JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

How Can CCMC Support Solar Missions?

Angelos Vourlidas (JHUAPL)

Modeling Support for STEREO

- **Support provided by the PSI group under their Co-I contribution to SECCHI and IMPACT (POC: P. Riley).**
  - **http://imhd.net/stereo/home.php**
  - **Funded (Co-Is) but effort constrained within available budget.**
  - **Planned during final launch preps and commissioning phase.**
  - **Evolved as data came in.**

- **Support provided by the GONG consortium (POC: G. Petrie)**
  - **http://gong.nso.edu/data/magmap/archive.html**
  - **On best effort basis.**

- **Support provided by CCMC (POC: M. Kuznetsova)**
  - **http://ccmc.gsfc.nasa.gov/stereo_support.php**
  - **Funding constraints → reduced scope.**

SOLAR TERRESTRIAL RELATIONS OBSERVATORY

PREDICTIVE SCIENCE MODELING SUPPORT FOR *SECCHI* AND *IMPACT*

DISCLAIMER: THIS IS A BETA VERSION OF THE SITE THAT MAY CONTAIN INCONSISTENCIES AND ERRORS. THE RESULTS ARE BASED ON A MODEL AND HAVE NOT BEEN VALIDATED. PLEASE CONTACT US BEFORE USING THIS DATA FOR APPLICATIONS WHERE ACCURACY IS IMPC

MAIN
- Home
- Predictive Science

IMPACT
- Spacecraft Mapping
- Time Series Comparisons

SECCHI
- Current Sheet
- Polarization Brightness
- Polarization Brightness Comparison

EUVI
- Pre-rendered Images
- Interactive View

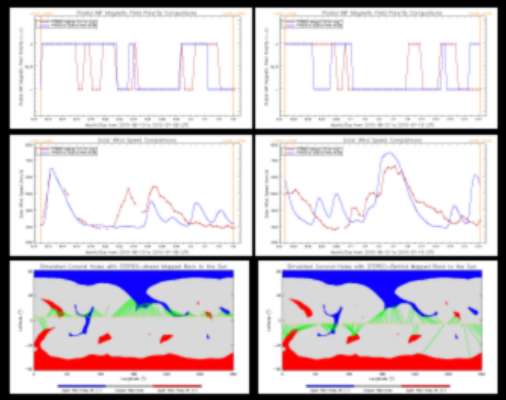
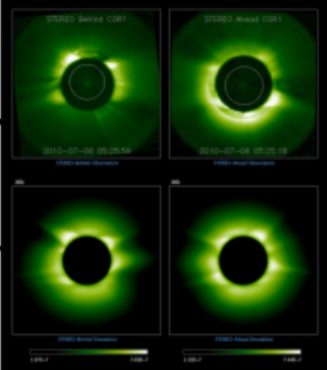
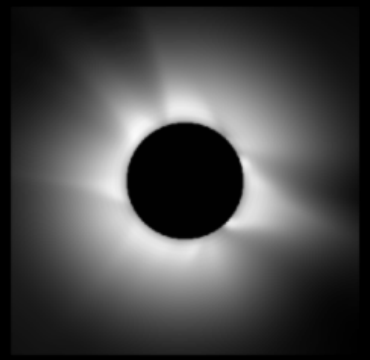
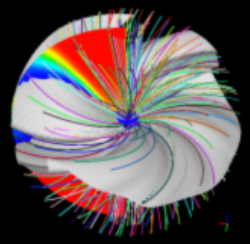
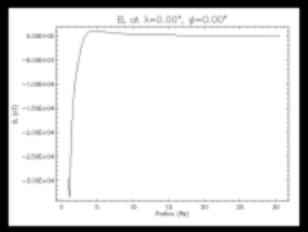
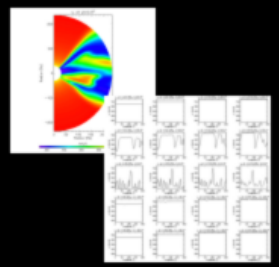
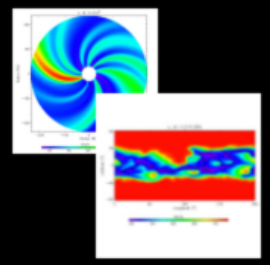
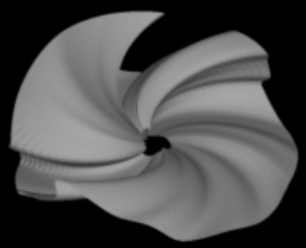
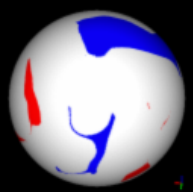
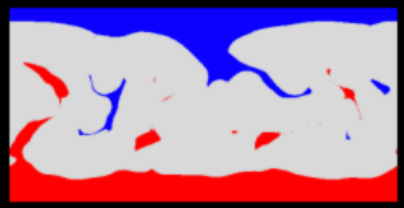
GENERAL TOOLS
- 1D Plot
- 2D Plot
- Field Lines Plot
- Coronal Hole Map
- Summary Plots
- Data Access

HELP
- Overview
- Contact Us

MODELING SITES
- HMI
- MHDweb

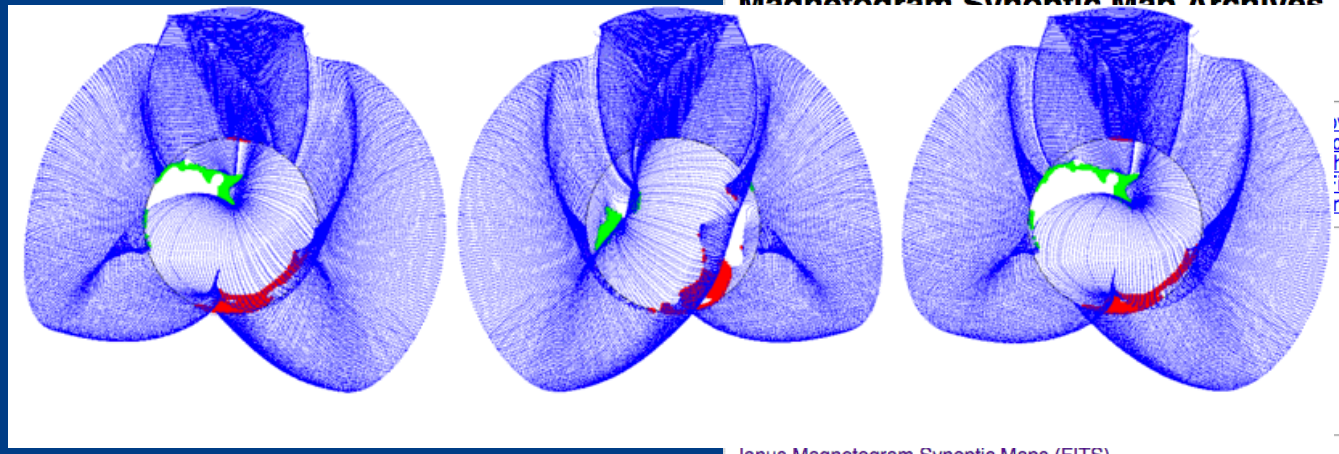
EXTERNAL RESOURCES
- STEREO
- SECCHI
- IMPACT

Welcome to STEREO modeling website developed by Predictive Science. On this site, you can visualize, analyze, and even download global MHD simulation results of the solar corona and inner heliosphere for the period coinciding with the STEREO mission. You can also compare our model results with measurements taken by the SECCHI and IMPACT instruments on board STEREO.


GONG STEREO Page

http://gong.nso.edu/data/magmap/archive.html



NSO/GONG

Magnetogram Synoptic Map Archives

vies | GONG Full Disk Images
cal Harmonic Transform Coefficients
herical Harmonic Transform Coefficients
ields
noptic Map Keywords

Janus Magnetogram Synoptic Maps (FITS)
Janus Magnetogram Synoptic Maps (JPG)

Models: Synoptic Coronal Hole Plot
Models: Line-Of-Sight Coronal Hole Plot
Models: Synoptic Field Plot
Models: Line-Of-Sight Field Plot
Models: Synoptic Ecliptic-Plane Field Plot
Models: Line-Of-Sight Ecliptic-Plane Field Plot
Models: Top View Ecliptic-Plane Field Plot
Spherical Harmonic Transform Coefficients

Integral Carrington Rotation Magnetogram Synoptic Maps (FITS)
Integral Carrington Rotation Magnetogram Synoptic Maps (JPG)
Integral Models: Synoptic Coronal Hole Plot
Integral Models: Line-Of-Sight Coronal Hole Plot
Integral Models: Synoptic Field Plot
Integral Models: Line-Of-Sight Field Plot
Integral Models: Synoptic Ecliptic-Plane Field Plot
Integral Models: Line-Of-Sight Ecliptic-Plane Field Plot
Integral Models: Top View Ecliptic-Plane Field Plot
Integral Spherical Harmonic Transform Coefficients
Integral Hole Fits
Integral NL.DAT

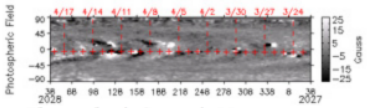
Simulated Line-of-Sight Views from Earth and from NASA's STEREO A & B Spacecraft

Opening & Closing Extrapolated Fields -- After
Opening & Closing Extrapolated Fields -- Before
Opening & Closing Extrapolated Fields, North View, After

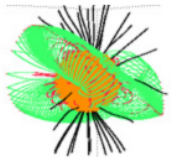
CCMC STEREO PAGE

CCMC STEREO Support

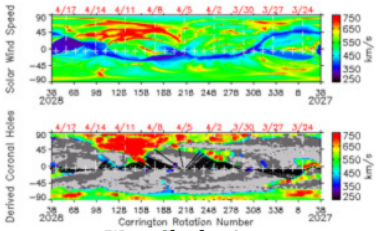
In support of STEREO project, the CCMC is running a series of solar and heliospheric models and saving model input/output on a daily basis.



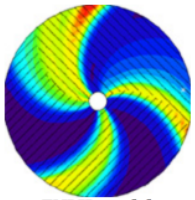
Photospheric Synoptic Magnetogram



Luhmann PFSS model



Wang-Sheeley-Arge
(potential field + current sheet model)



ENLIL model

Run Results by Year and Month:

Year 2018 Year 2017

January | February | March | April

January | February | March | April | May | June | July | August | September | October | November | December

Year 2016

January | February | March | April | May | June | July | August | September | October | November | December

Year 2015

January | February | March | April | May | June | July | August | September | October | November | December

Year 2014

January | February | March | April | May | June | July | August | September | October | November | December

Year 2013

January | February | March | April | May | June | July | August | September | October | November | December

Year 2012

January | February | March | April | May | June | July | August | September | October | November | December

Year 2011

January | February | March | April | May | June | July | August | September | October | November | December

Year 2010

January | February | March | April | May | June | July | August | September | October | November | December

Year 2009

January | February | March | April | May | June | July | August | September | October | November | December

Year 2008

January | February | March | April | May | June | July | August | September | October | November | December

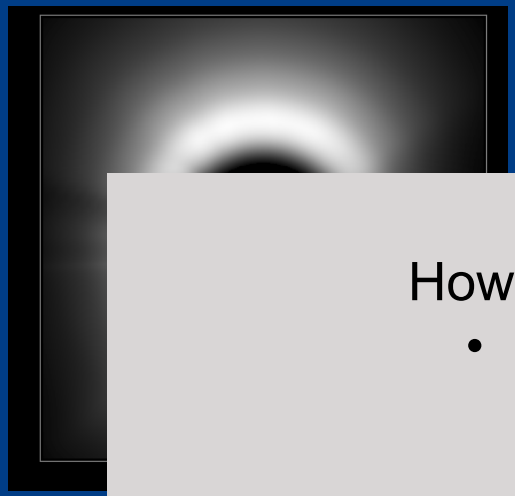
Year 2007

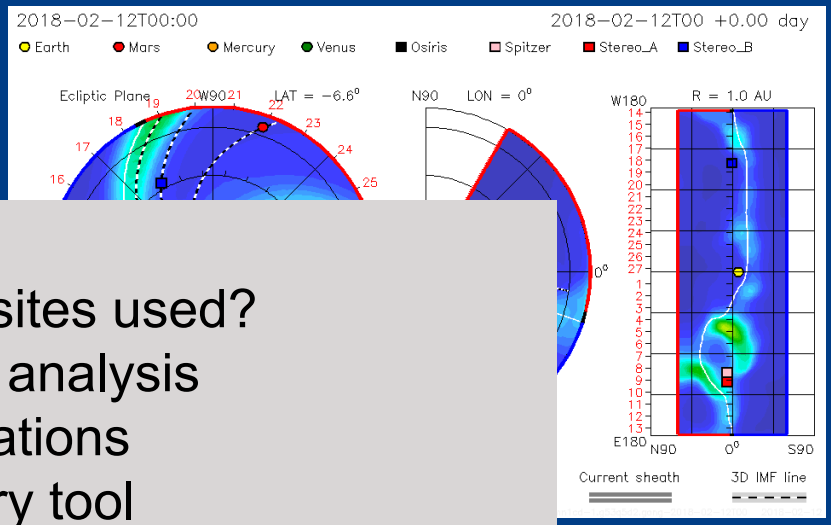
January | February | March | April | May | June | July | August | September | October | November | December

Year 2006

January | February | March | April | May | June | July | August | September | October | November | December

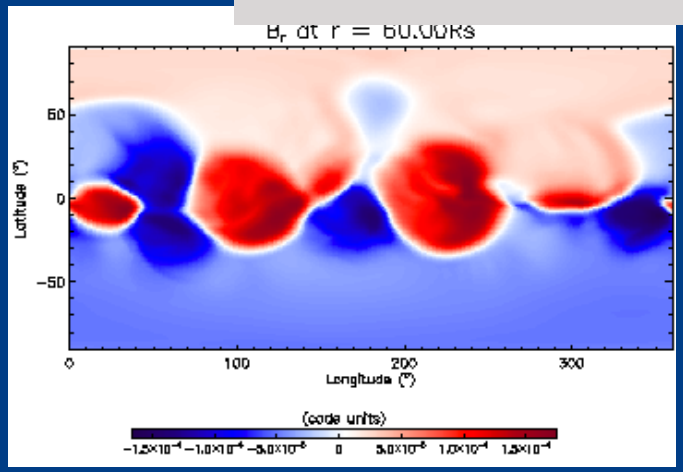
Multiple modeling outputs can fit a variety of mission needs.





How are these sites used?

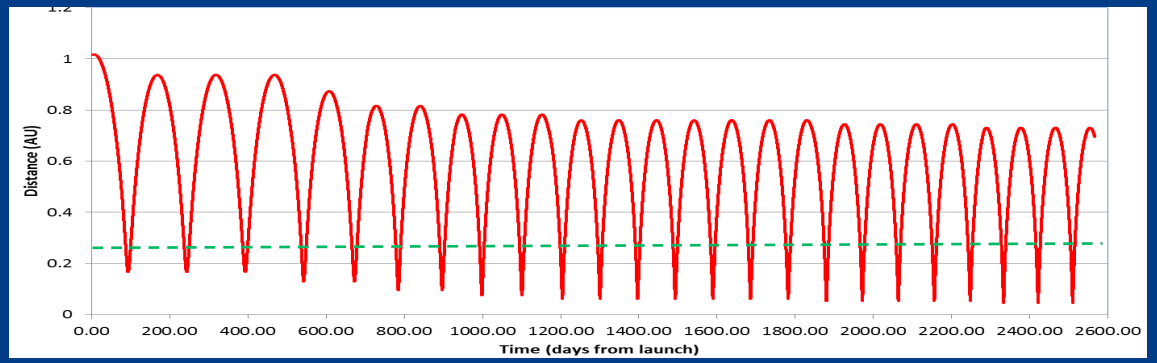
- ”quicklook” analysis
  - Presentations
  - Discovery tool



Coronal Parameters

Coronal Hole Locations

PSP Mission: Launch and Mission Design Overview

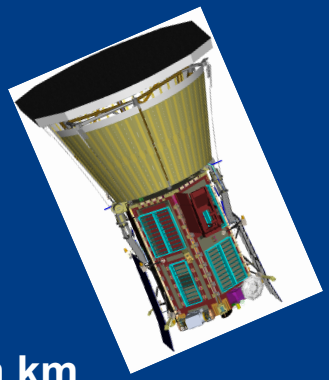


Launch

- Dates: Jul 31 – Aug 19, 2018
- Max. Launch C3: 154 km^2/s^2
- Delta IV-Heavy w/ Upper Stage

Trajectory Design

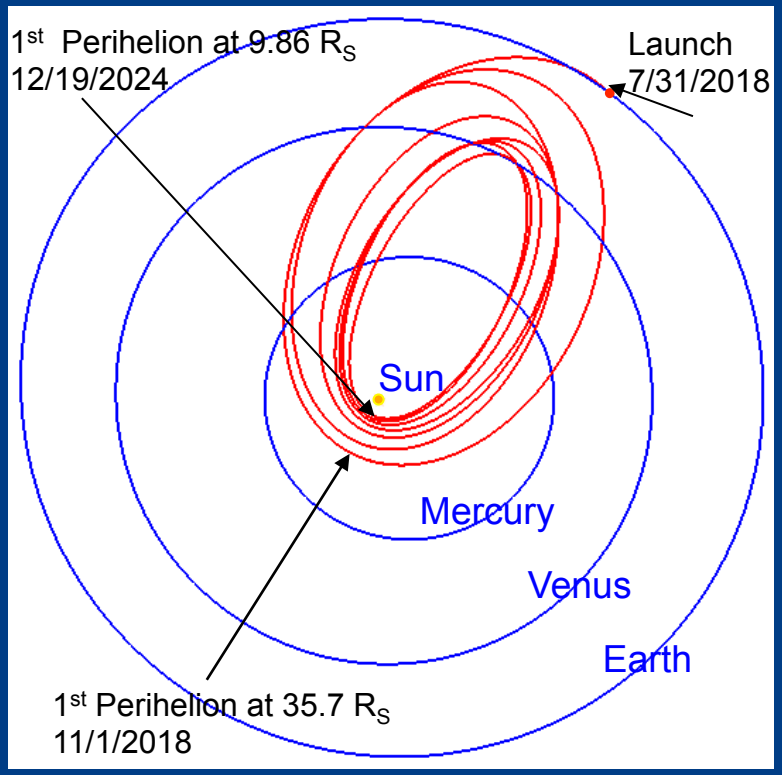
- 24 Orbits
- 7 Venus gravity assist flybys



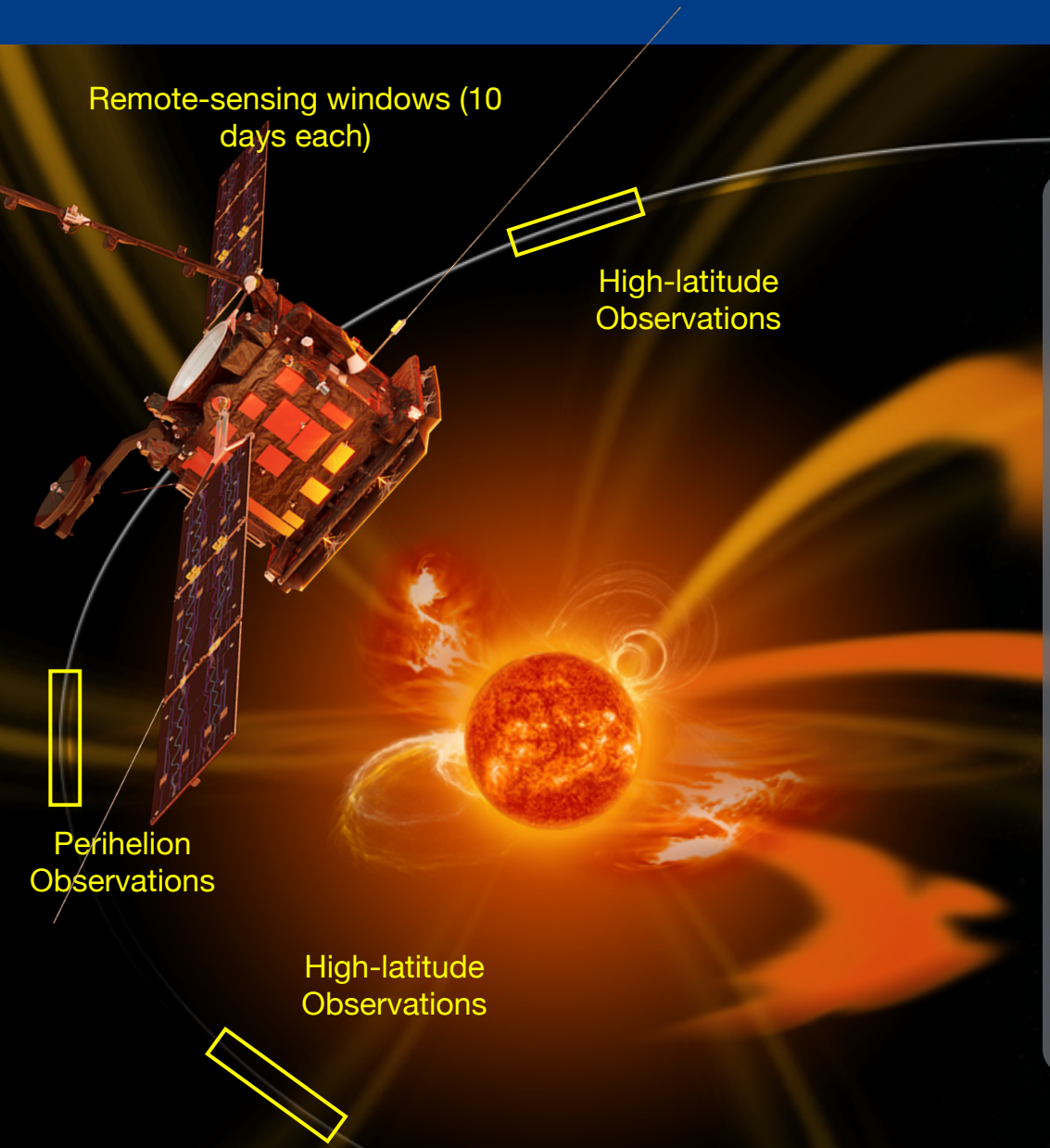
Final Solar Orbits

- Closest approach: 6.86 million km
- Speed: ~720,000 km/hr (~200 km/sec)
- Orbit period: 88 days

Mission duration: 6 years, 11 months



Solar Orbiter
Exploring the Sun-Heliosphere Connection



Mission Summary

Launch: February 2020 (NET)

Cruise Phase: 1.7 years

Nominal Mission: 3.5 years

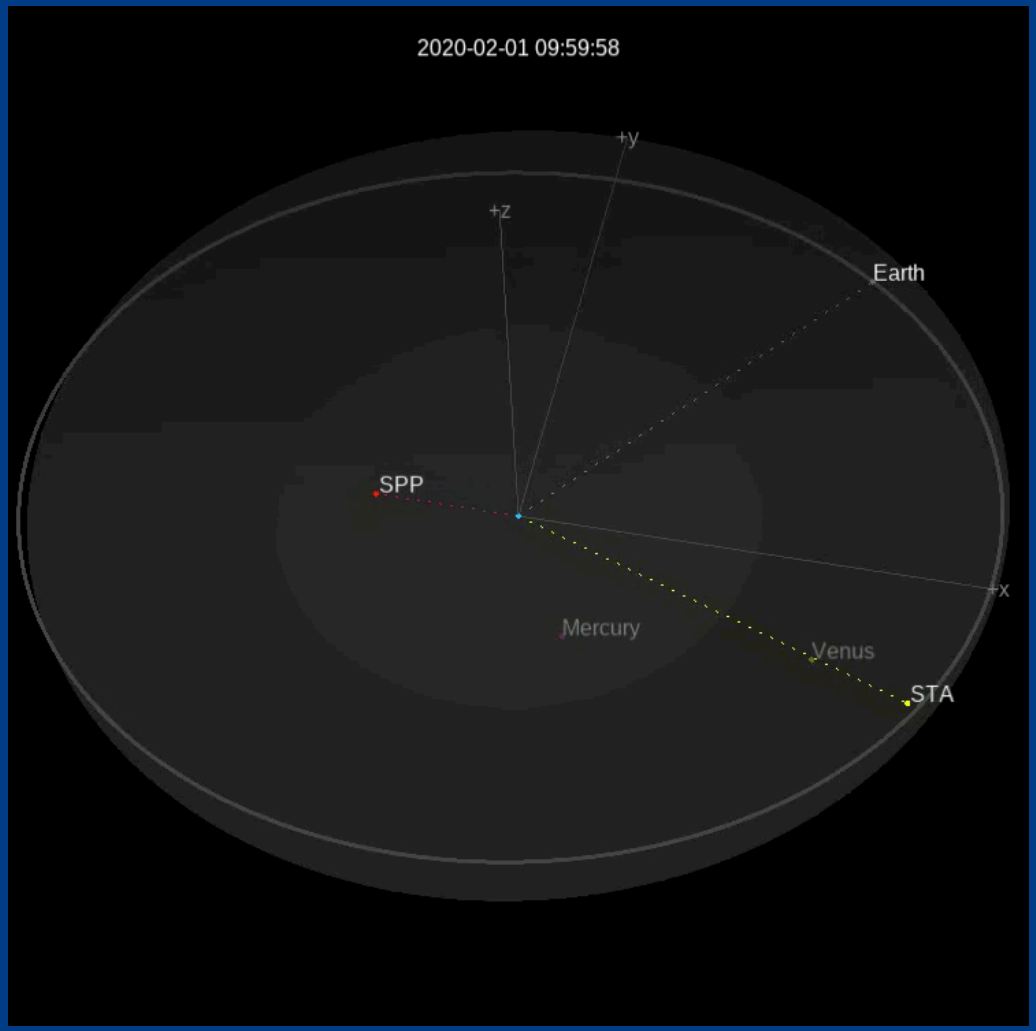
Extended Mission: 2.5 years

Orbit: 0.28–0.91 AU (P=150-180 days)

Out-of-Ecliptic View:
Multiple gravity assists with Venus to increase inclination out of the ecliptic to >24° (nominal mission), >32° (extended mission)

Reduced relative rotation:
Observations of evolving structures on solar surface & in heliosphere for almost a complete solar rotation

Solar Orbiter Cruise Phase



Solar Orbiter Cruise Phase with PSP, STEREO-A & Earth orbits

PSP/SO are VERY Different than Past Solar Missions:

- **Encounter**
- **Long Latency**
- **Variable Viewpoints**
- **Emphasis on in-situ meas.**

How can CCMC help?

- "Traditional" CCMC Support
  - i.e., model runs, ISWA, etc.

- **Observations Planning**
  - **New for SO/PSP (2018 – 2024+)**
  - Forecast model runs to be used for planning (per orbit basis)
  - "SpW predictions" at SO/PSP locations (target most likely activity
  - Magnetic Foot point and Plasma Packet Tracing (in-situ – imaging connection)
  - ISWA applets designed for SO/PSP

- **Mission Simulation**
  - Simulate measurements from novel viewpoints (e.g. solar polar)
  - Help optimize no. of s/c, sensor deployment, etc.
  - Develop visuals, cases to disseminate mission concept.

JOHNS HOPKINS
APPLIED PHYSICS LABORATORY