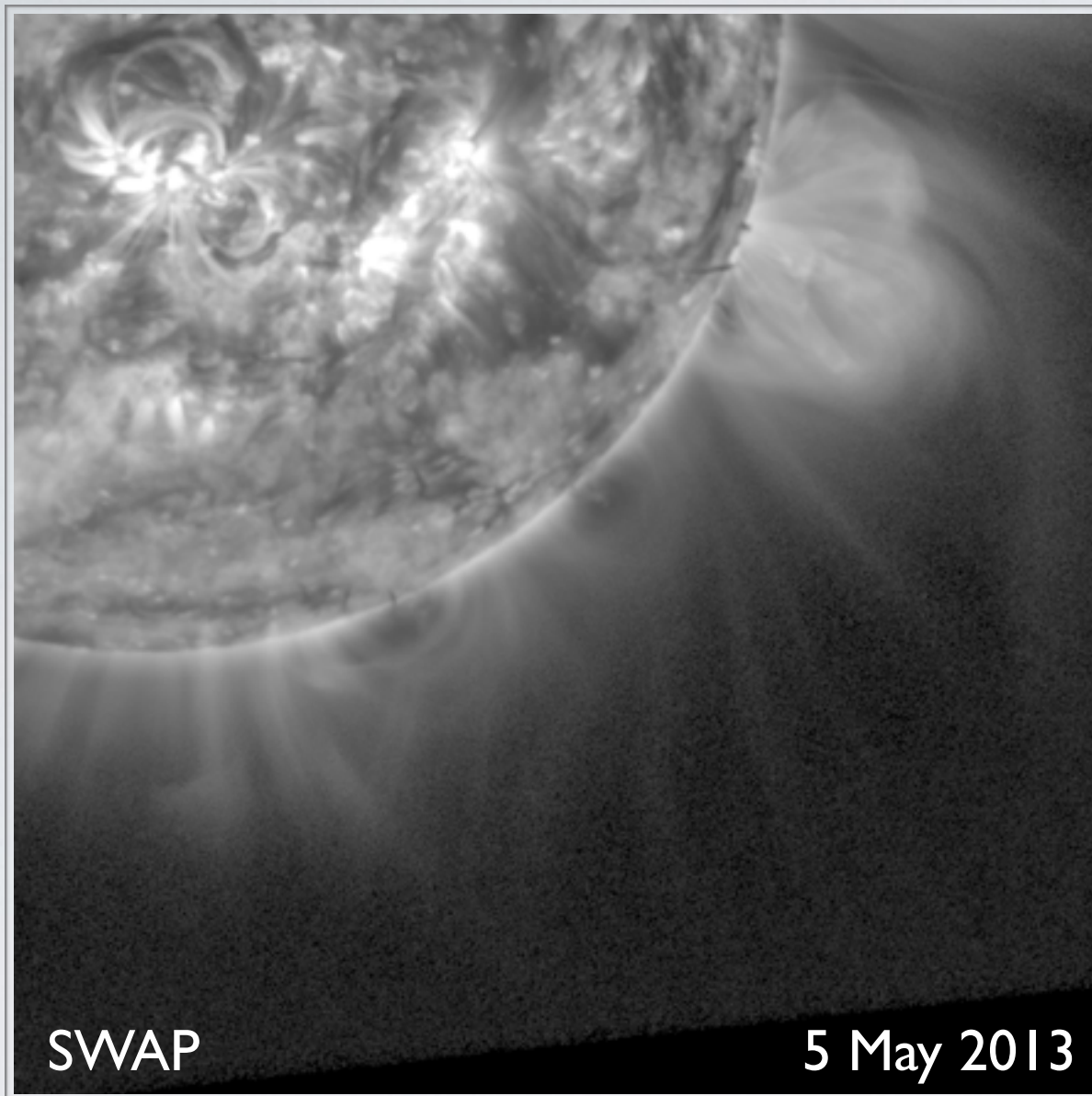
East longitude = 48

PROBA2/SWAP 2012-11-08 01:43:53

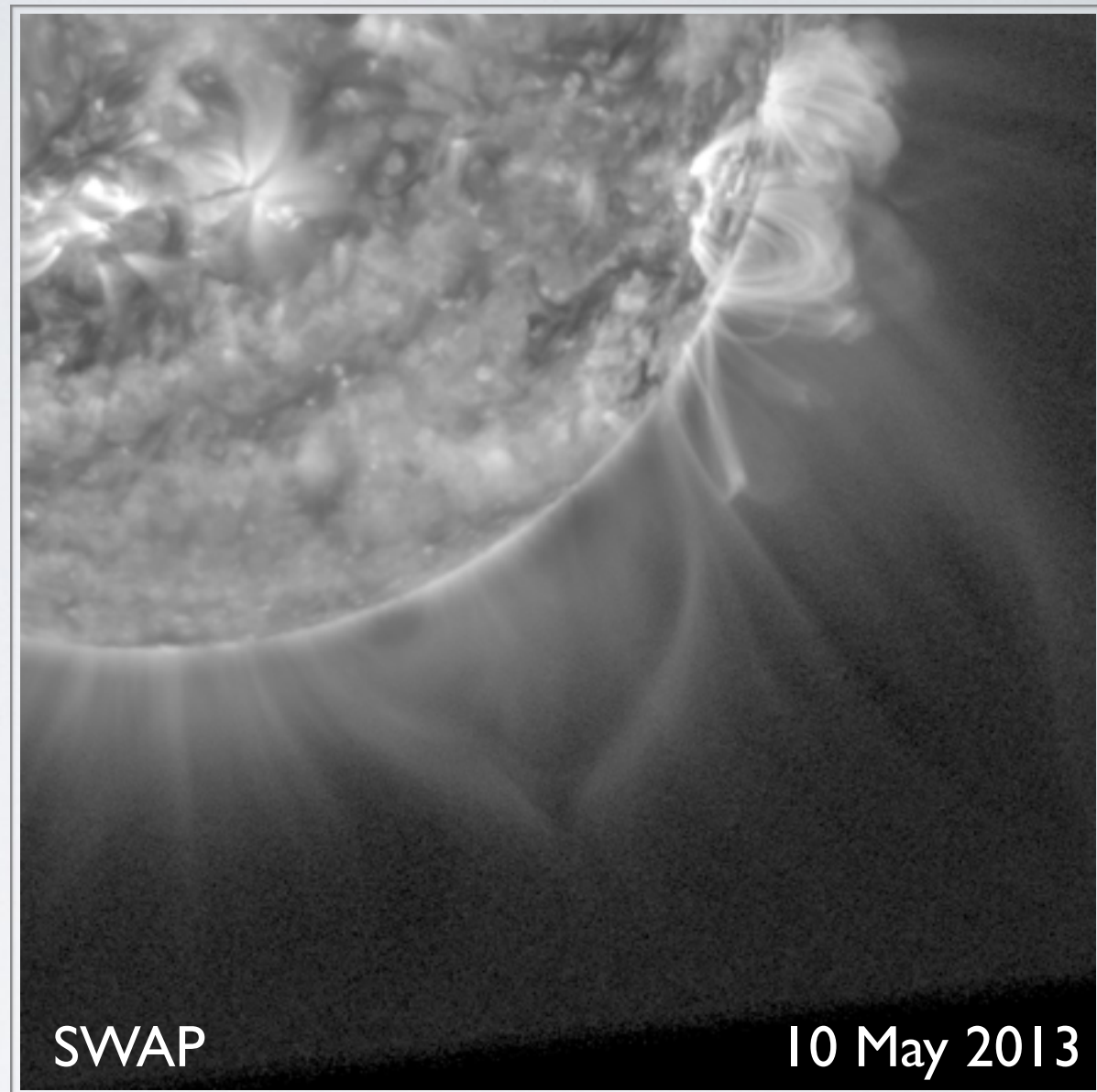
West longitude = 228



PSEUDOSTREAMERS

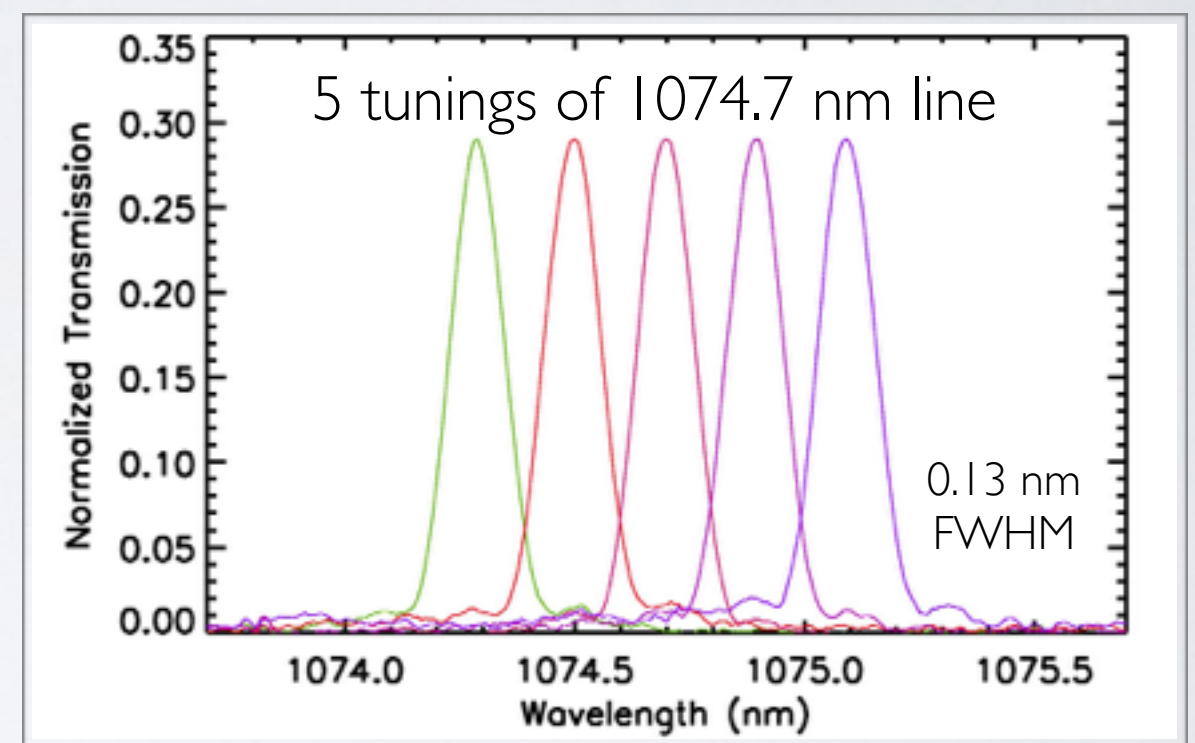
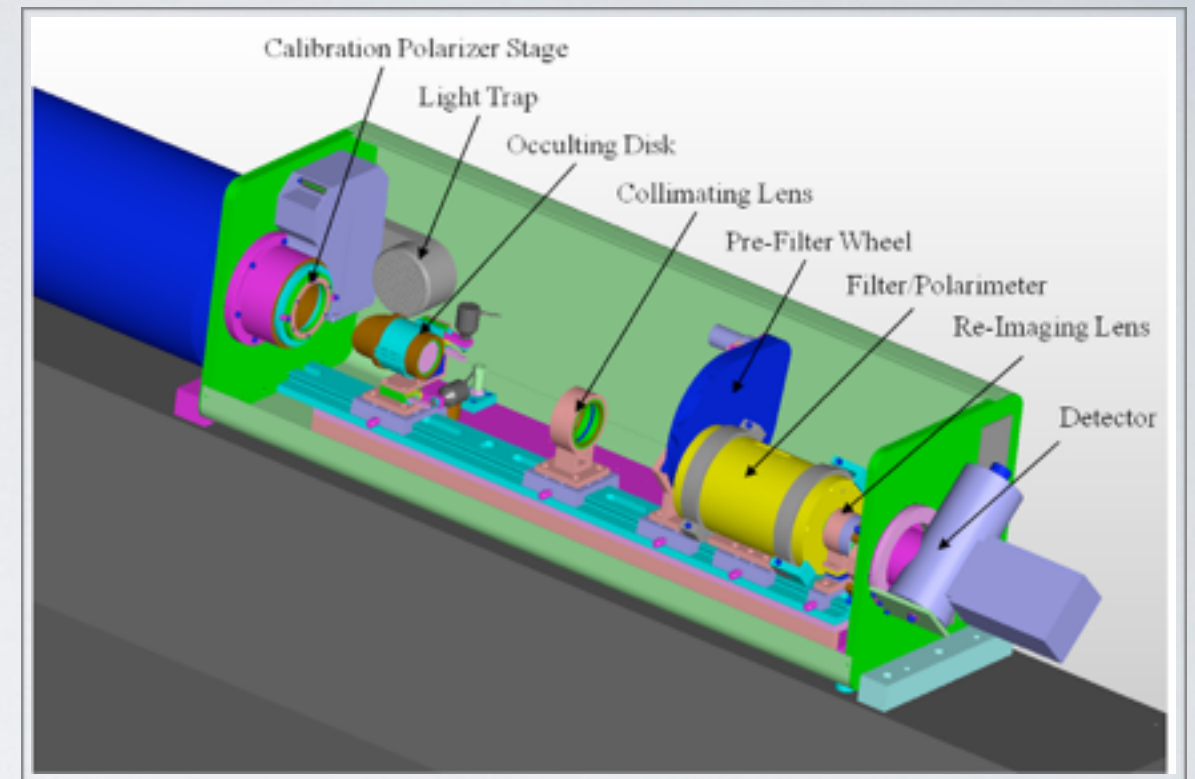


DOUBLE
HELMET
STREAMER



PSEUDO-
STREAMER

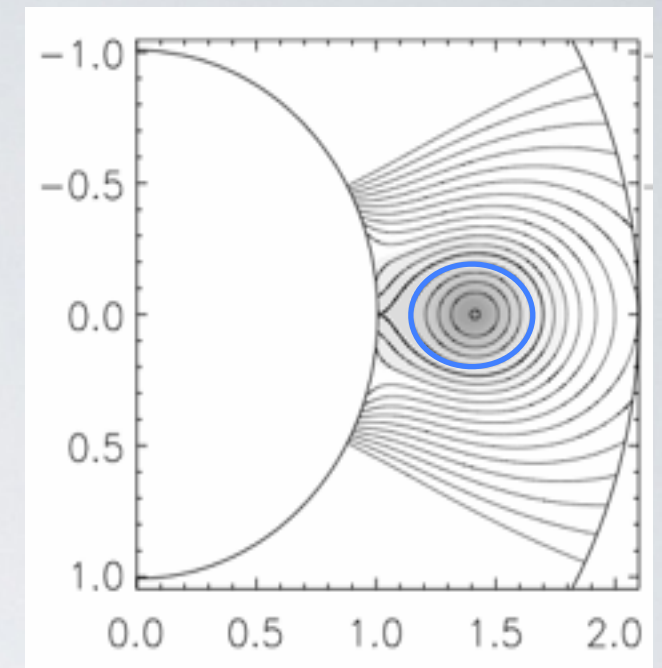
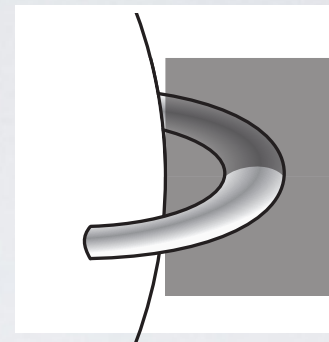
- Ground-based occulted coronagraph, 20 cm aperture, 4.46 arcsec/pixel
- Combination tunable filter and polarimeter
- Measures full polarization vector (Stokes I,Q,U,V)
- Dual beam output simultaneous corona and continuum images



COMP: CORONAL MULTICHANNEL POLARIMETER

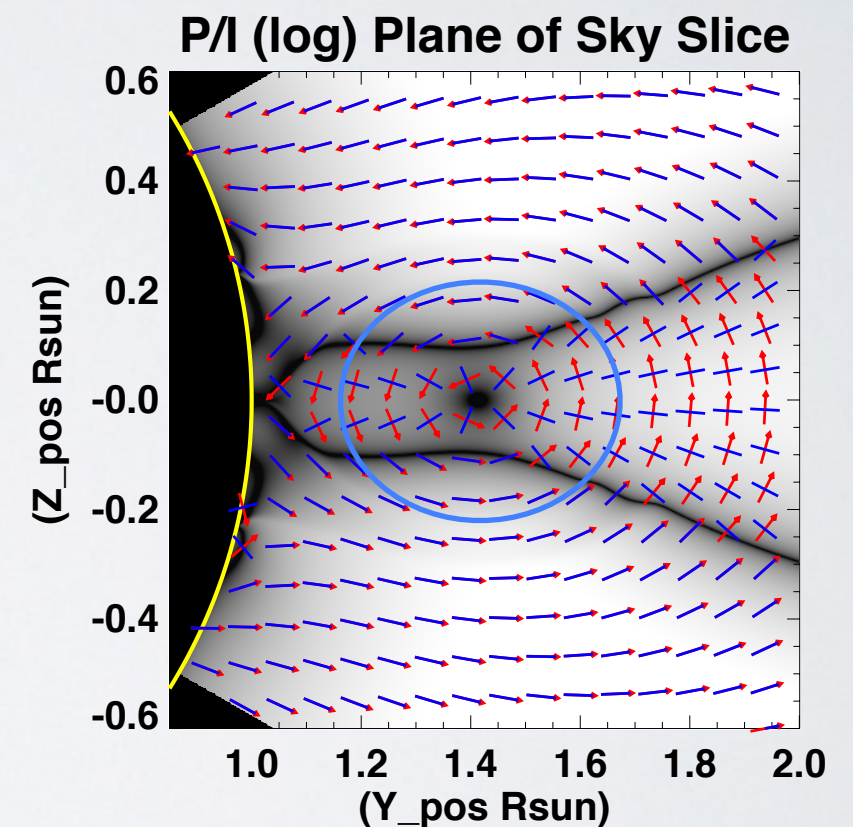
Linear polarization: B direction
in the plane of sky

$$\frac{L}{I} = \frac{\sqrt{Q^2 + U^2}}{I} \approx 10^{-2} \propto \sin^2 \Theta$$

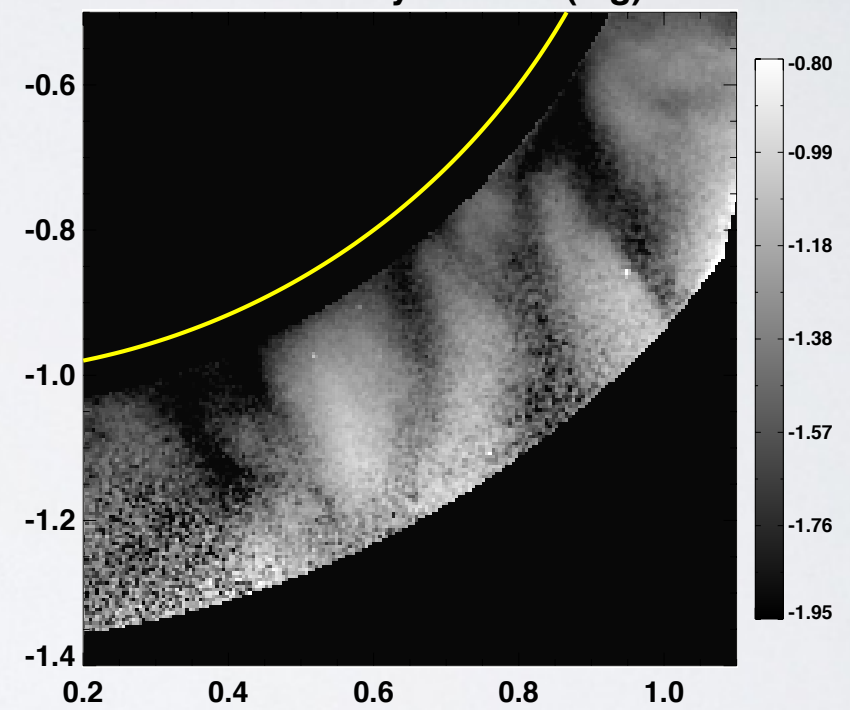
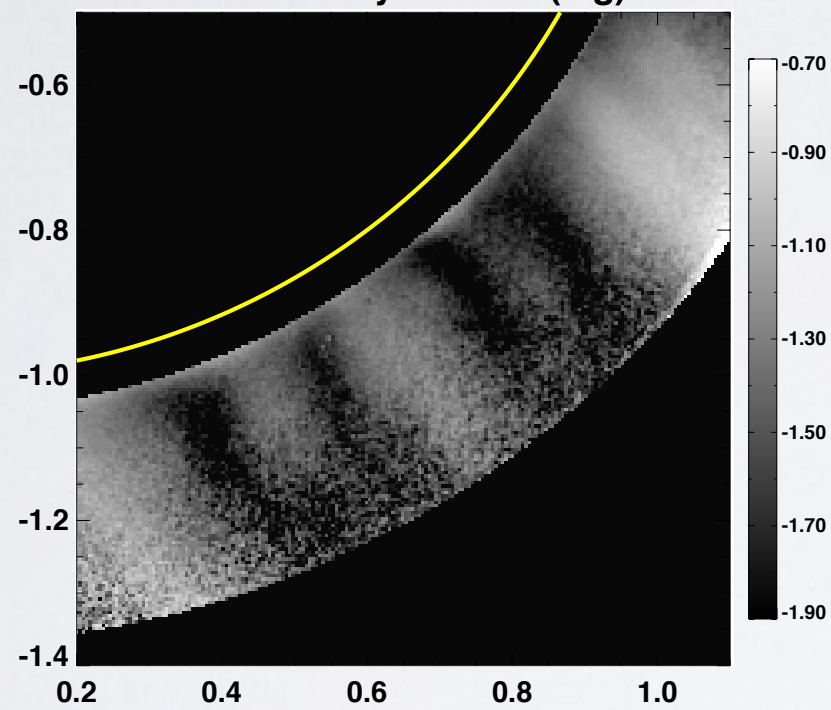
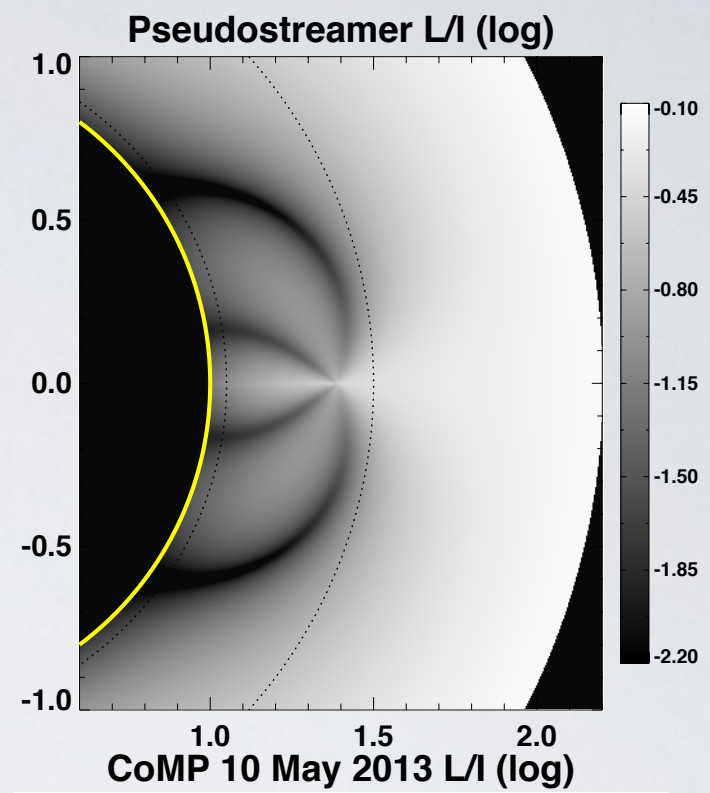
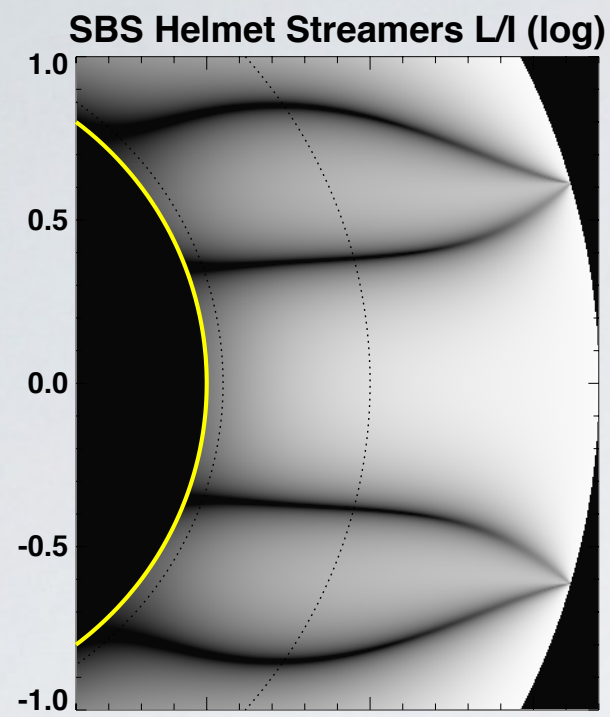


L=0 provides useful information

1. B is along line of sight
($\theta=90^\circ$)
2. Van Vleck Inversion, B is about
 54° from radial
3. High symmetry causes false
LOS signal (not shown)



CORONAL POLARIZATION



DOUBLE HELMET
STREAMER

PSEUDO-
STREAMER

CoMP 1074

2013-05-10 19:28:34 UT

N
W

L_{tot}/I

$\log(L_{\text{tot}}/I)$

-2.3 -1.8 -1.3 -0.8 -0.3



COLLABORATION

ground-based CoMP data

SWAP data are online at proba2.oma.be



PROBA2/SWAP 17.4nm 2010-FEB-02