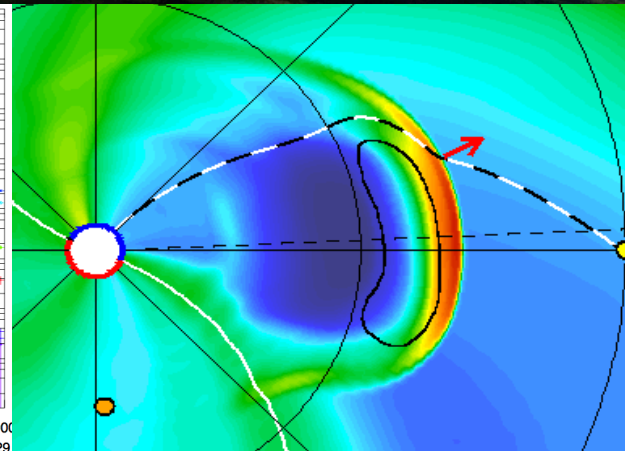
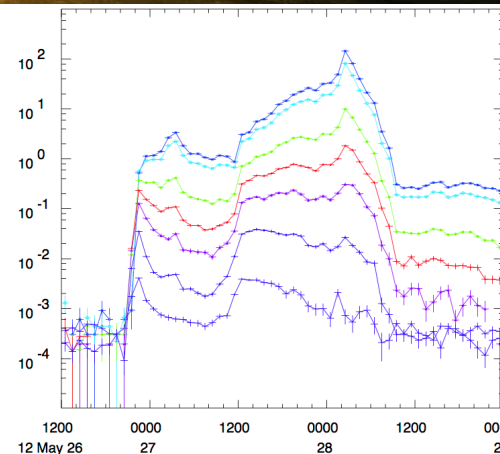
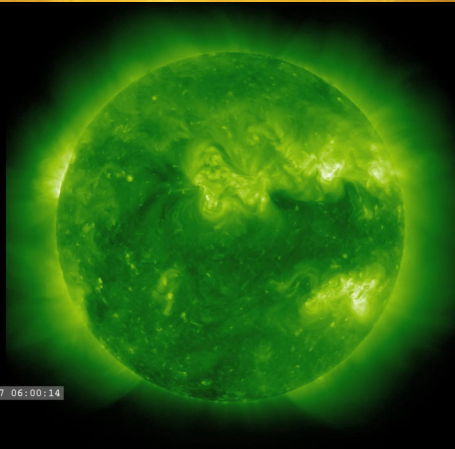
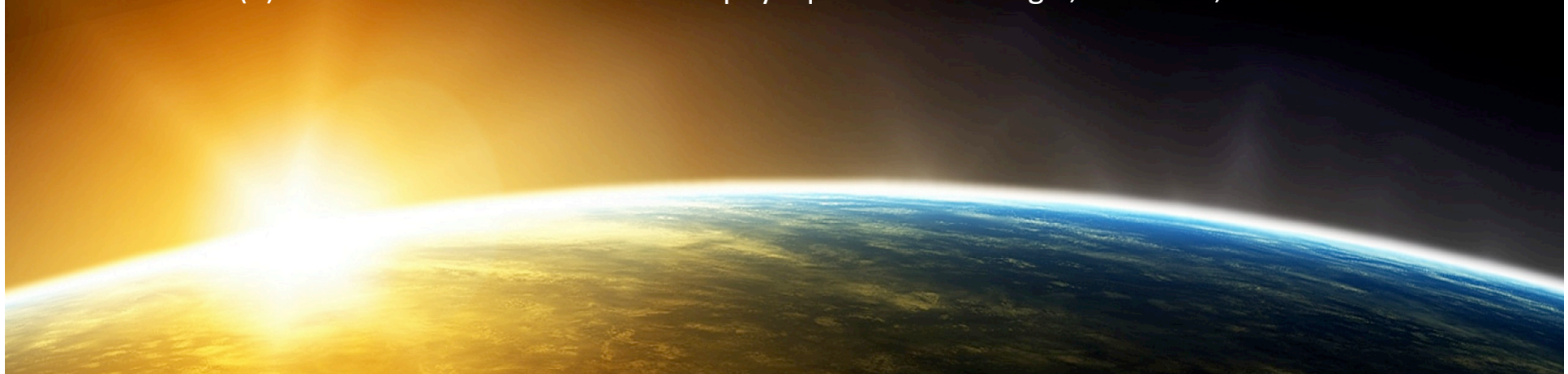


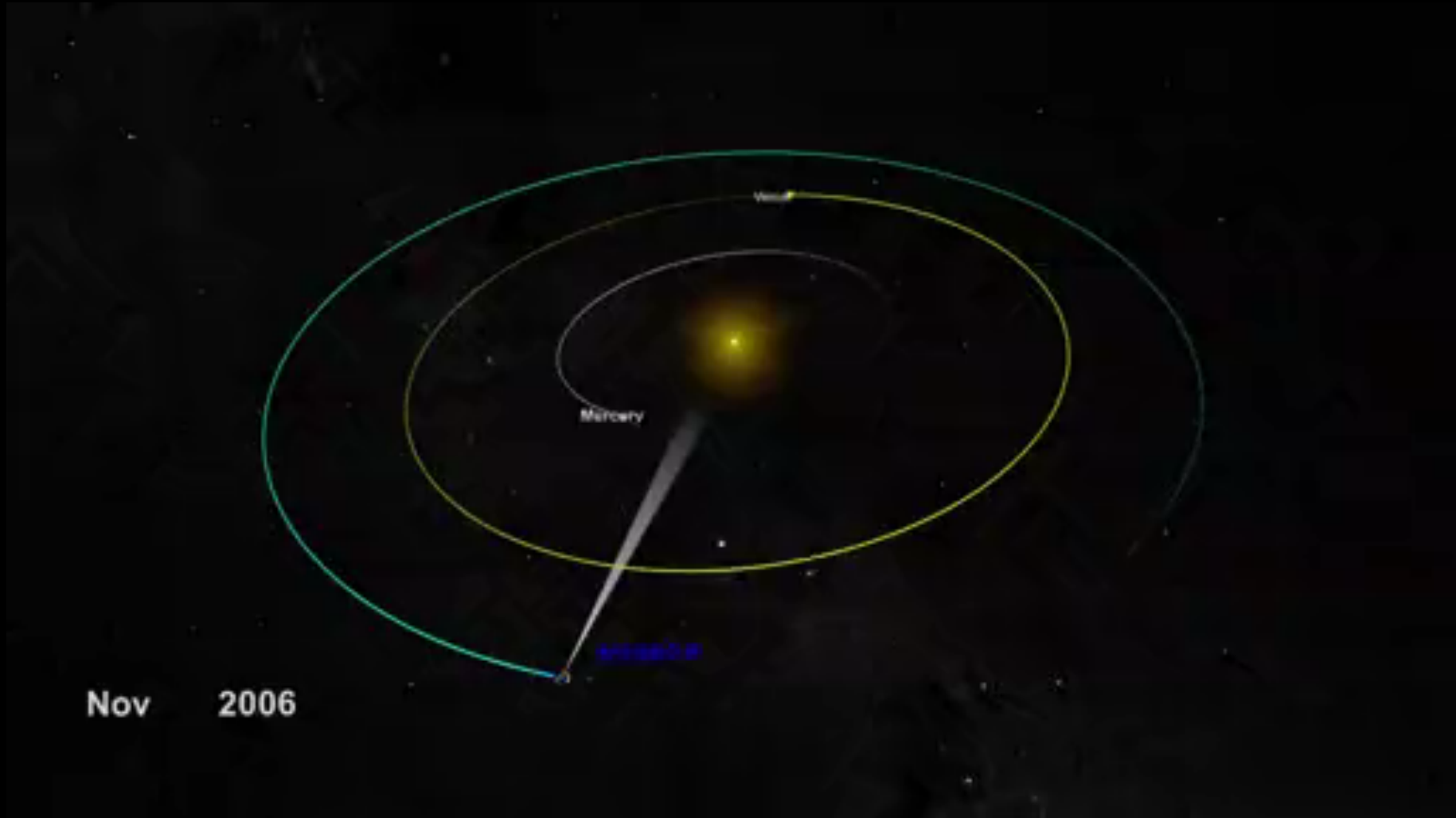


# Structure 3-D: mesures STEREO

Alexis P Rouillard<sup>1</sup>, Illya Plotnikov<sup>1</sup>, Rui Pinto<sup>1</sup>, Eduardo Sanchez-Diaz<sup>1</sup>, Benoit Lavraud<sup>1</sup>,  
et STEREO aficionados

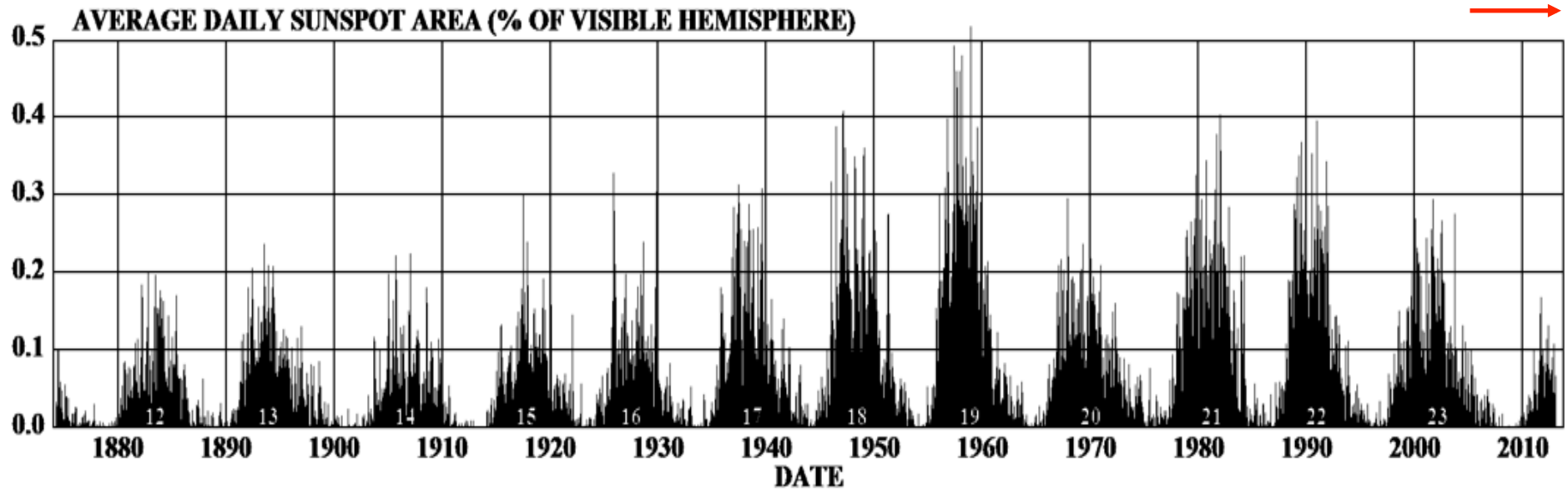
(1) Institut de Recherche en Astrophysique et Planétologie, Toulouse, France







STEREO →



## Structure 3-D: mesures STEREO:

1. Reconstruction 3-D de la variabilité du vent lent
2. Reconstruction 3-D des chocs coronaux et l'accélération des particules

Je ne présenterai pas les résultats STEREO sur les reconstructions 3-D des champs torsadés, les boucles coronales, triangulation des émissions radio.

Il y a aussi toute une littérature sur les aspects météo de l'espace.

## L'originalité de STEREO:

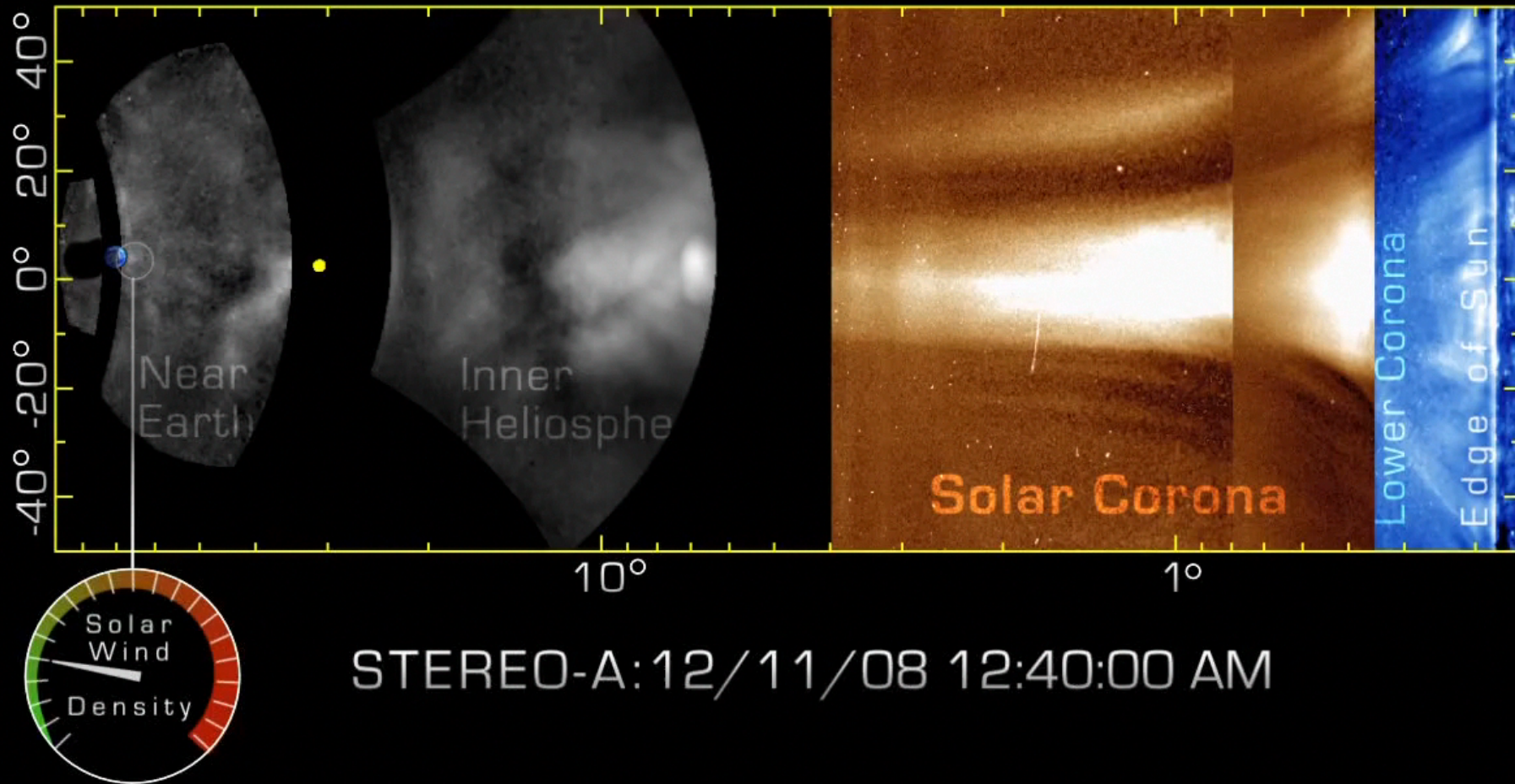
1. Imagerie de la couronne depuis plusieurs points de vue simultanément
2. Imagerie du vent solaire à haute cadence et haute résolution

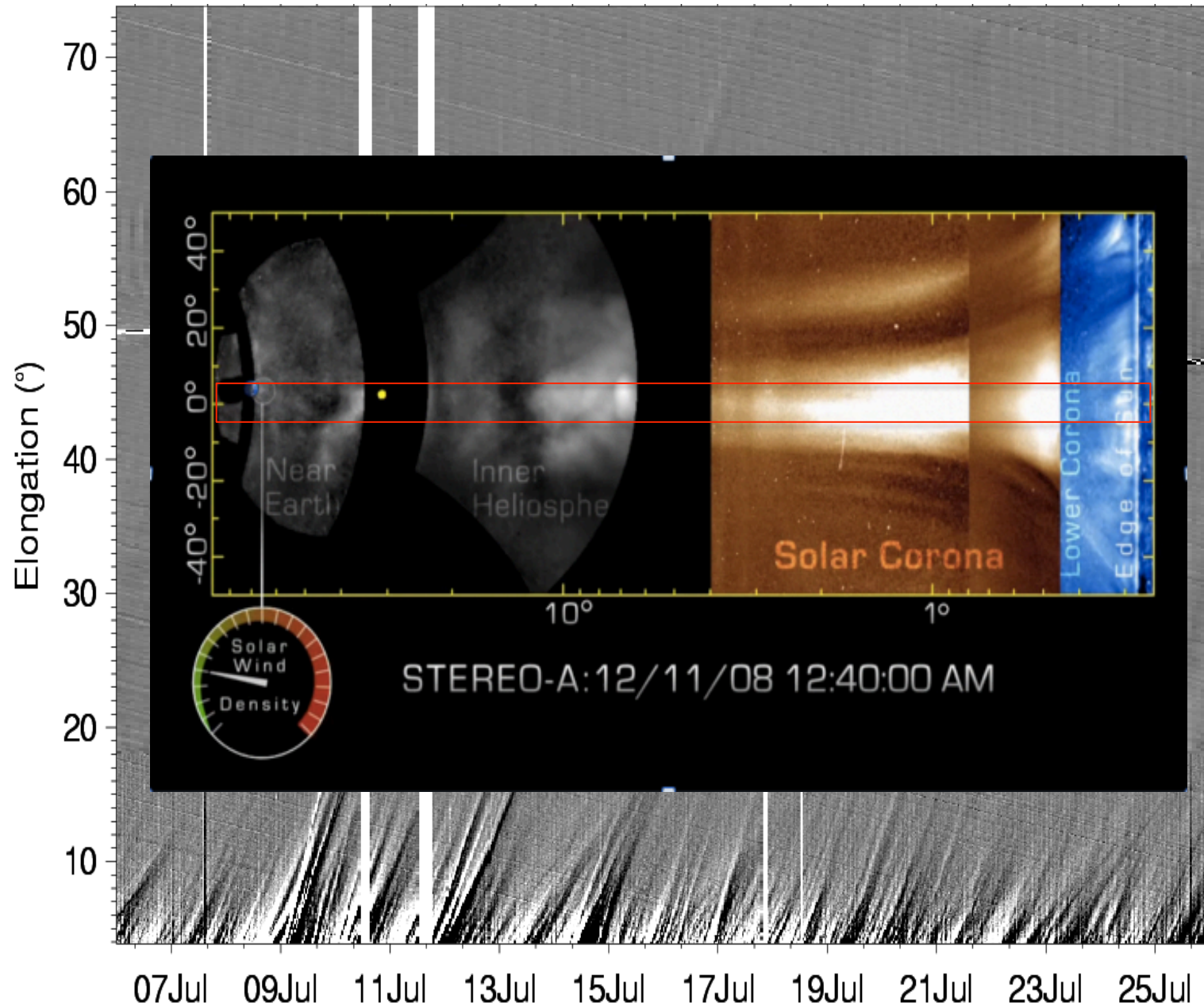


HI-2A

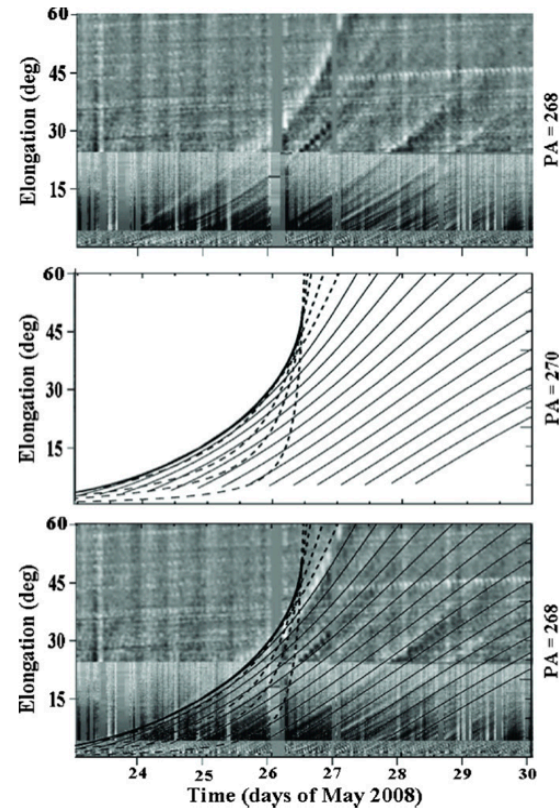
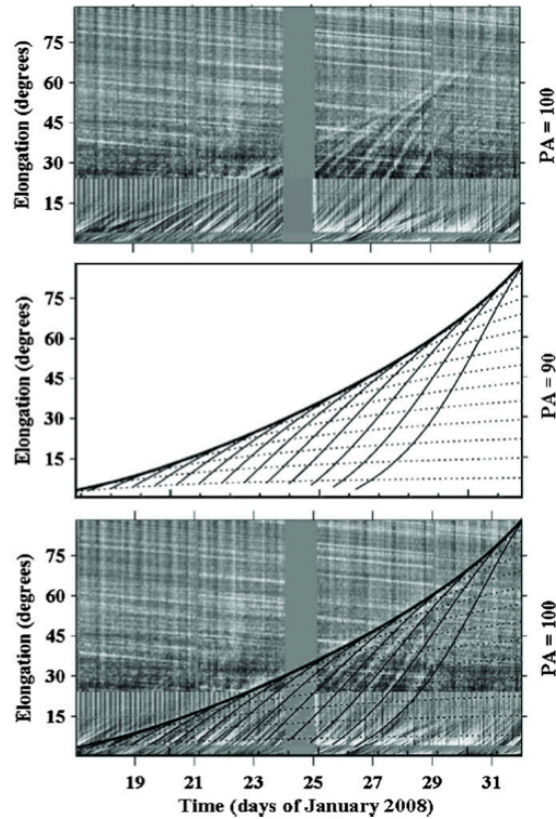
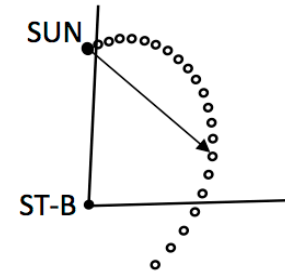
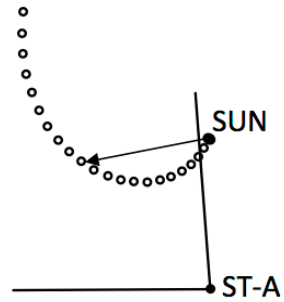
HI-2B



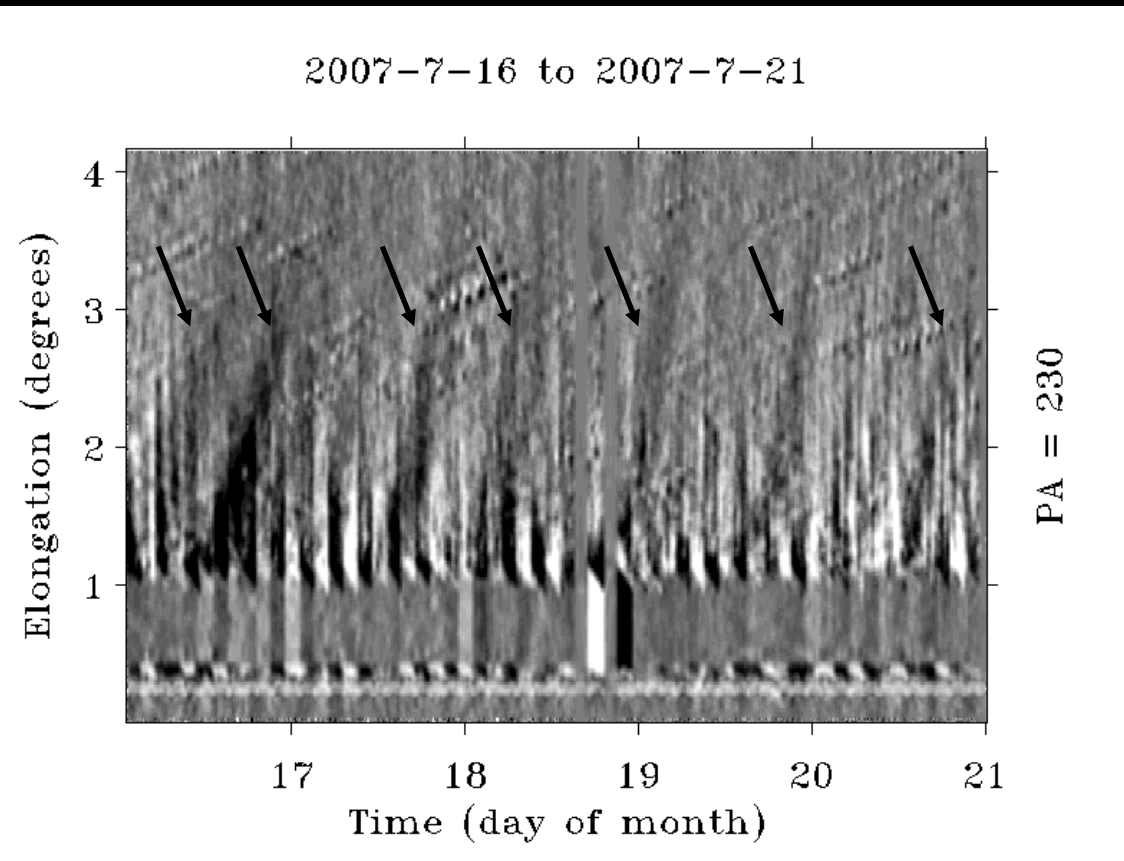
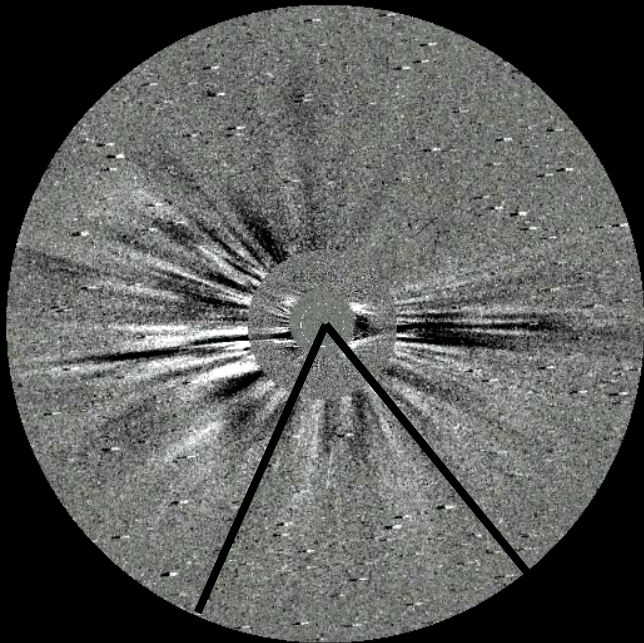




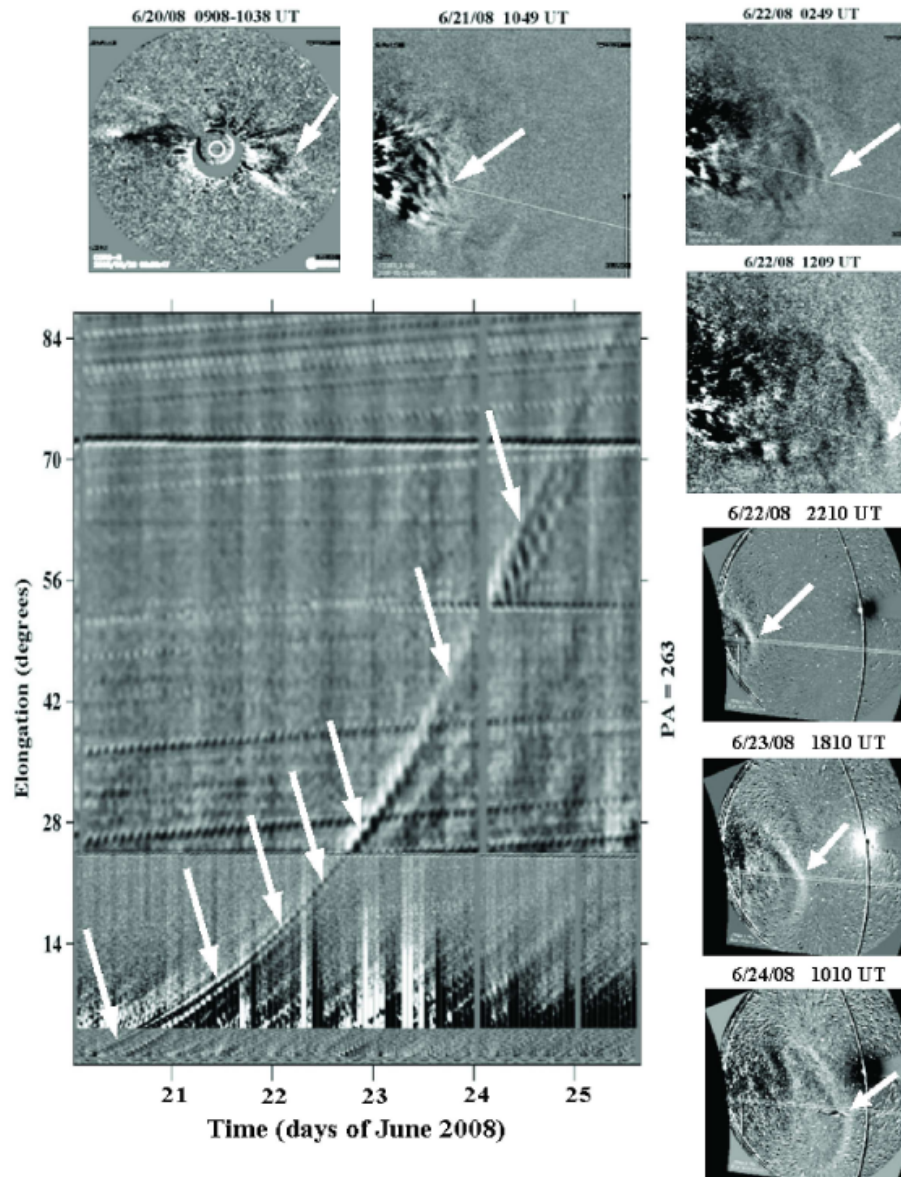




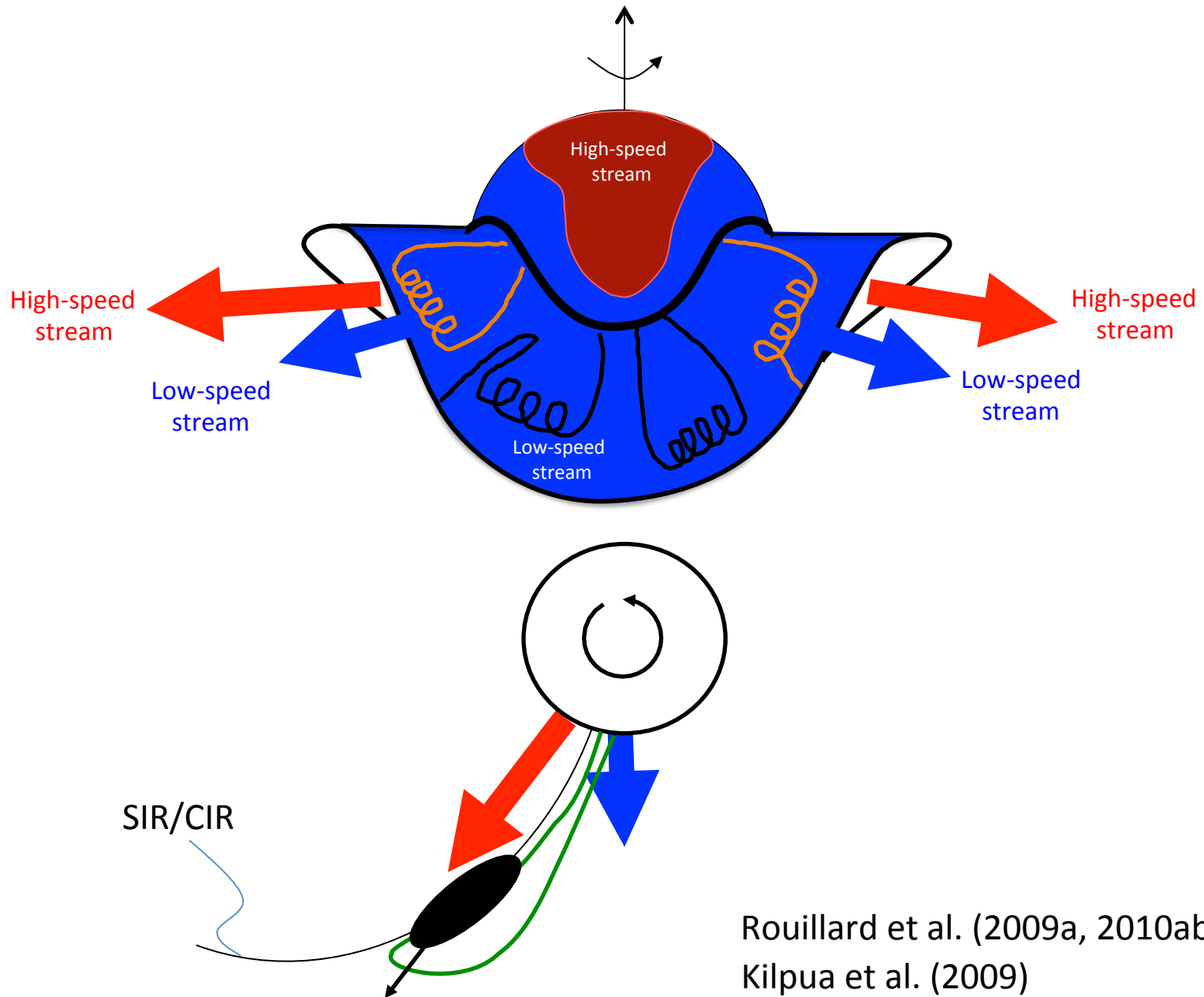
Blobs observed face-on at high latitudes tend to be faint so we average and subtract a combination of 16 running COR-1 frames and 6 running COR-2 frames: many more loop structures appear to emerge.



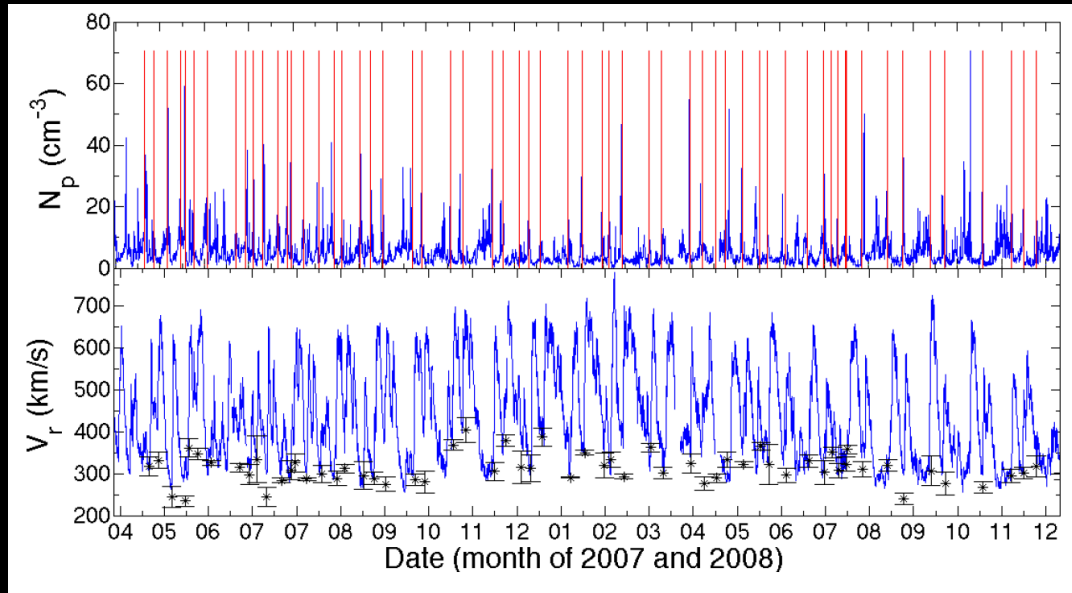




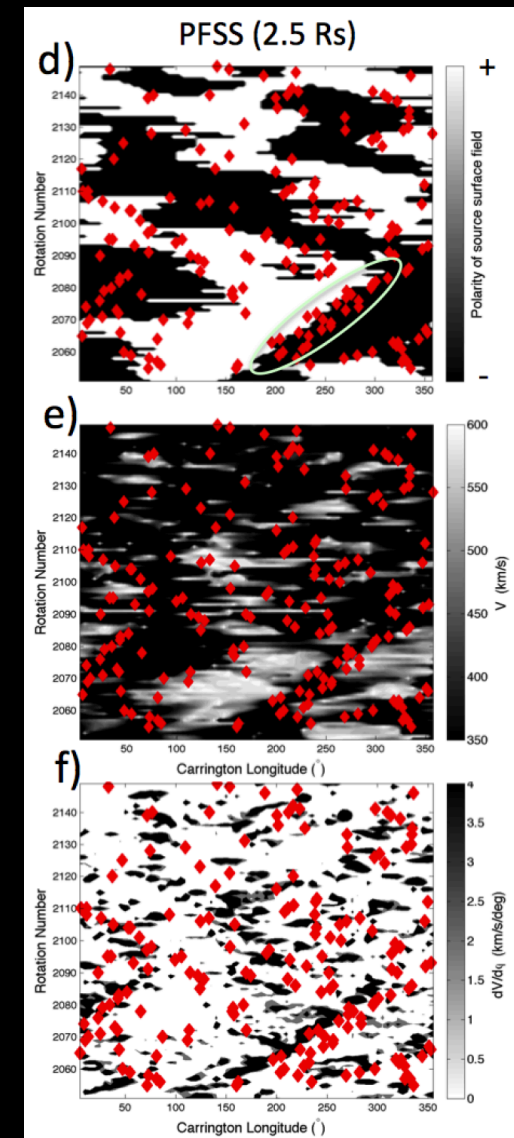
Sheeley and Rouillard (2010)  
Rouillard et al. (2011)



Rouillard et al. (2009a, 2010ab, 2011a)  
Kilpua et al. (2009)



Plotnikov et al. (2016a)  
 >> Poster 7.20



Présence de structures très lentes: 200-260 km/s jusqu'à 0.3-0.5AU:  
 voir poster de Sanchez-Diaz

## CMEs/MAGNETIC CLOUDS:

Lowest height of appearance: just above solar surface  
 Identified in-situ signatures  
 Source region: vicinity of photospheric neutral line

## STREAMER BLOBS/ARCHES:

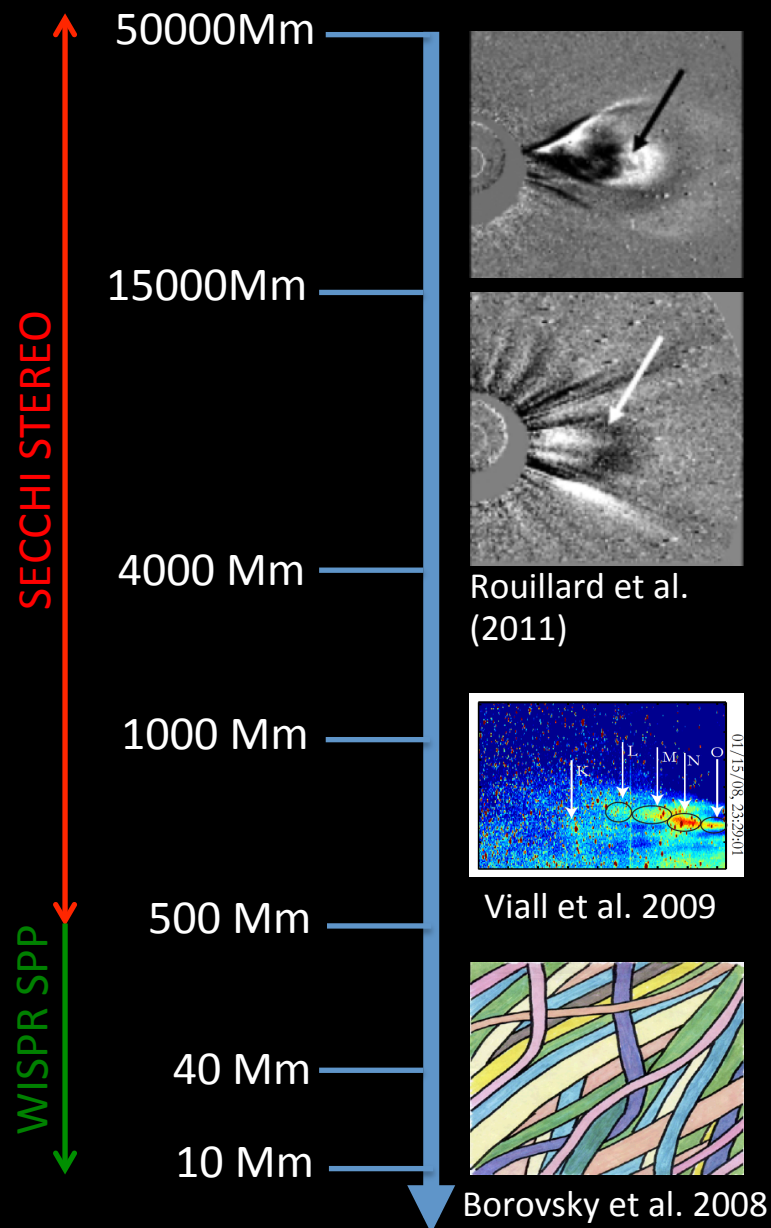
Lowest height of appearance: about 2  $R_s$   
 Identified in-situ signatures  
 Source region: vicinity of coronal neutral line  
 ~8-hr periodicity  
 Small flux ropes with  $R < 0.1$  AU have a steep power-law in contrast to Magnetic Clouds that have a Gaussian-like distribution (Janvier et al. 2014).

## PERIODIC DENSITY STRUCTURES:

Lowest height of appearance: about 2.5  $R_s$   
 Identified in-situ signatures  
 ~90 minutes periodicity

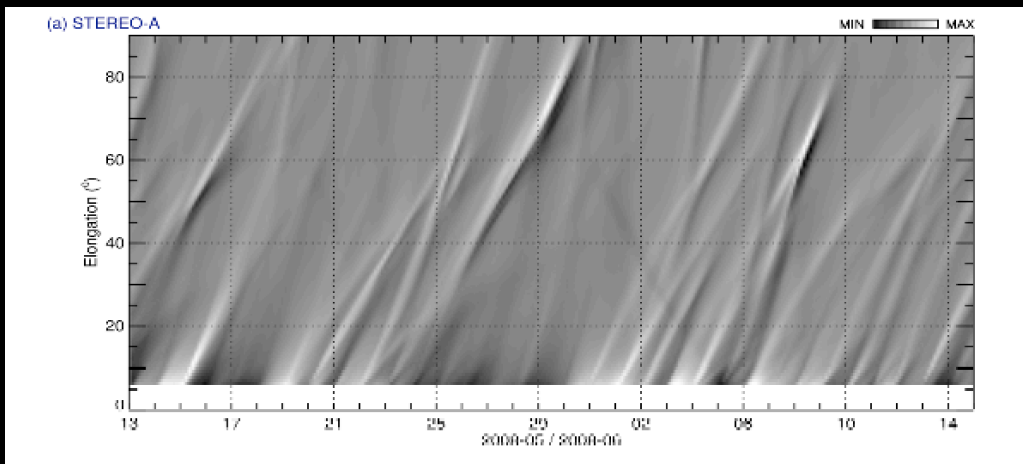
## COHERENT MAGNETIC STRUCTURES:

Lowest height of appearance: undetected yet in imagery  
 Identified in-situ signatures (e.g. Borovsky et al. (2008))

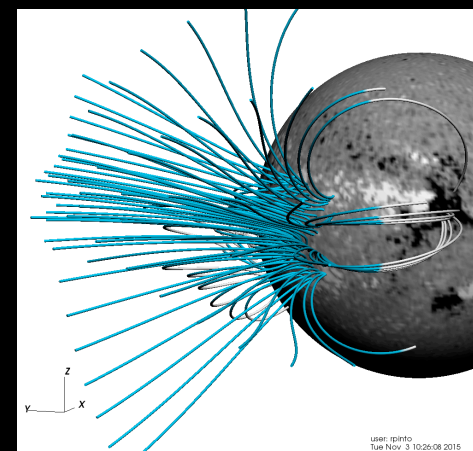
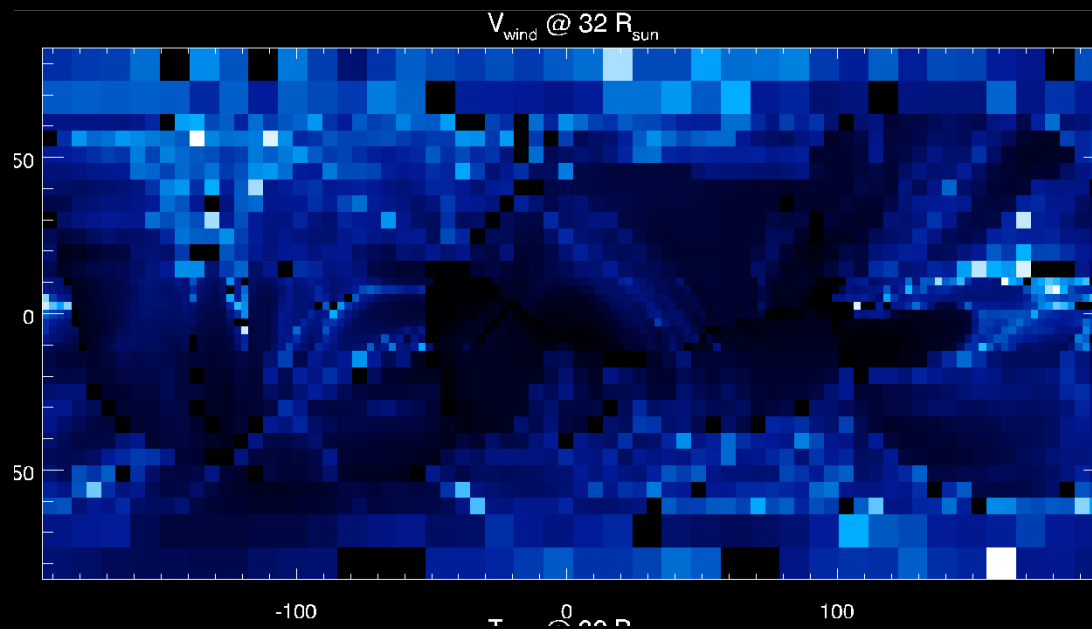




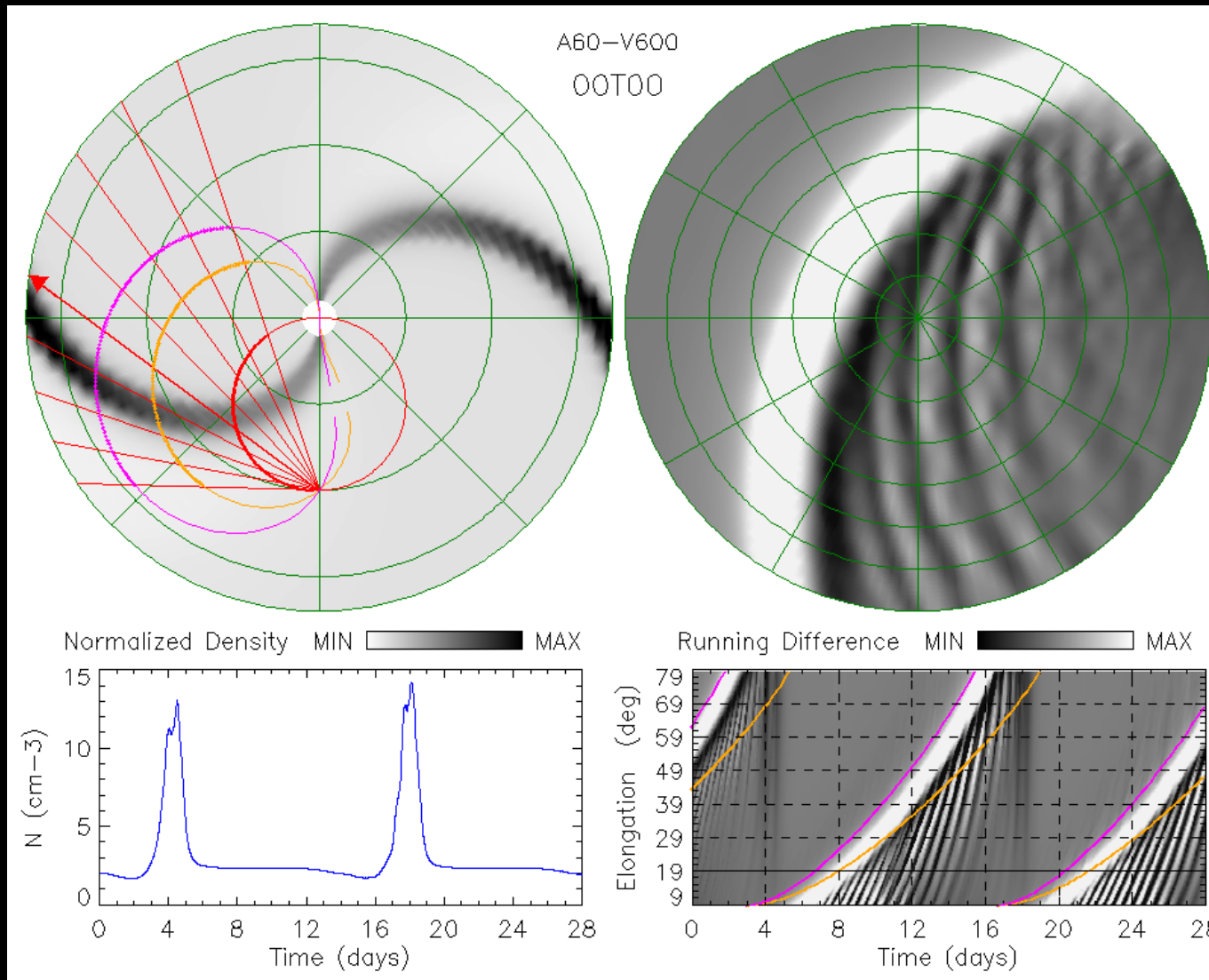
Conditions aux limites dépendentes du temps (cartes magnétiques photosphériques: 24hr cadence temporelle et Wang-Sheeley-Argé)



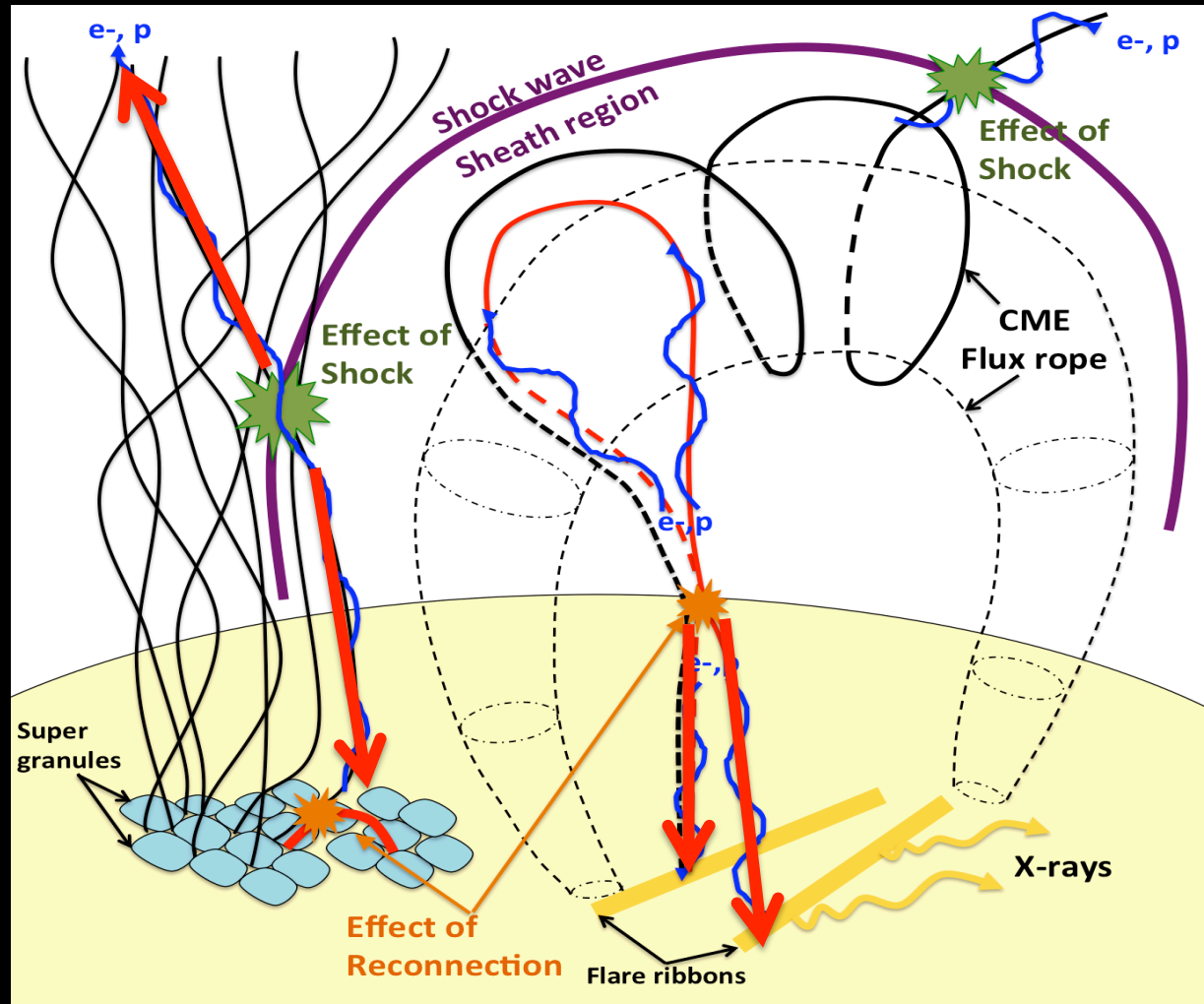
S'agit-il de variations des hauteurs de chauffage sur des échelles de quelques heures?



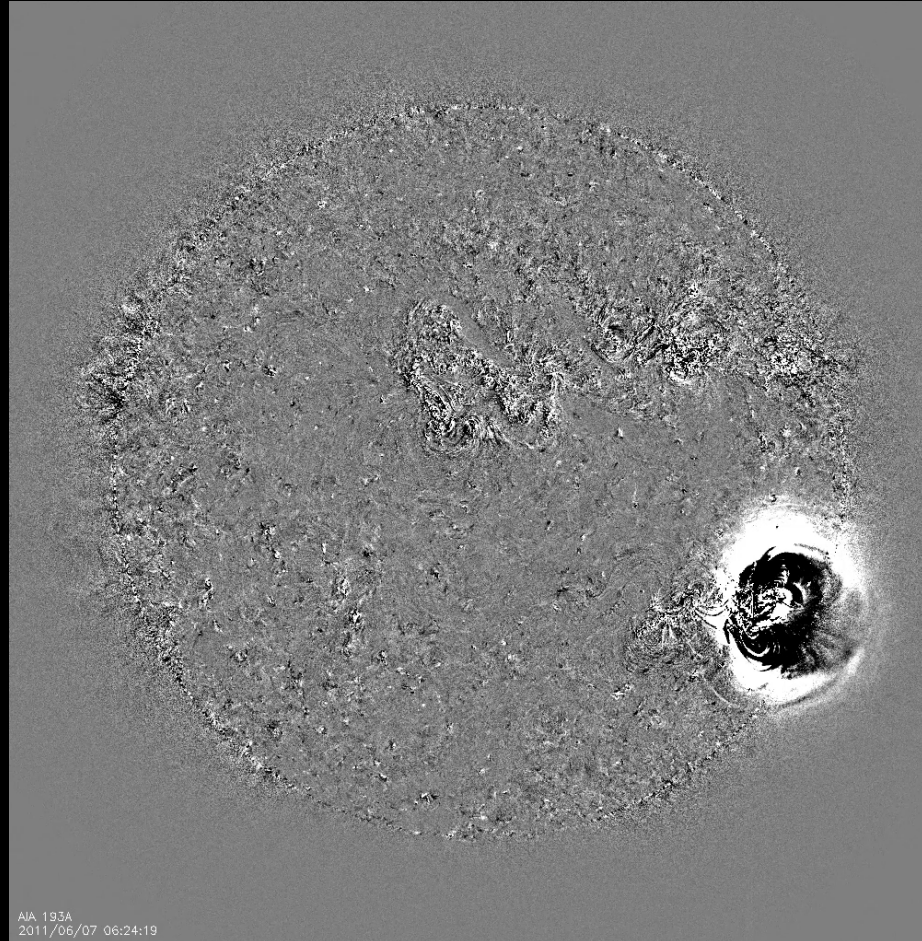
Etude en cours  
Pinto et al.



# Structure 3-D: les chocs coronaux

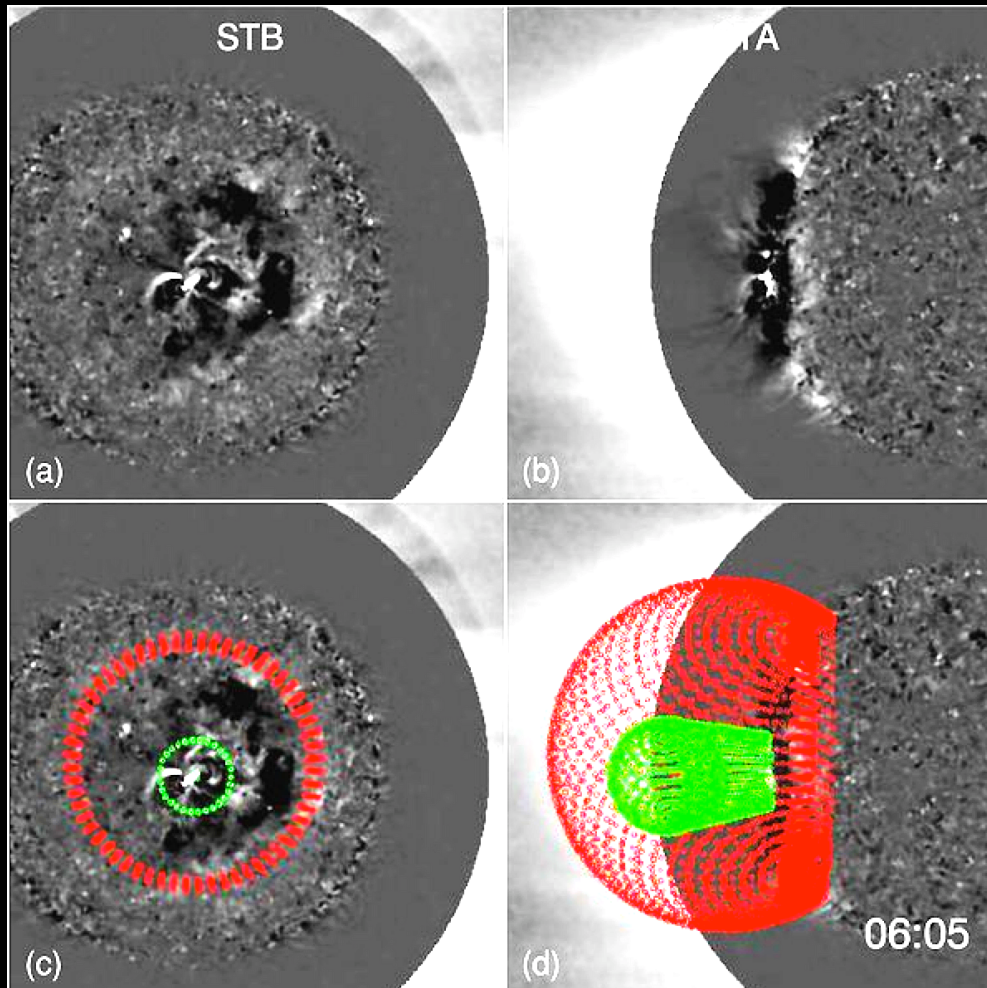




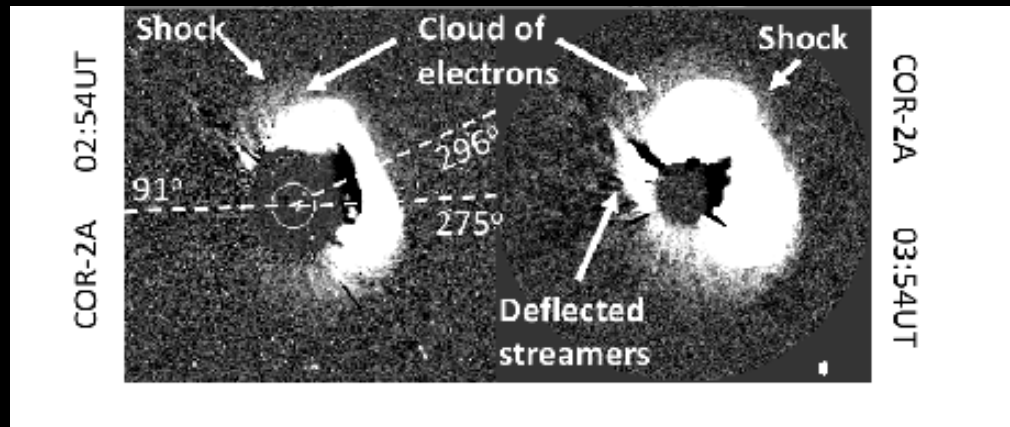
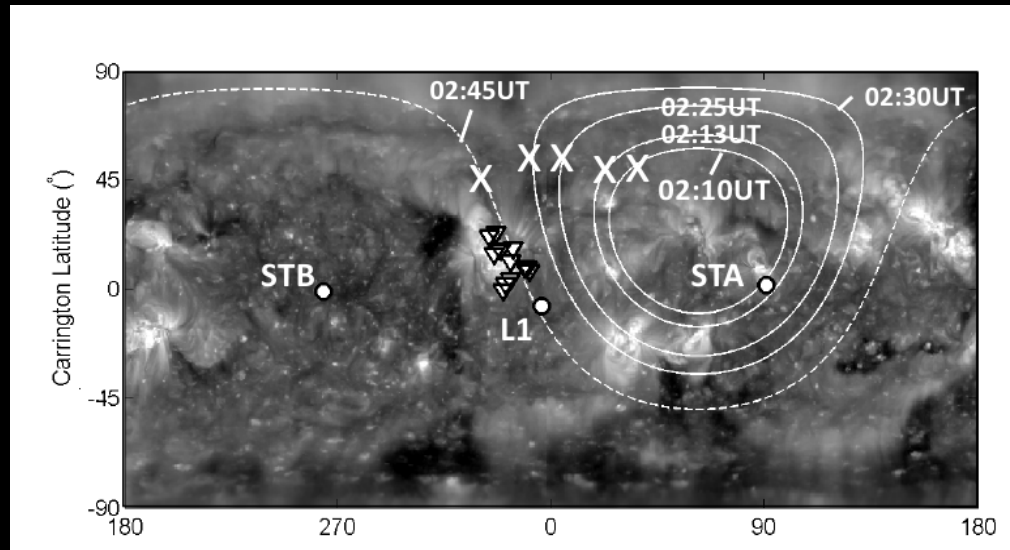
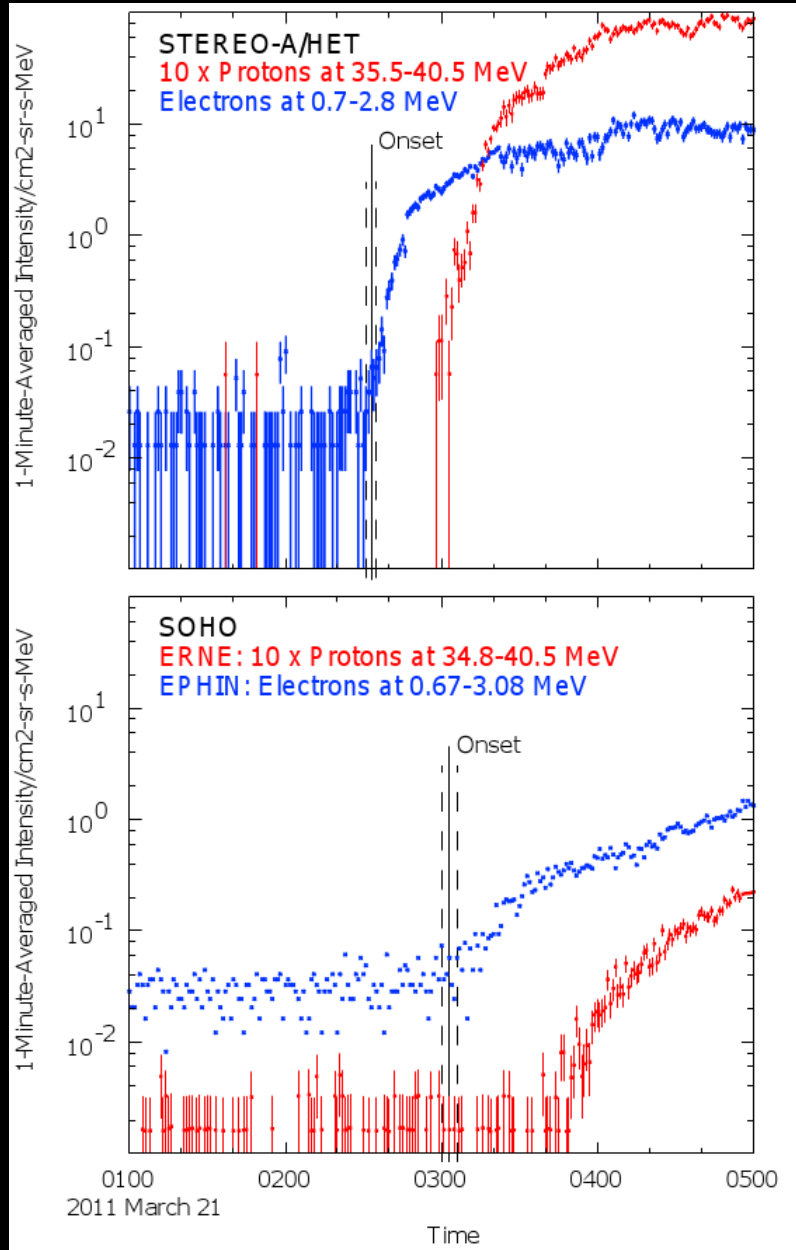


Multi-point and multi-instrumental observations (remote sensing and in situ):

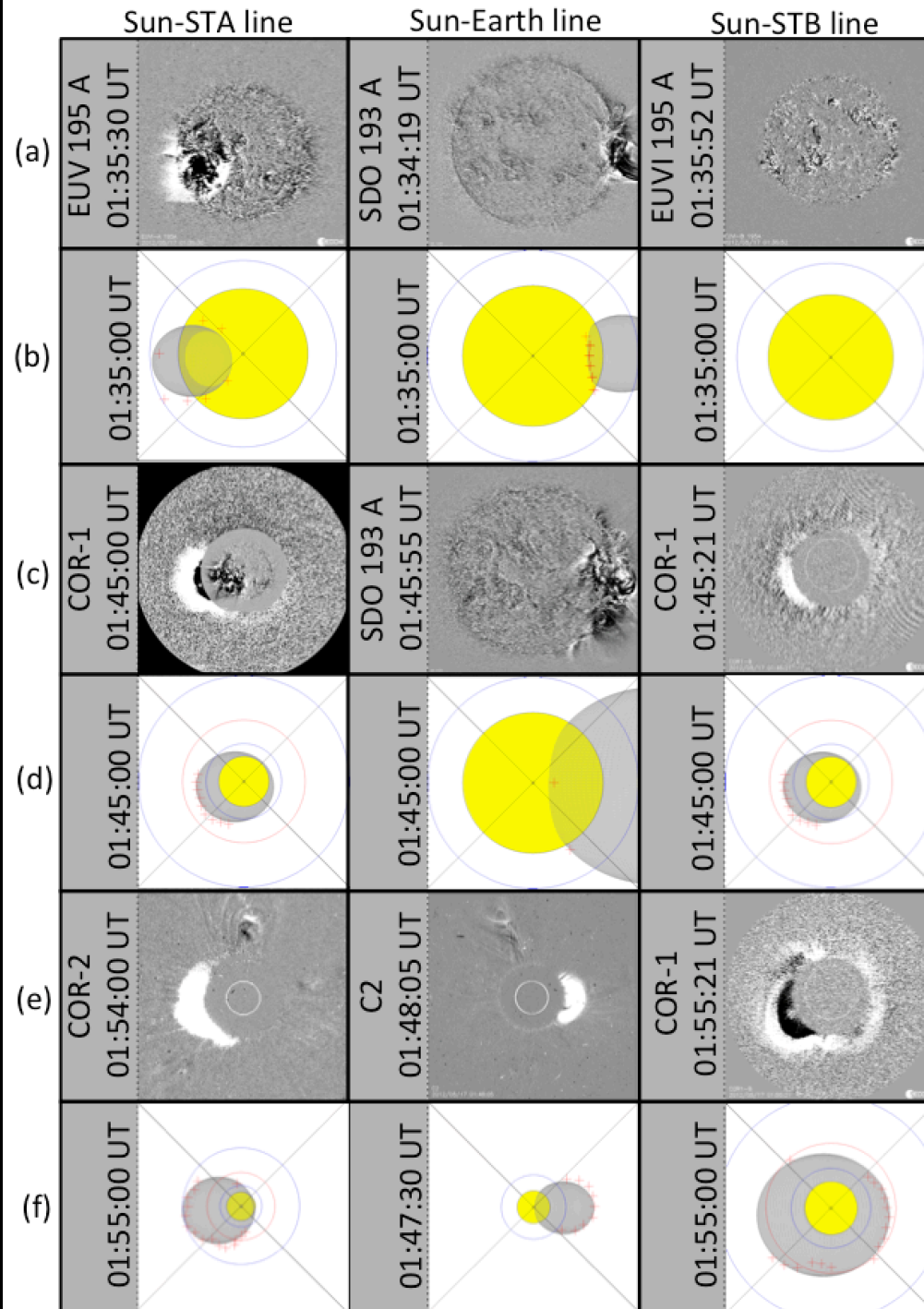
- Can reveal the spatial connection between various structures:

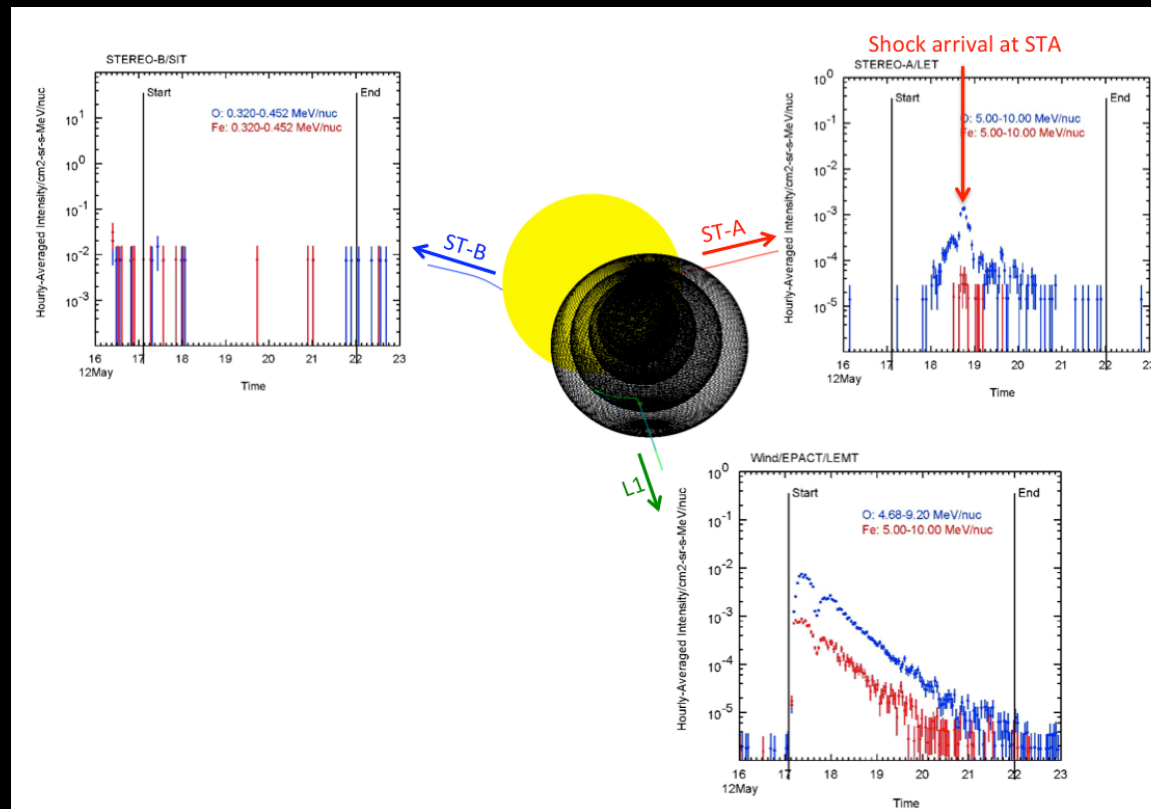


Patsourakos and Vourlidas (2009)

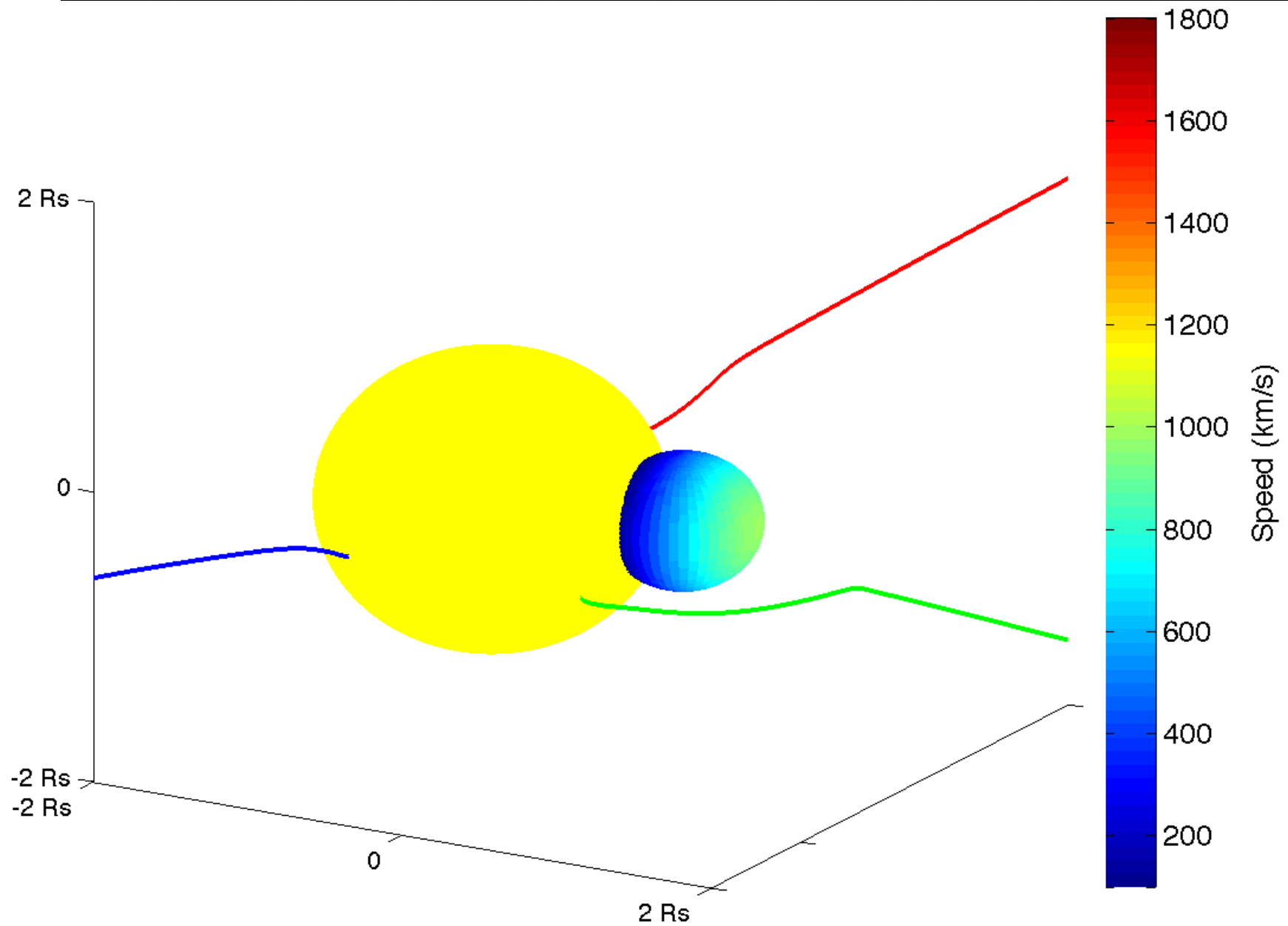


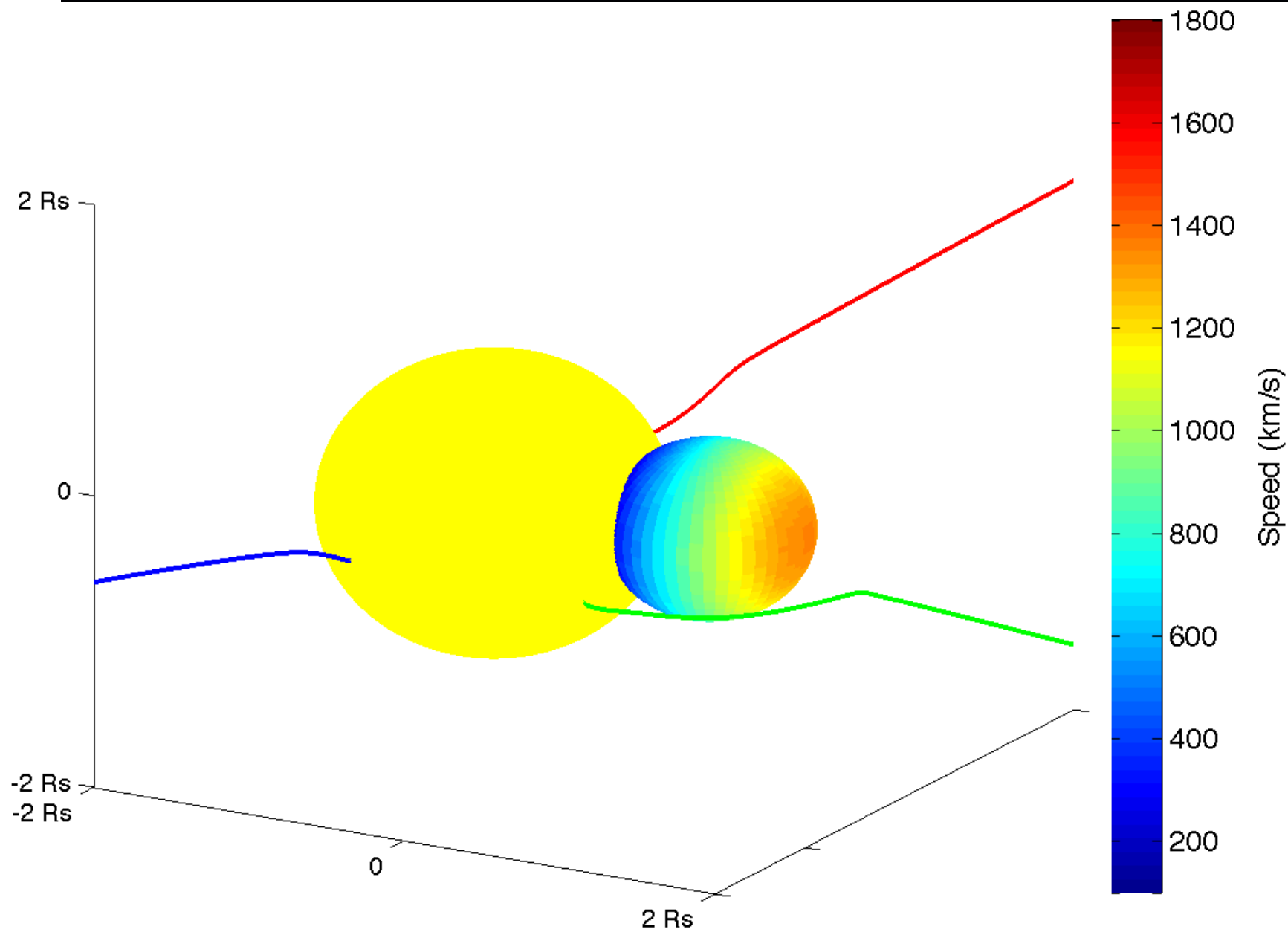


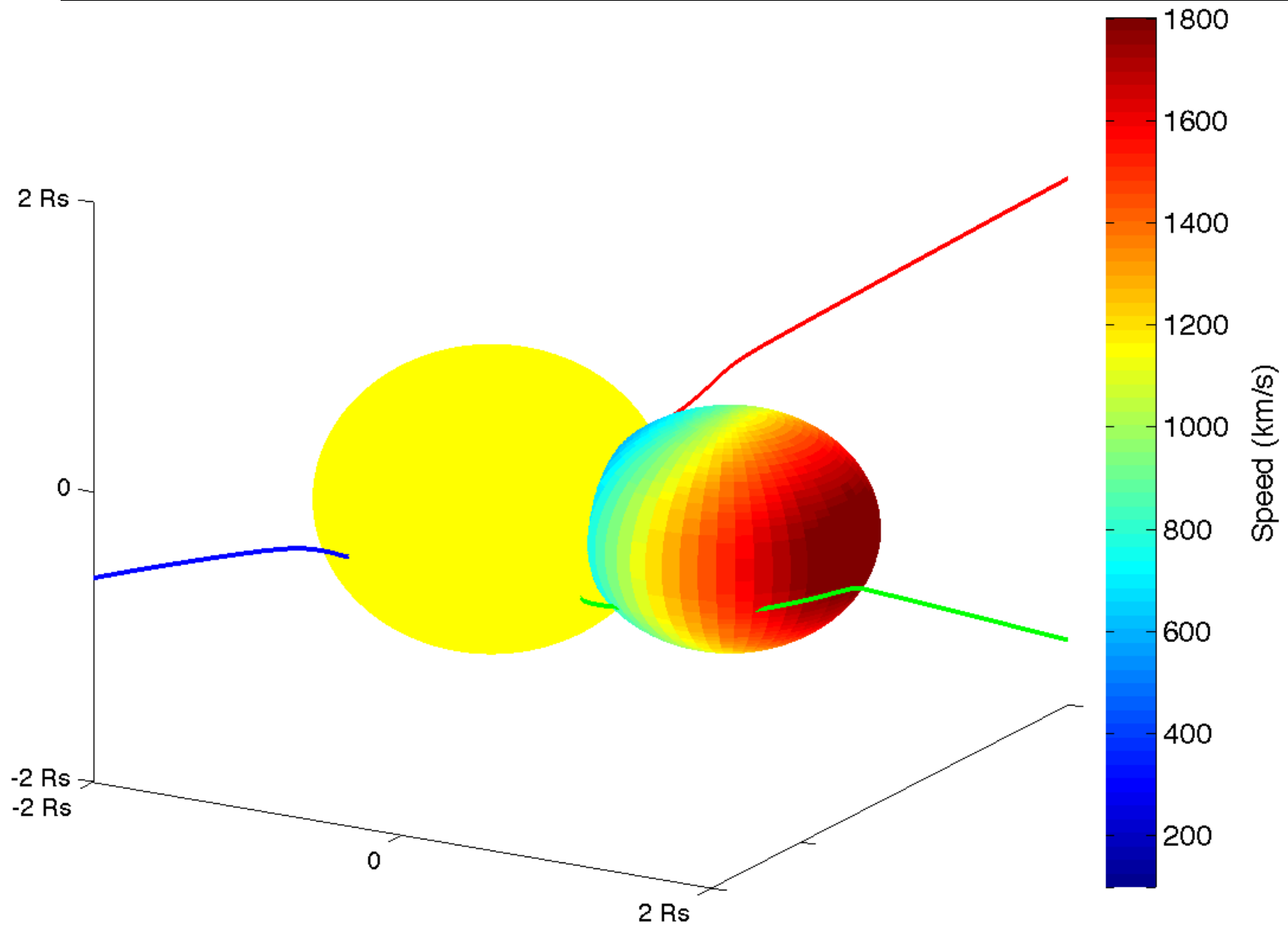


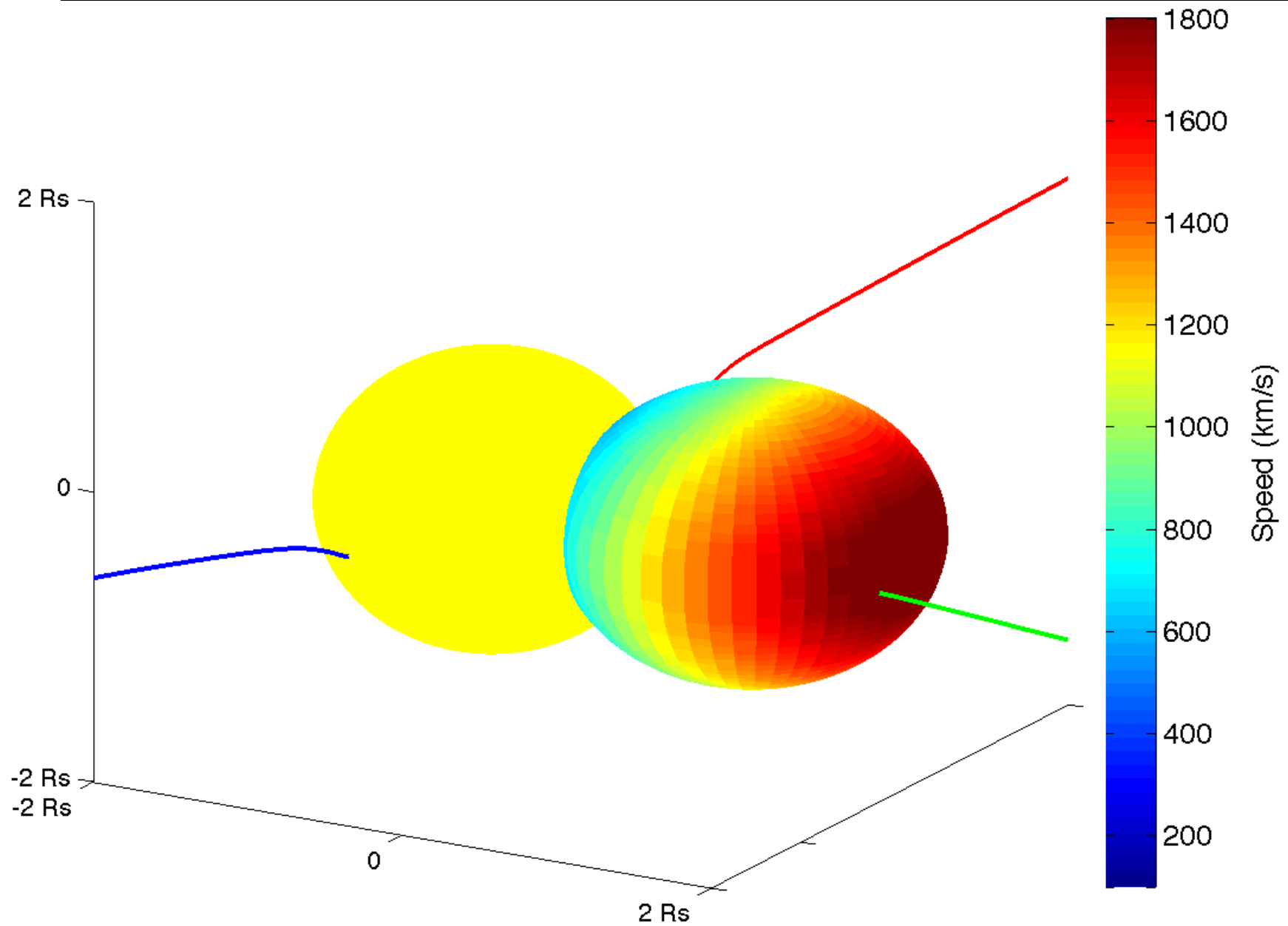


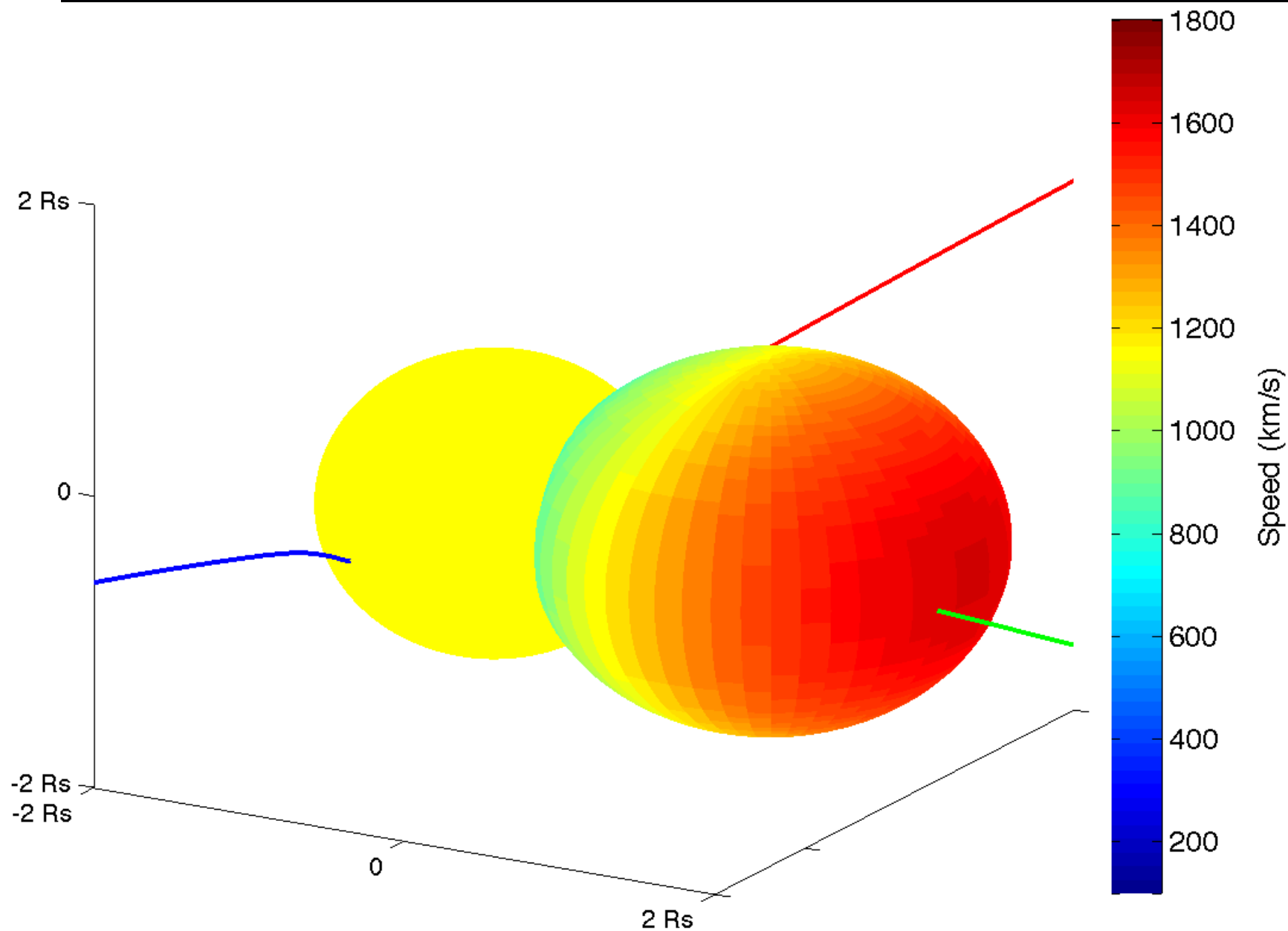


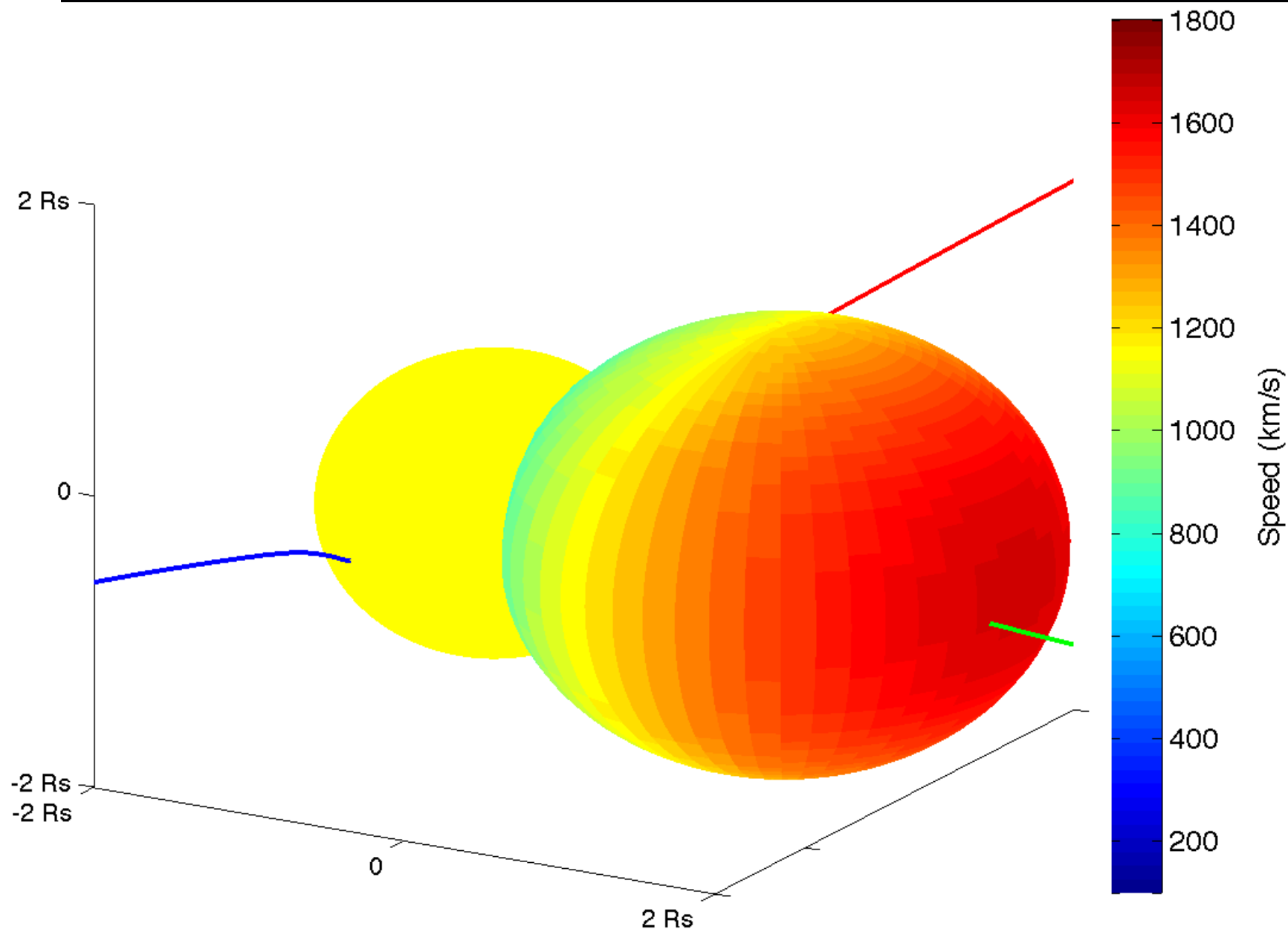




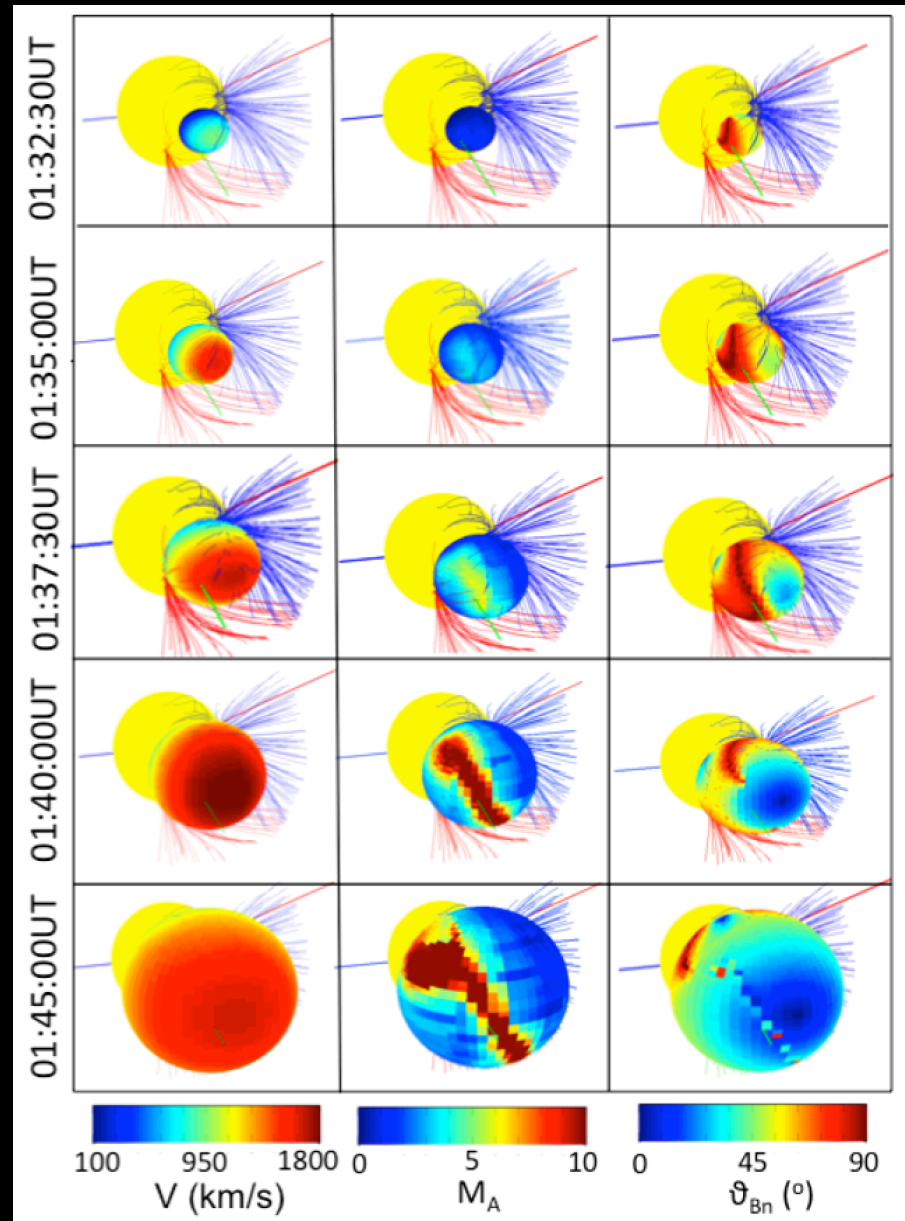




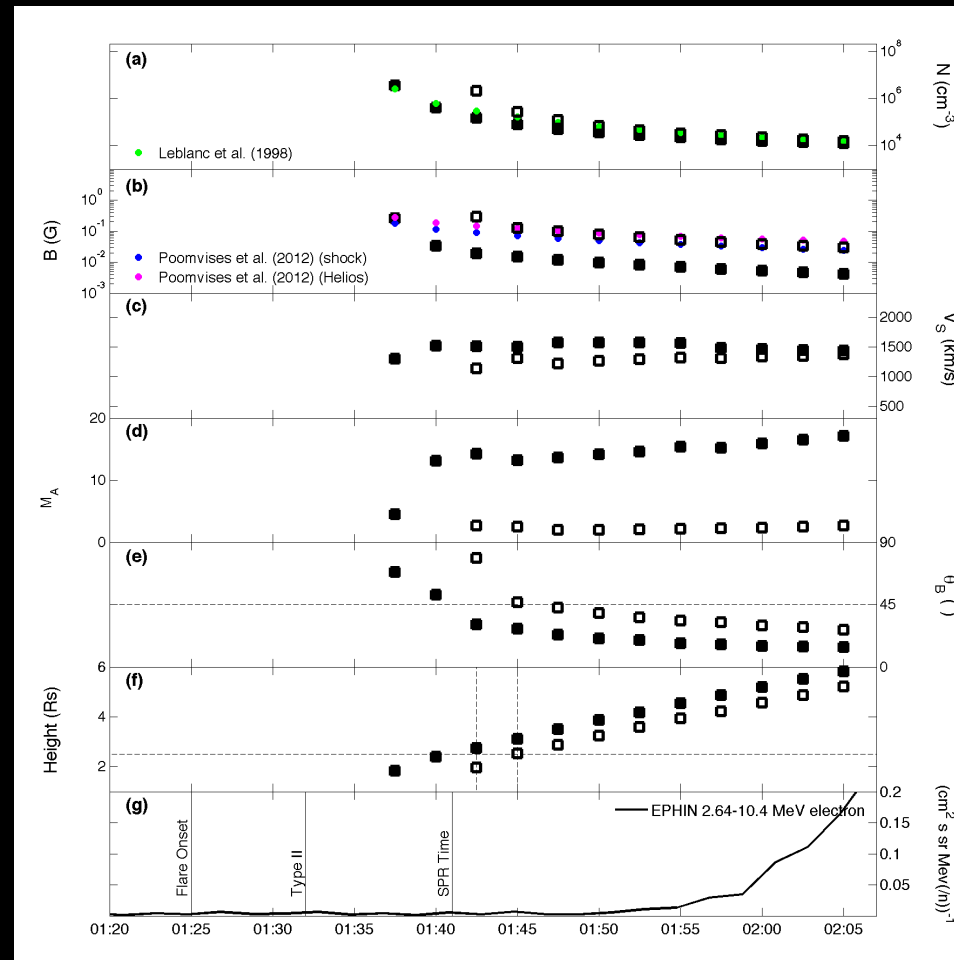




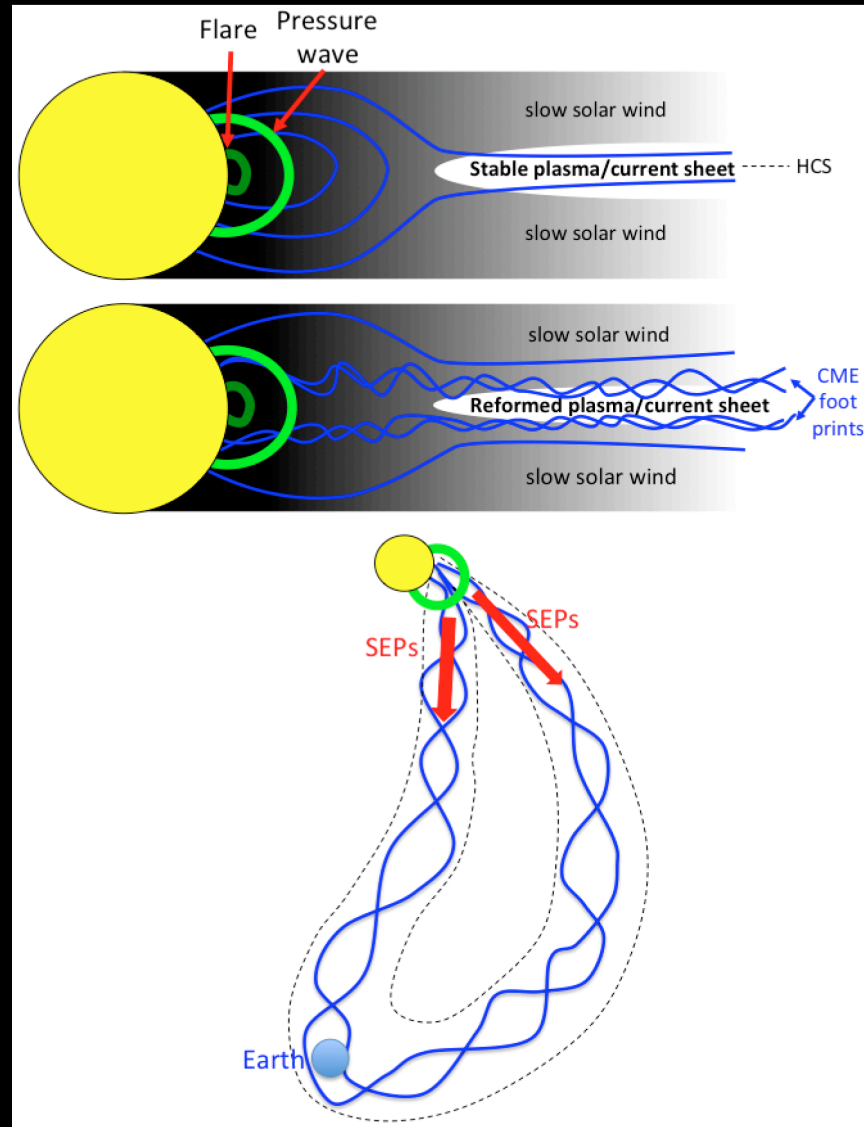


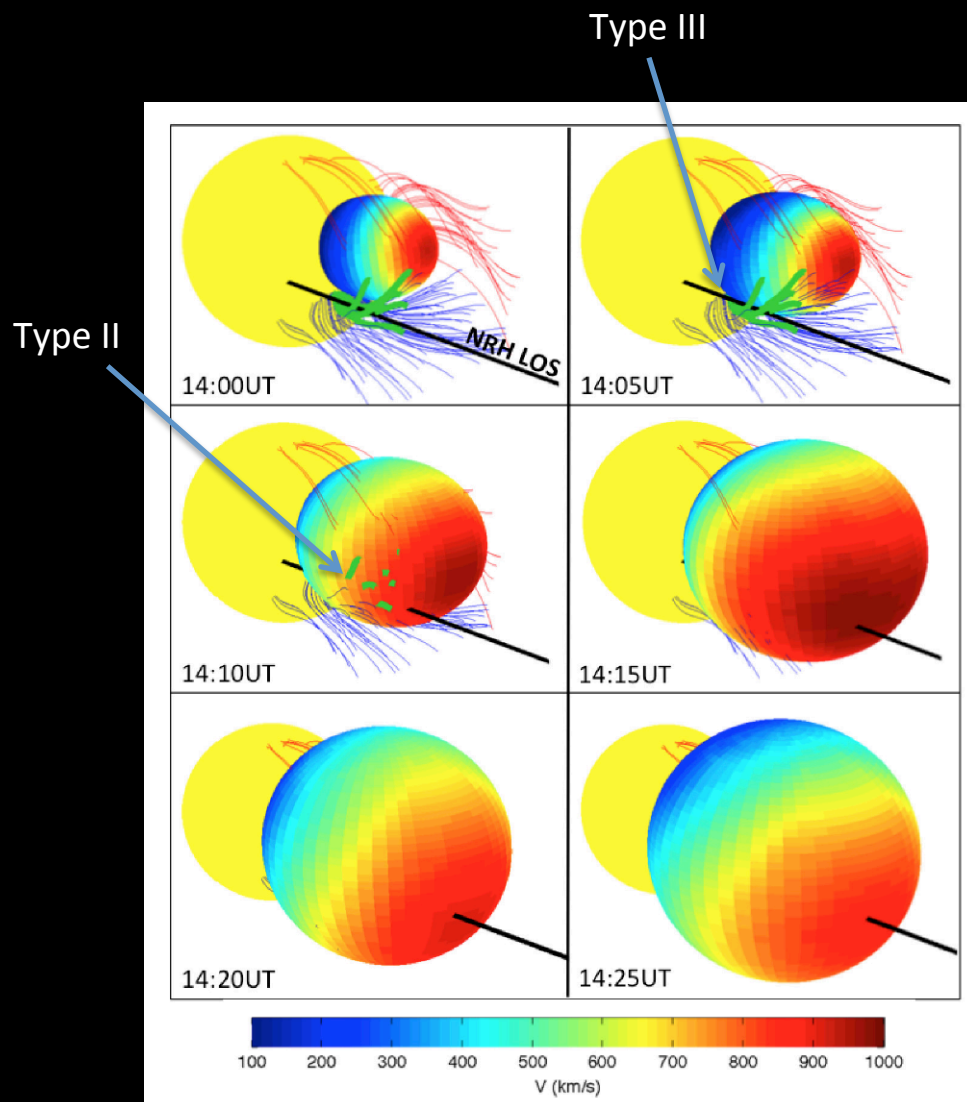


We employ Zucca et al. (2014) technique to derive the coronal density.

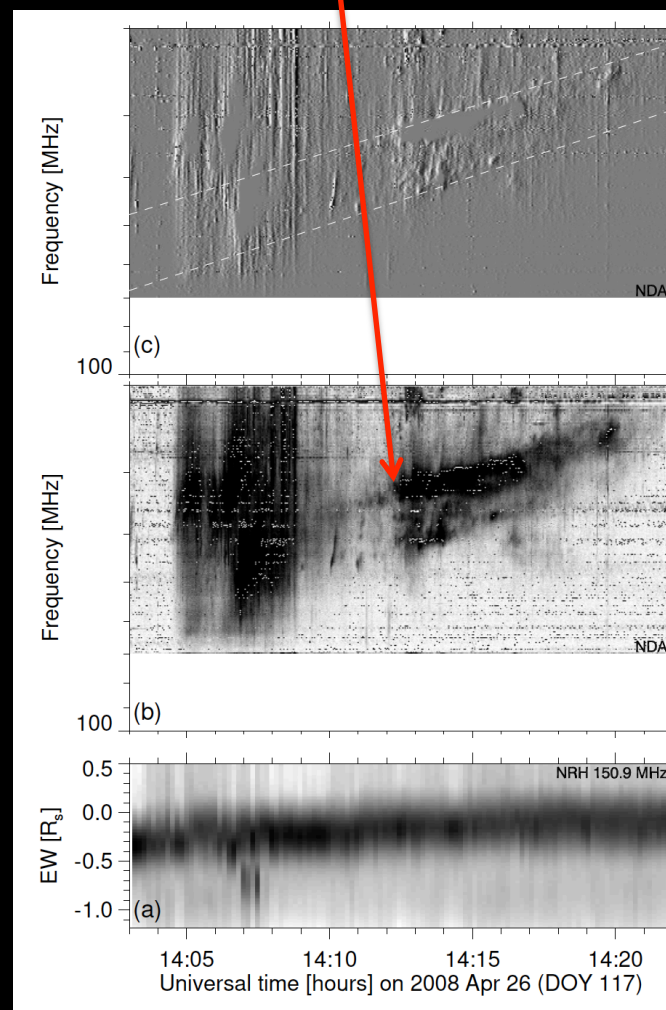


Masson et al. 2011 showed that most GLEs are measured during the passage of a flux rope near 1AU, the 2012 May 17 does too!





The dynamic spectrum shows a regular type II suggesting that the exciter travels along a smooth density gradient.

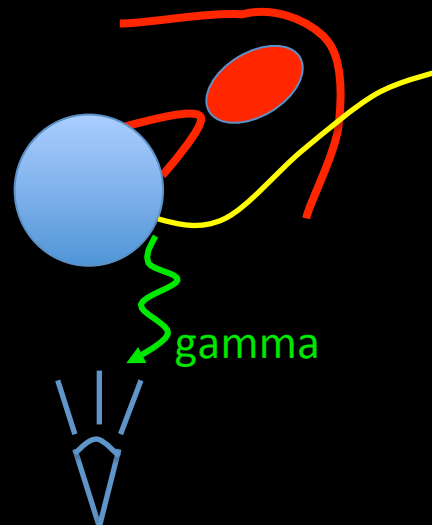
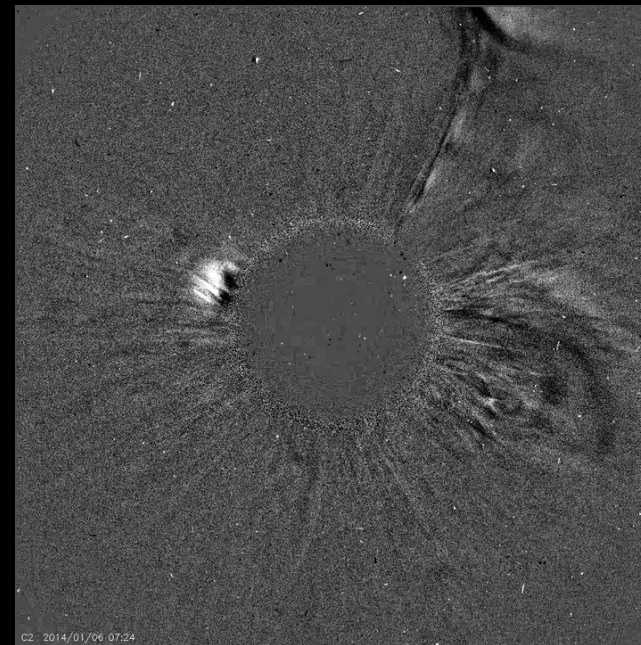
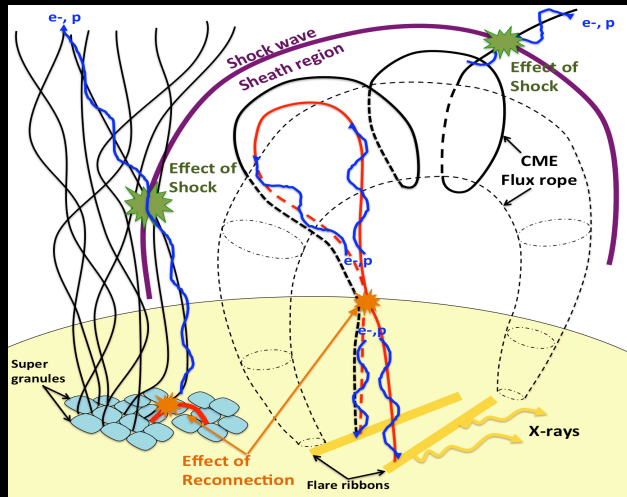


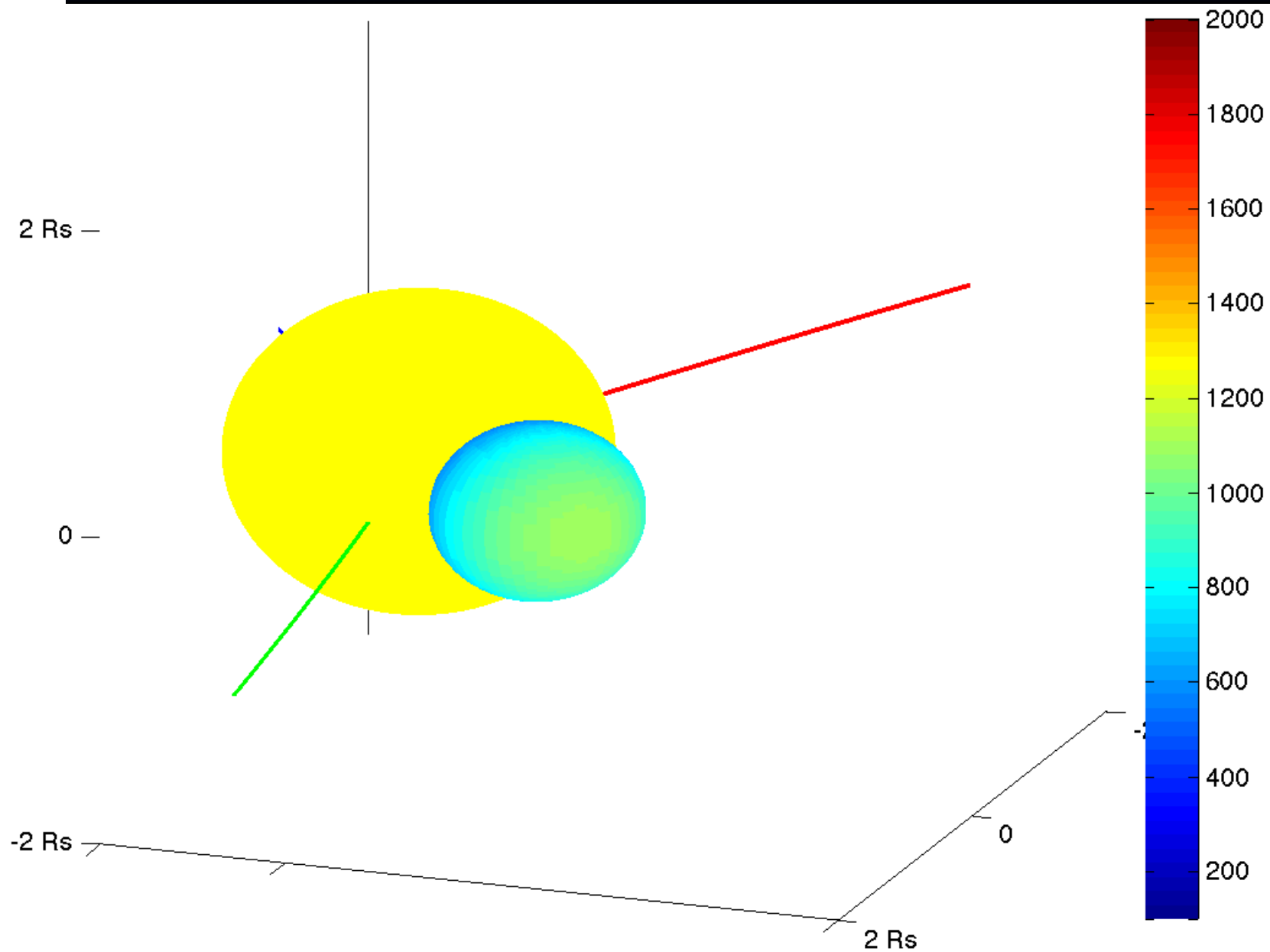
metre-wave radio emission  
Nançay Decameter Array

FERMI LAT observations demonstrated the frequent occurrence Gamma-ray bursts lasting several hours. Their origin is not yet explained >> some events are triggered by CME events erupting on the far side of the Sun, how?

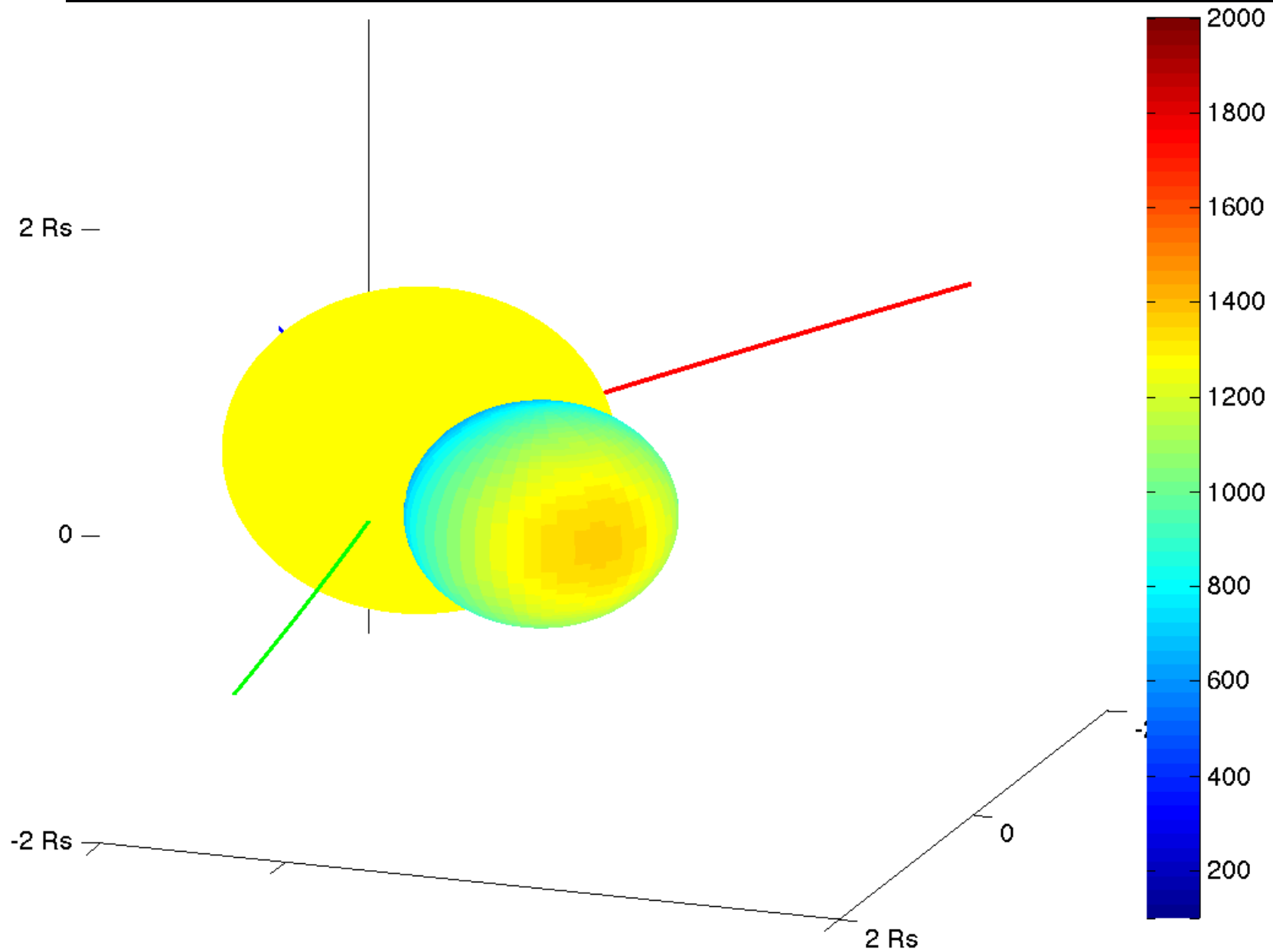
2014 Jan 06 07:40 X3.5 S8W110 (20° behind the limb)

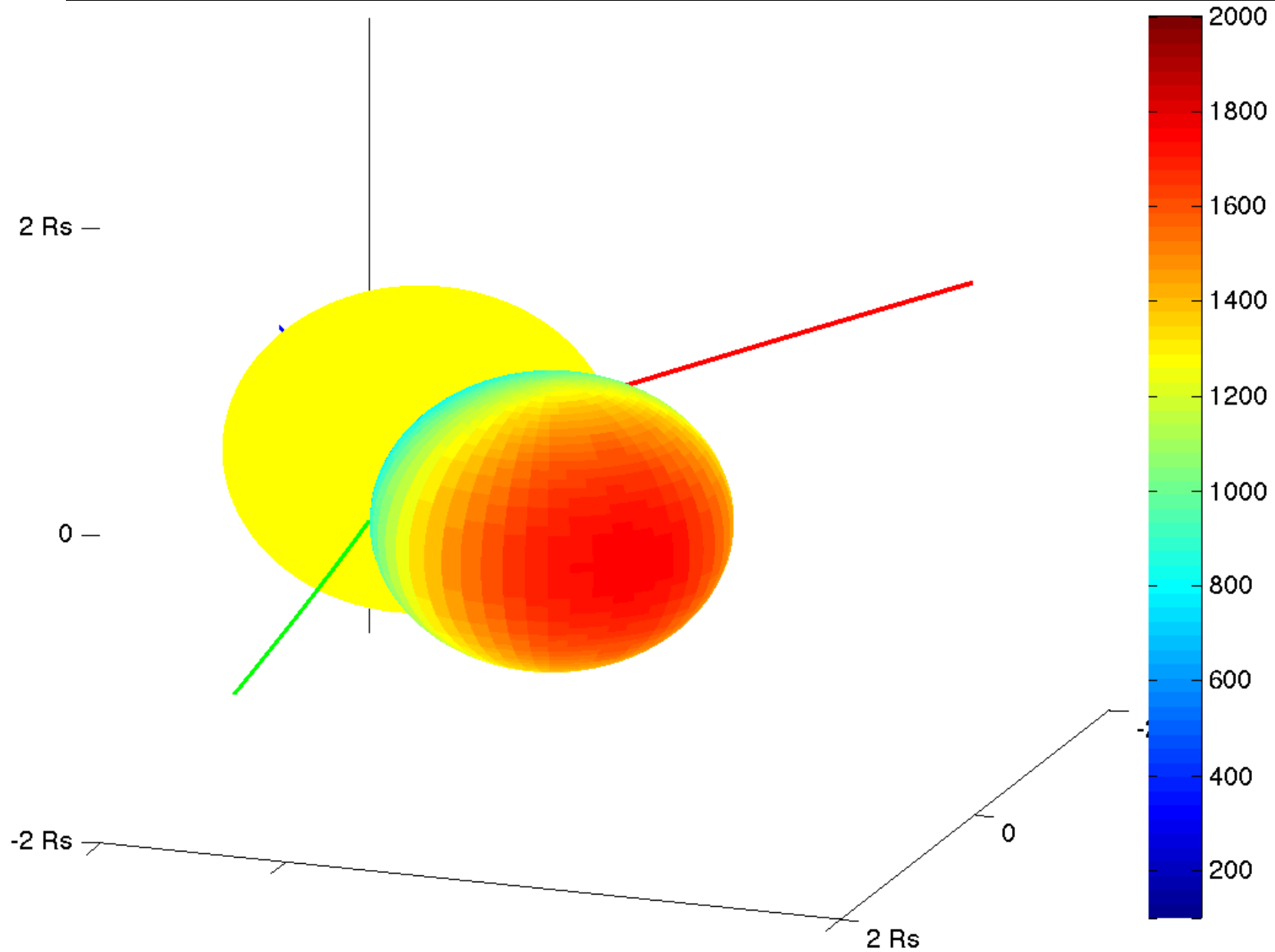
FERMI LAT measured >100MeV for about 20 minutes (Pesce-Rollins et al. 2015)

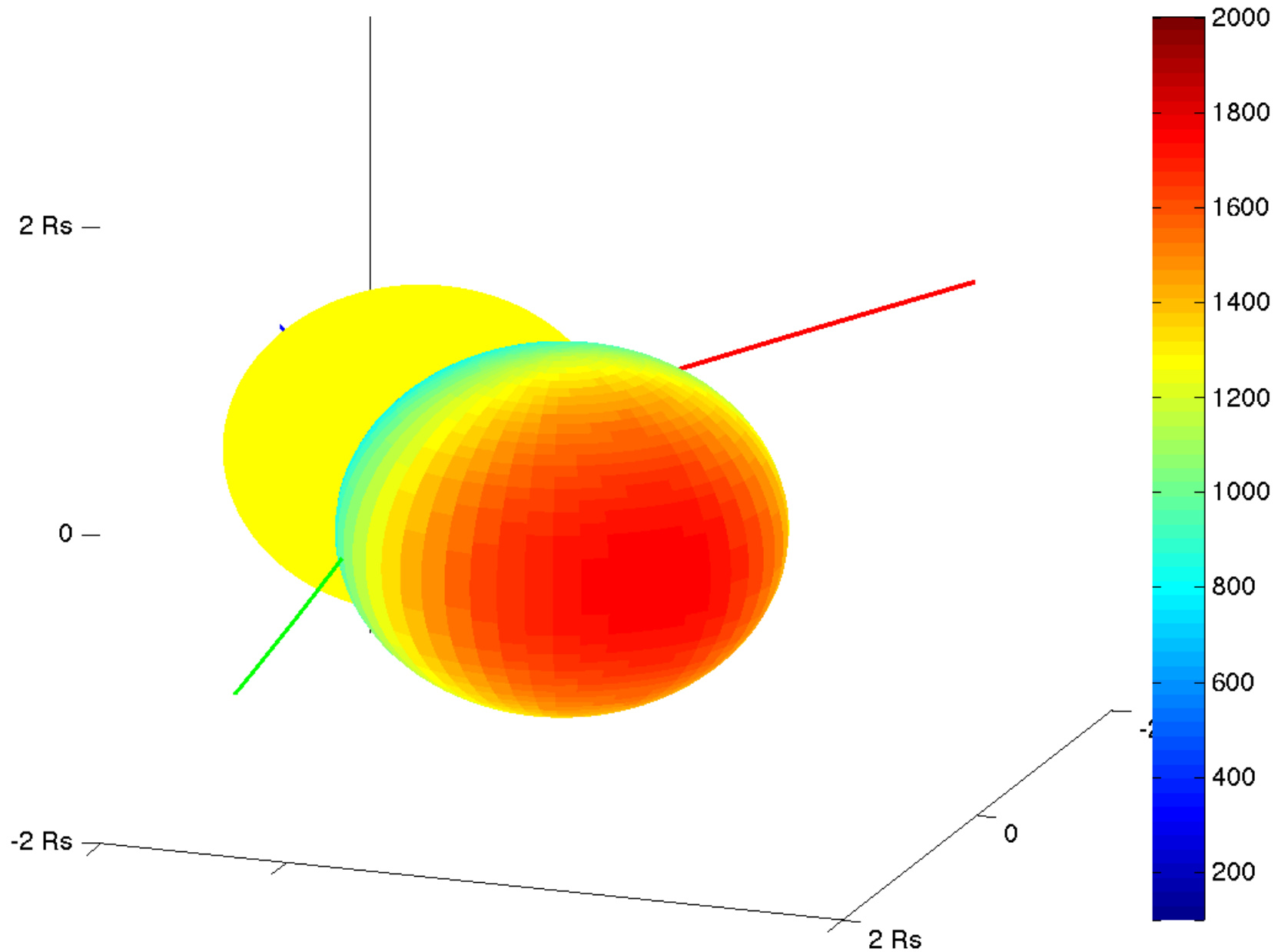


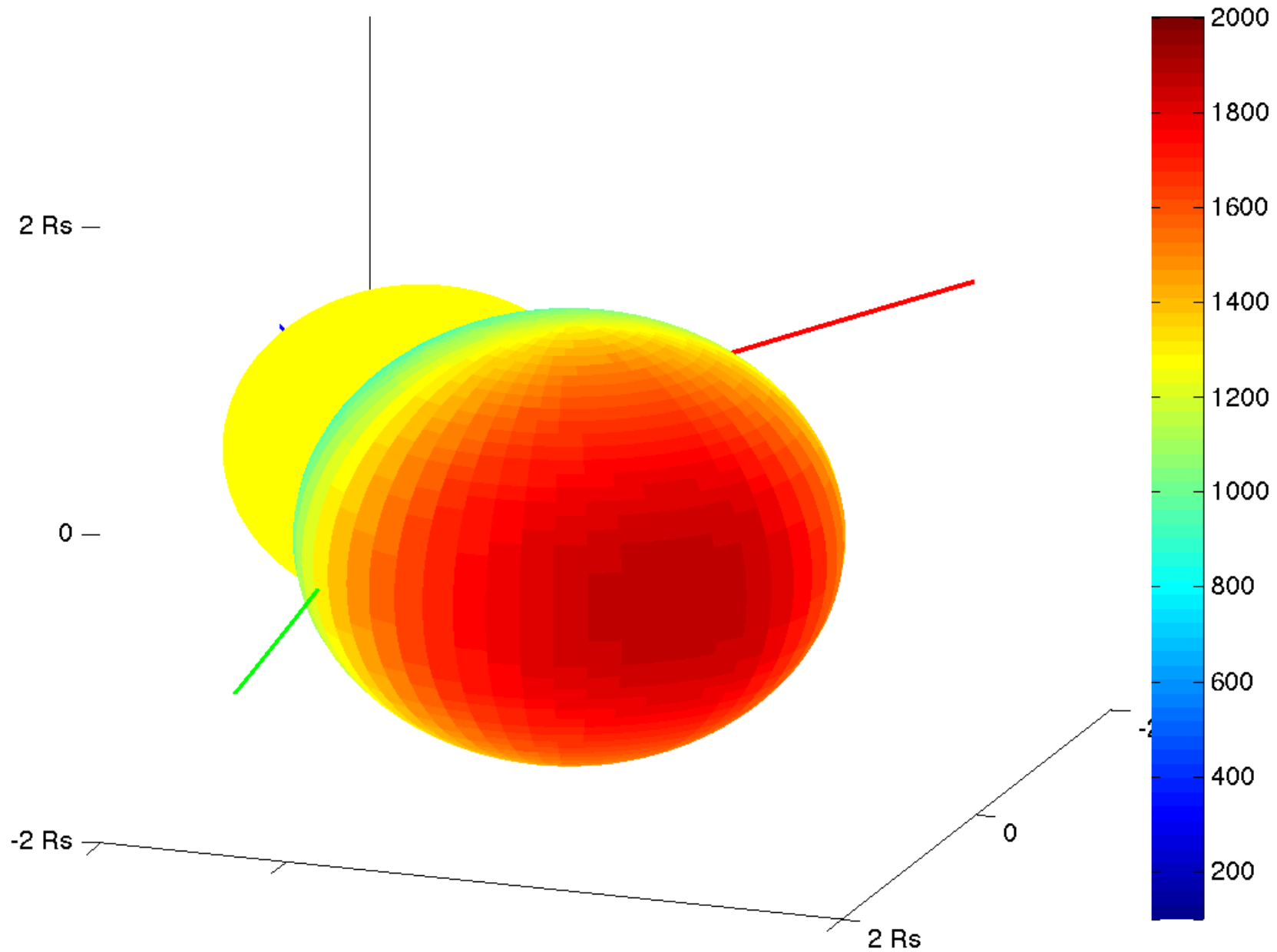




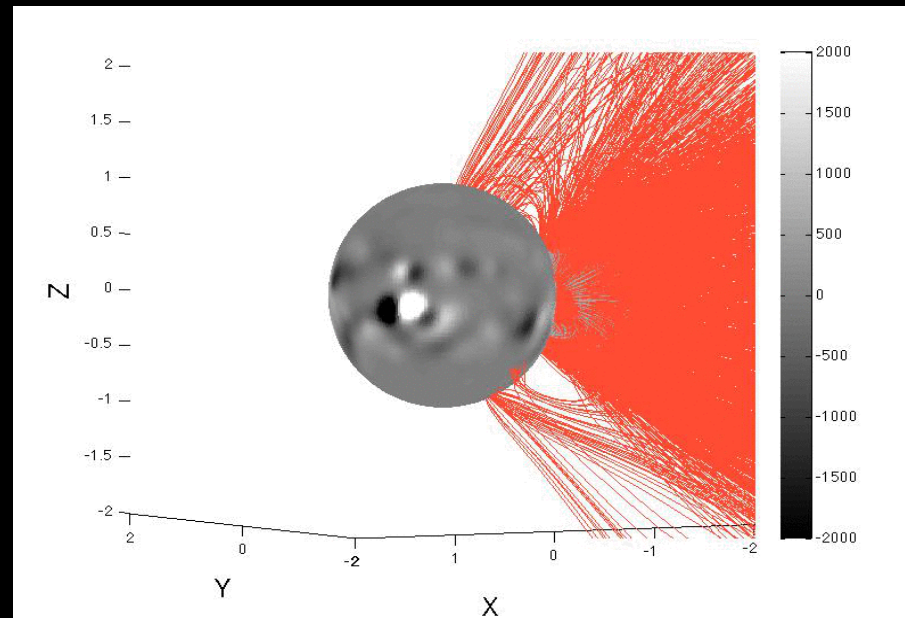






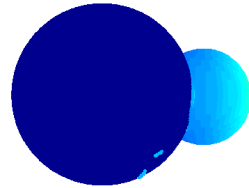


Source region of CME located 20 degrees behind west limb  
FERMI LAT measured  $>100\text{MeV}$  for about 20 minutes.

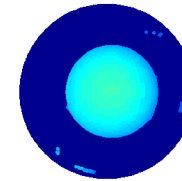




View from Earth

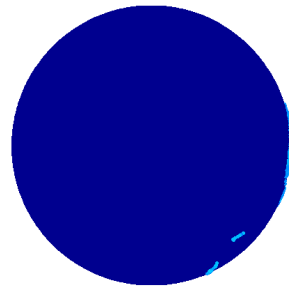


View from CME front

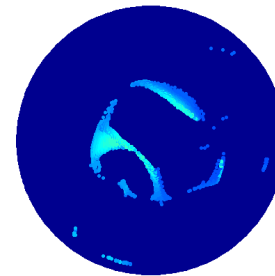


Time 7:47:30

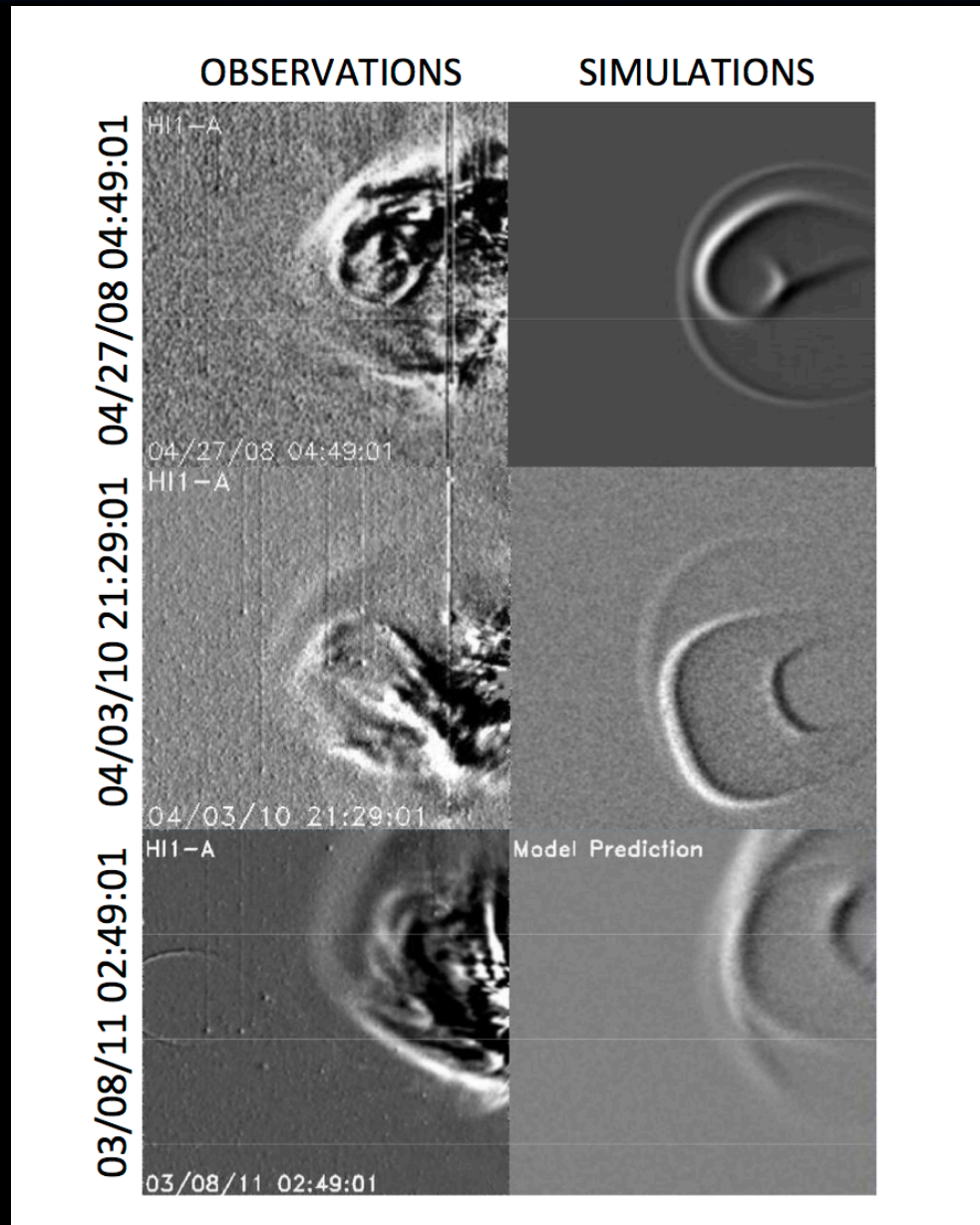
View from Earth



View from CME front

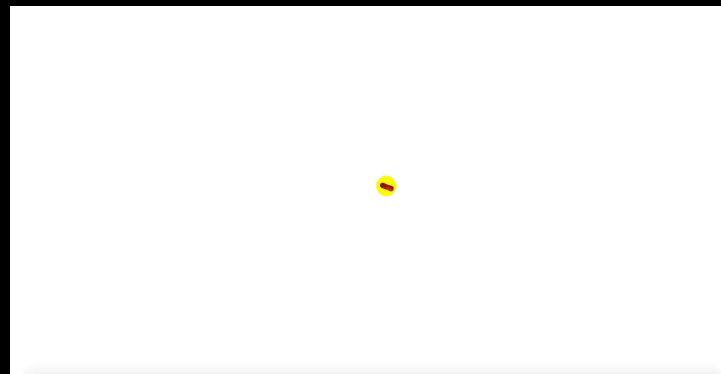
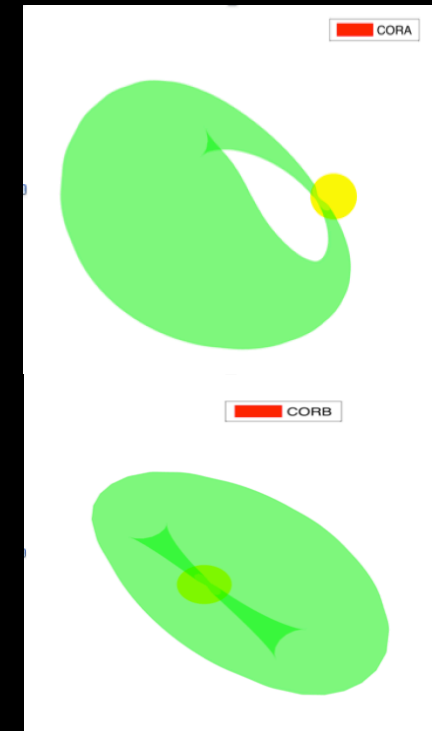
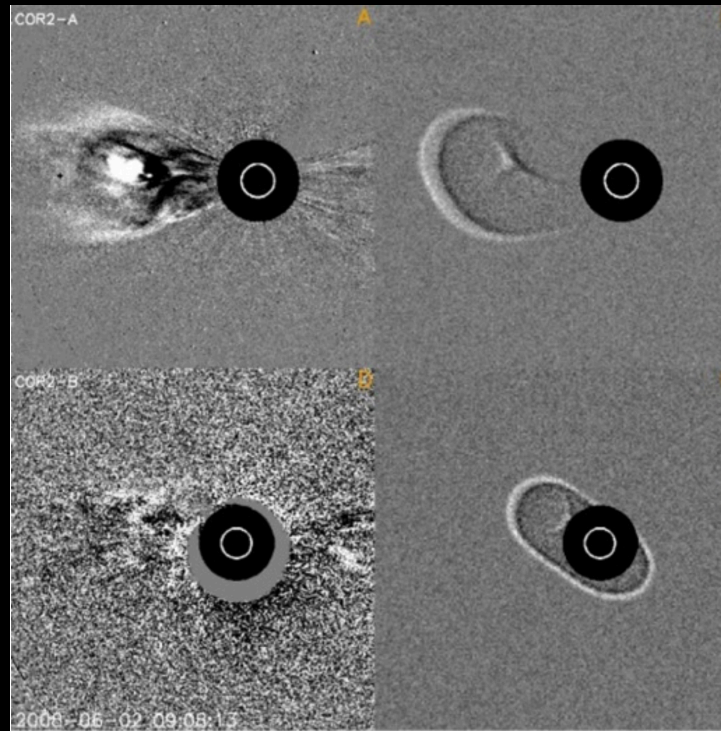
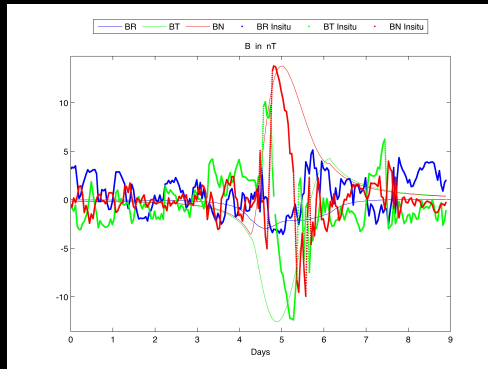


Time 7:47:30

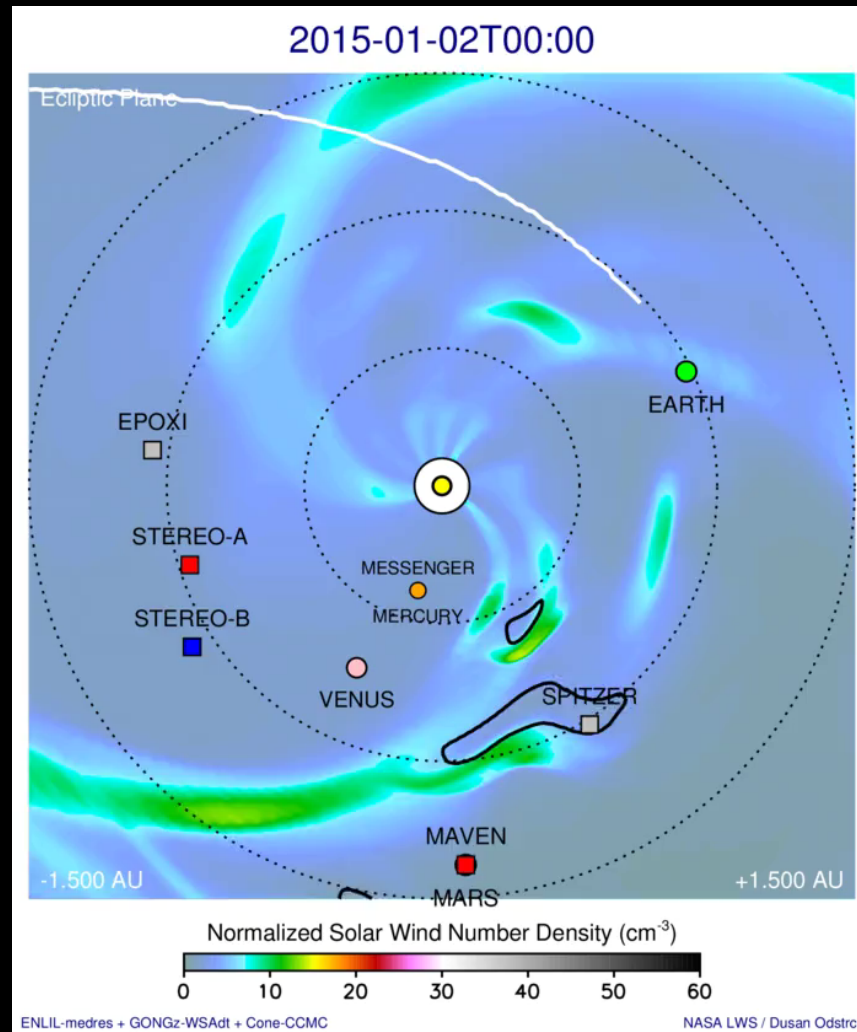


Taken from Wood et al.  
(2008, 2009, 2011)

See Rouillard et al., Living Reviews (2016b)



>> Rouillard et al. (2016c)

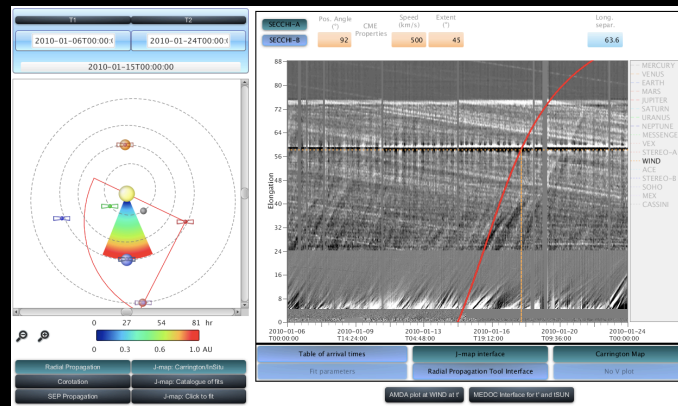
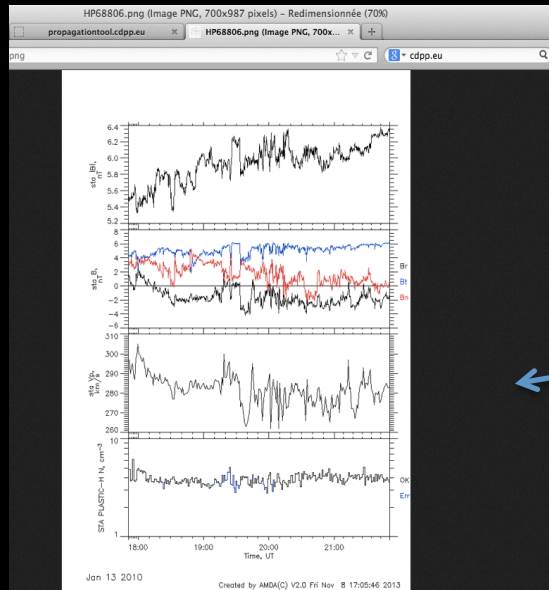


Effort de modélisation MHD vent solaire-CME pour HELCATS >> Pinto

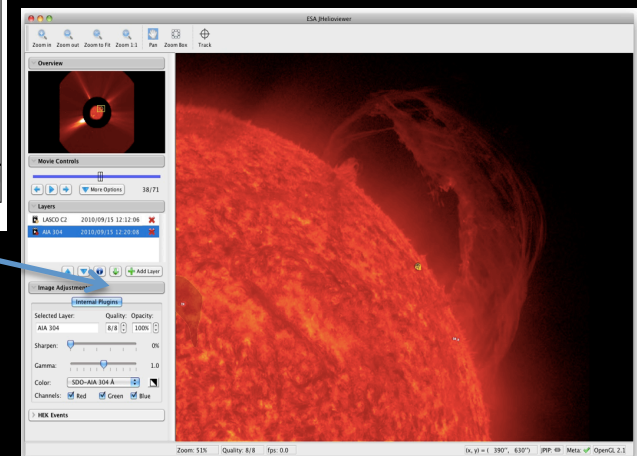


# The link to the French plasma (CDPP) and solar image (MEDOC) data centers is via web-service:

- In situ datasets are accessed in a fixed format via AMDA (CDPP data mining tool),
- Solar (daily) movies are launched in your browser via the MEDOC data center



JHelioviewer



Scene begin = 2019/01/01 00:00:00  
Scene end = 2023/01/01 00:00:00  
Scene time = 2019/01/01 00:00:00  
Frame = J2000  
Center = Sun

