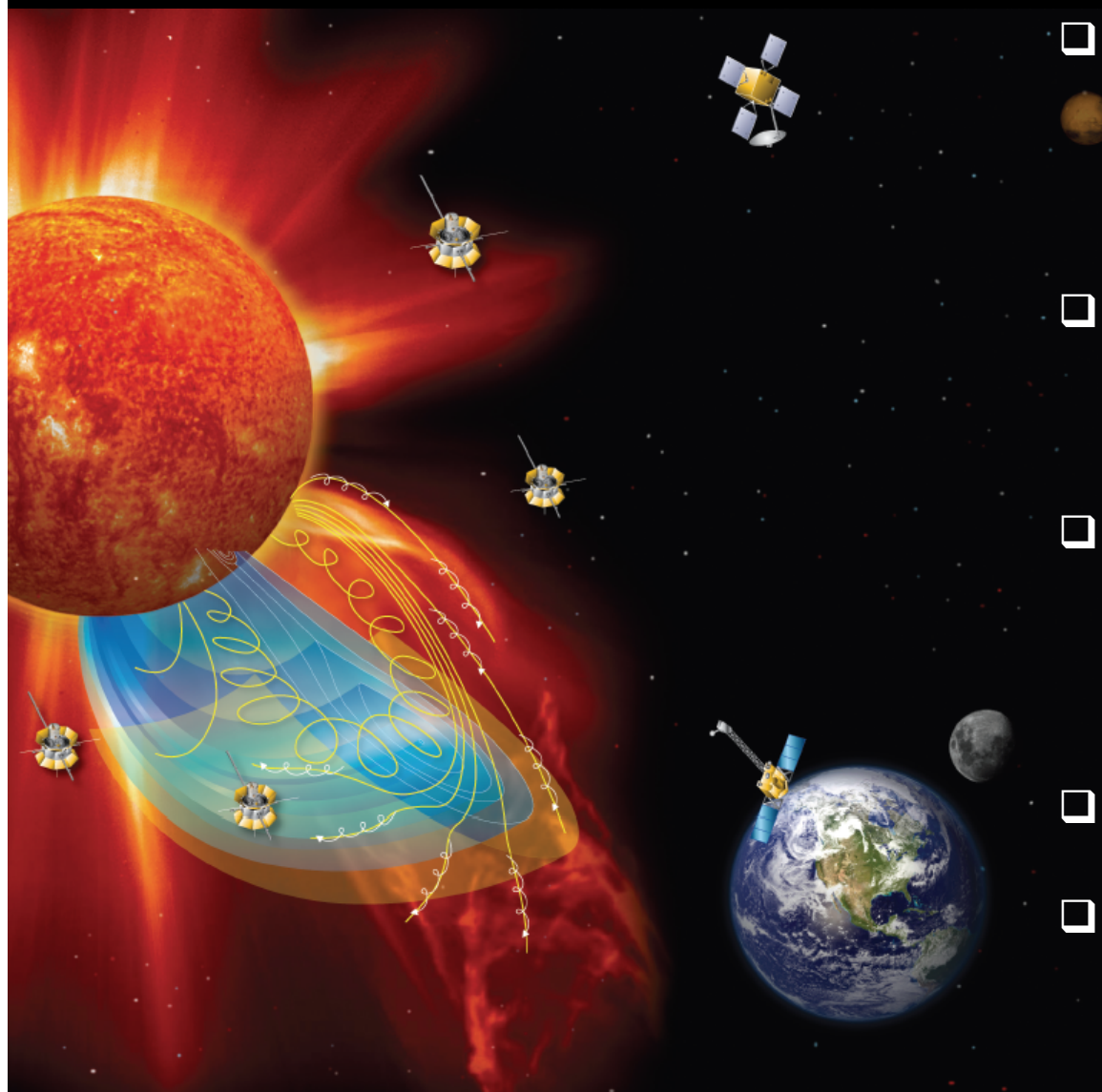


ILWS Task group on « Coordinated science with the Solar Orbiter, Solar Probe Plus, Interhelioprobe and SPORT missions”

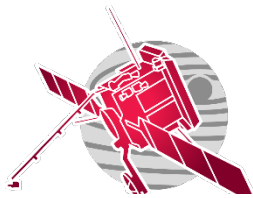
- Resolution proposed during the Irkutsk June 2013 ILWS Workshop
- Maximize the scientific output of each mission by coordinating the operations & data analysis
- Teleconf # 1, 16 June 2014

Vladimir Kuznetsov	InterHelioprobe	IZMIRAN, Russian Academy of Sciences
Ivan Zimovets	InterHelioprobe	IKI, Russian Academy of Sciences
Ying Liu	SPORT	National Space Science Center, CAS
Xiong Ming	SPORT	National Space Science Center, CAS
Milan Maksimovic	Solar Orbiter	Paris Observatory, LESIA
Andrei Zhukov	Solar Orbiter	Royal Observatory of Brussels
Suart Bale	Solar Probe Plus	SSL, UC Berkeley
Angelos Vourlidas	Solar Probe Plus	NRL, Washington
Marco Velli	Theory	UC Los Angeles

Multi Spacecraft Observations of the Inner Heliosphere

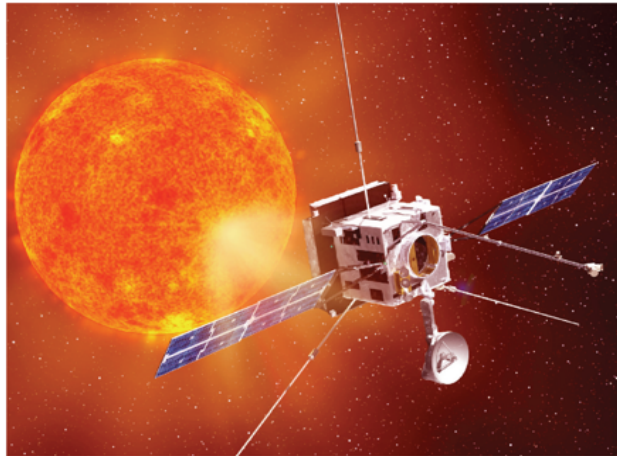


- ❑ Explore the inner heliosphere with multiple observatories (as with STEREO but closer to the sun)
- ❑ Understanding the sources, acceleration and transport of solar energetic particles
- ❑ Study the origin, evolution and interaction of CMEs, shocks and other geoeffective structures
- ❑ NASA Sentinels
- ❑ NASA & ESA HELEX (Sentinels + Solar Orbiter)

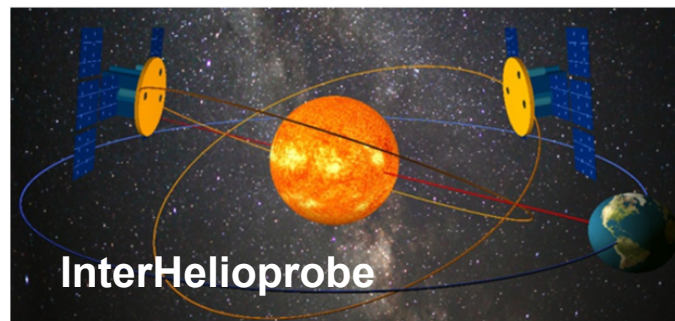


esa
solar orbiter

Exploring the
SUN-heliosphere
connection



- ☐ ESA mission with NASA participation
- ☐ Up to 0.28 AU with dedicated in-situ & remote sensing instrumentation
- ☐ Out of ecliptic observations
- ☐ M1 ESA Cosmic Vision, launch July 2017

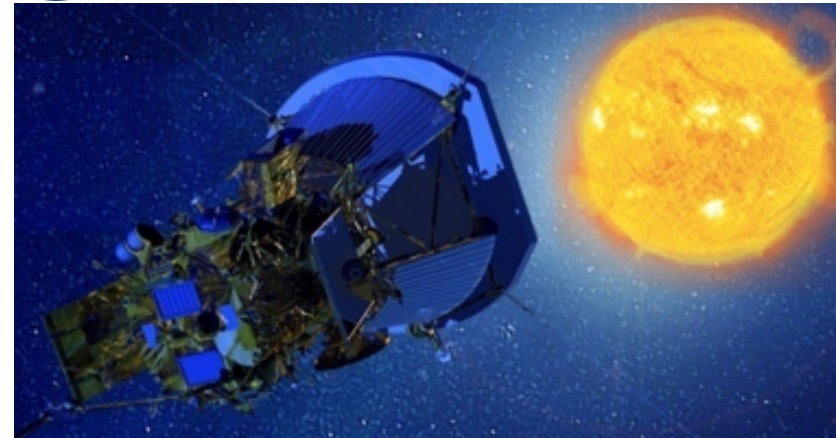


- ☐ ROSKOSMOS/IKI mission
- ☐ Two « Solar Orbiter-like » spacecraft
- ☐ Engineering study phase
- ☐ **Implementation decision on 2015**
- ☐ Launch ~ 2022

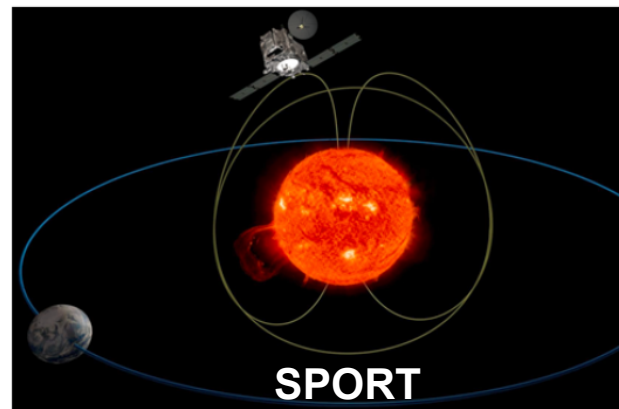


Solar Probe Plus

A NASA mission to touch the SUN



- ☐ 9.5 Rs to 30 RS : primary science
- ☐ Focussed in-situ instrumentation
- ☐ instruments under selection
- ☐ Launch in August 2018

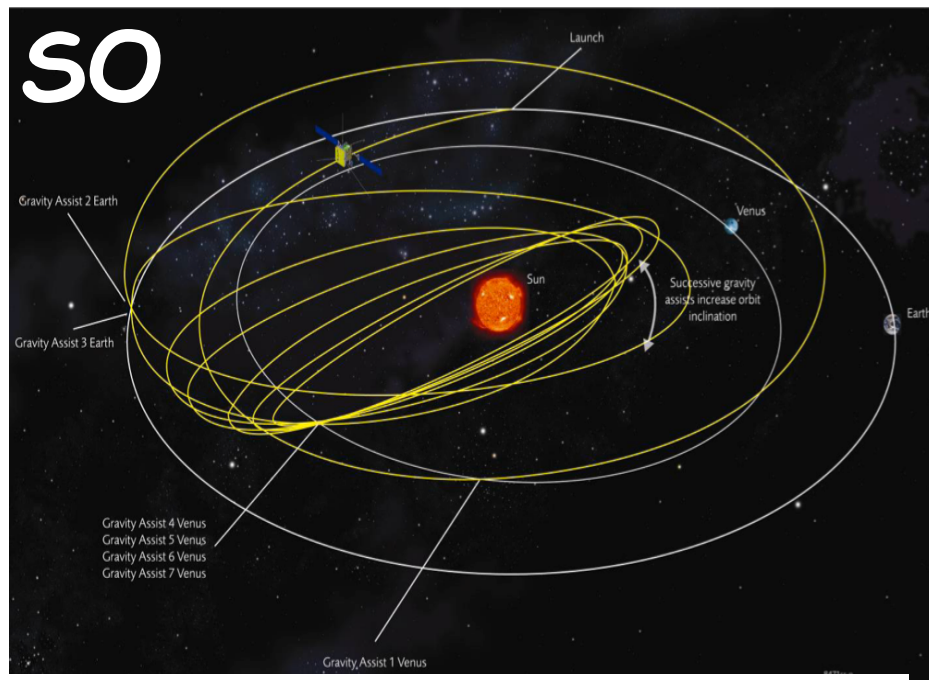


- ☐ CAS/NSSC mission
- ☐ Solar Polar mission with a « Ulysses-like » mission profile
- ☐ Venus GA to circularize the orbit
- ☐ Engineering study phase
- ☐ **Implementation decision on 2015**
- ☐ Launch in ~2020



中国科学院
CHINESE ACADEMY OF SCIENCES

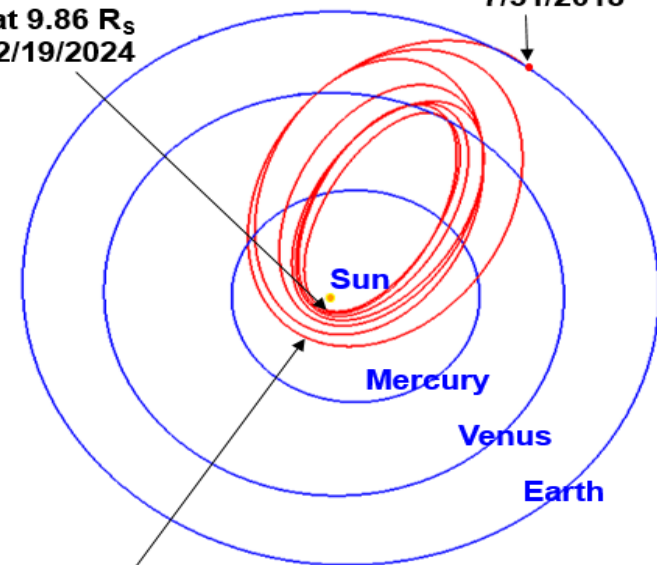
Mission Profiles



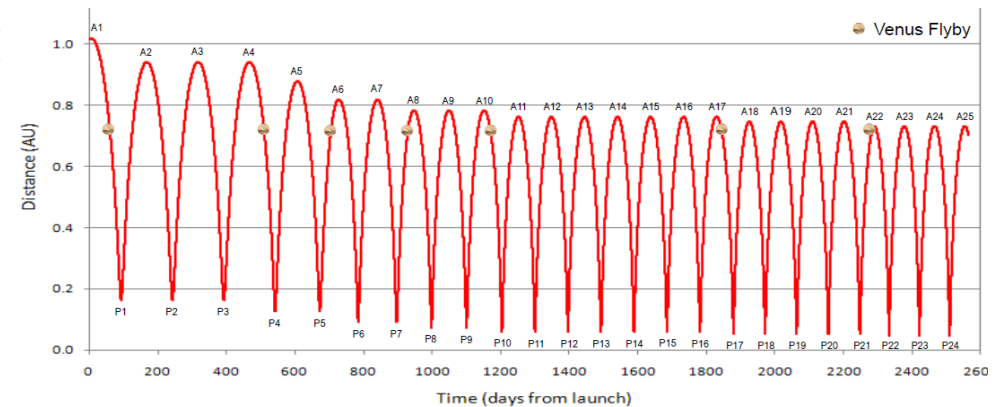
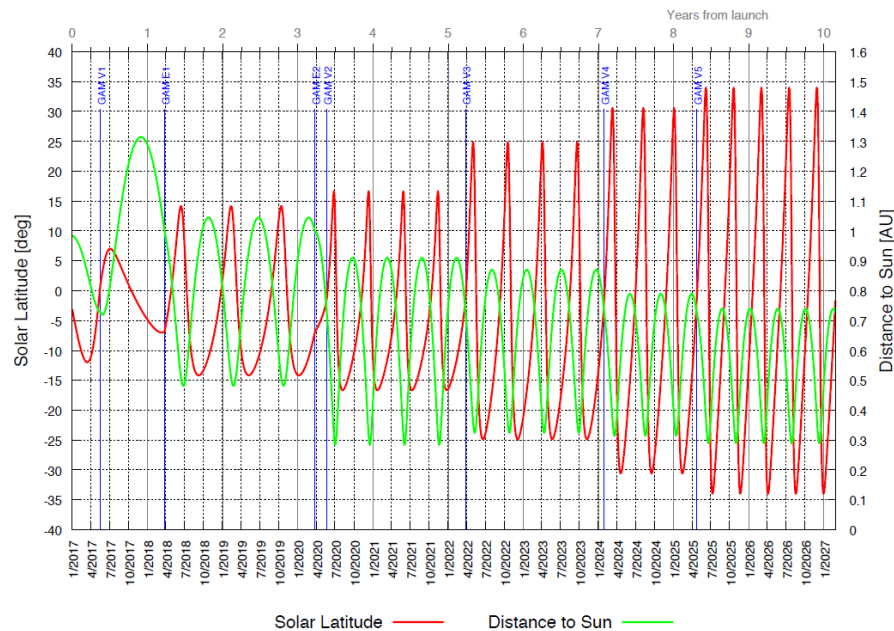
1st Min Perihelion at 9.86 R_s 12/19/2024

SPP

Launch 7/31/2018

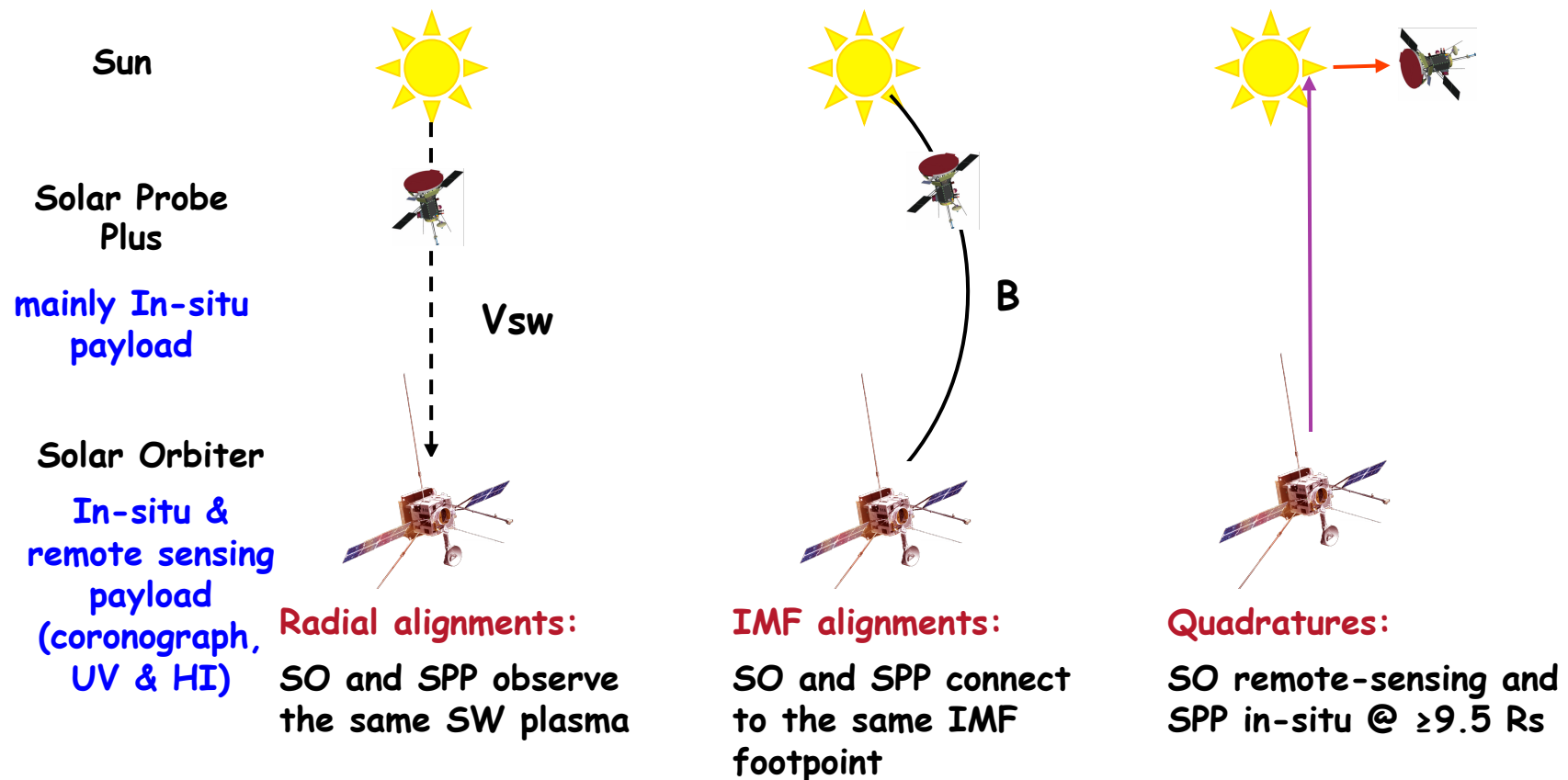


1st Perihelion at 35.7 R_s 11/1/2018



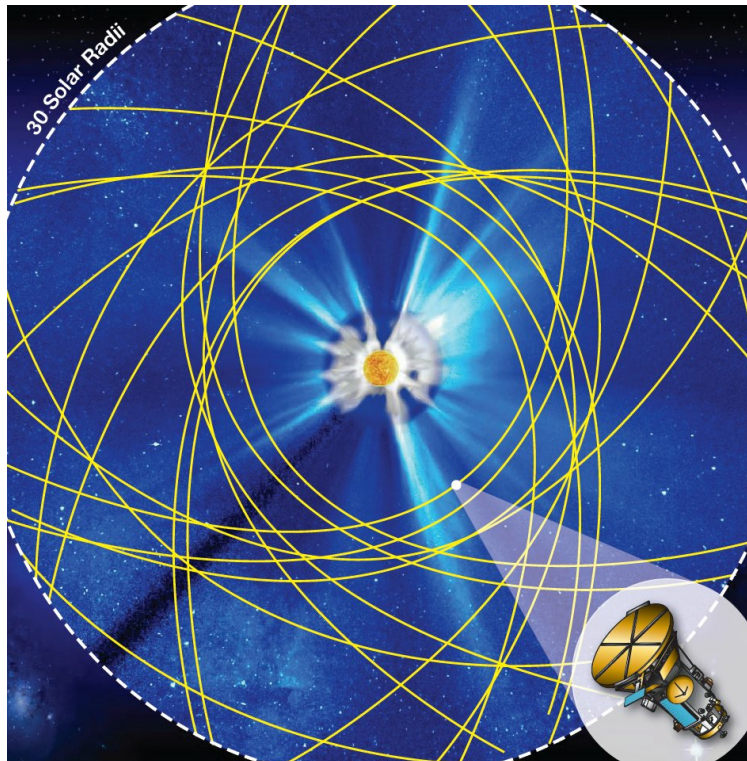
Joint Observations Solar Orbiter - Solar Probe Plus

Example of alignments/quadratures:



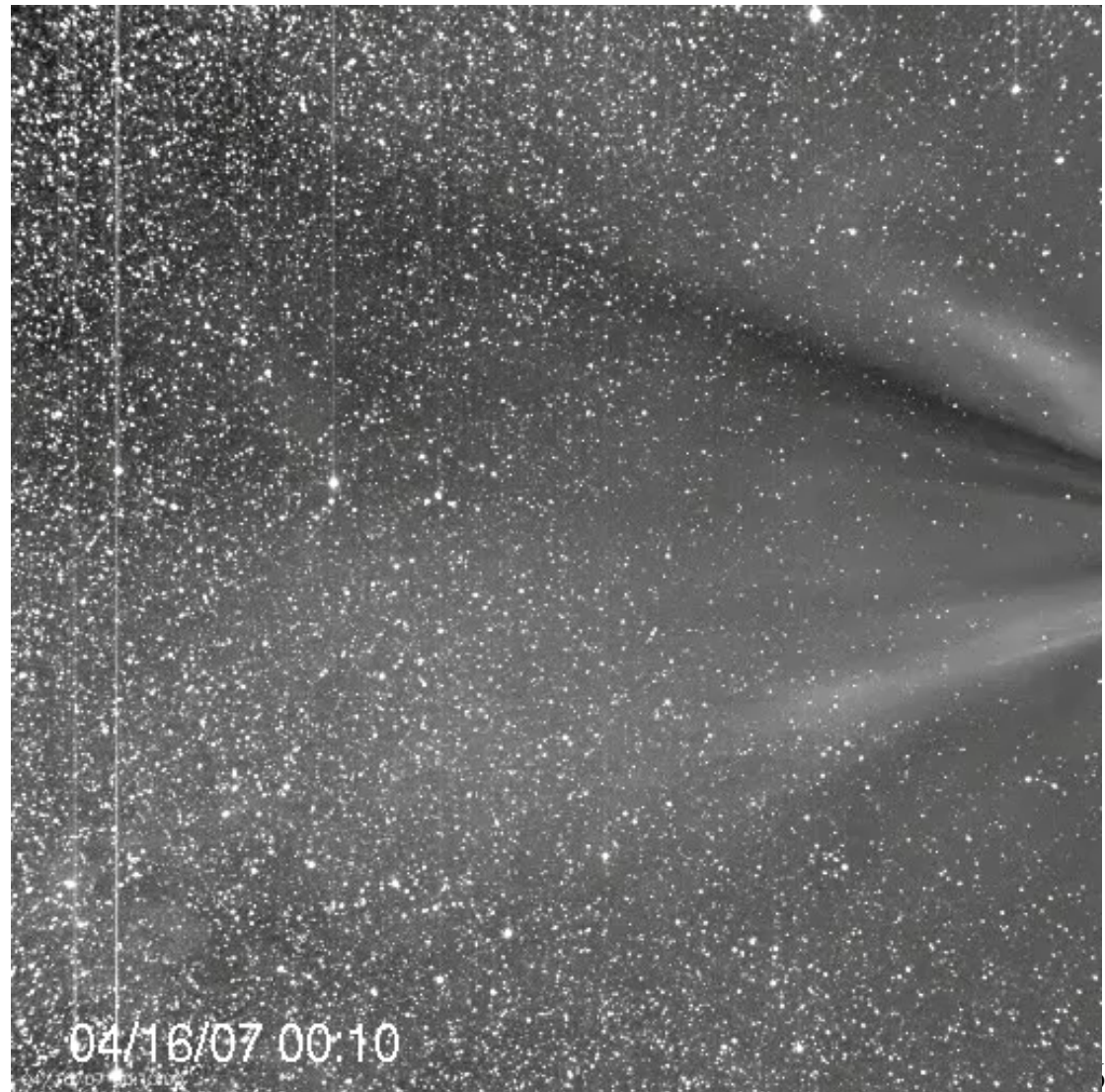
A joint WG has been established to maximize the opportunities provided by the contemporaneous presence of both missions in the inner heliosphere.

Solar Probe Plus in the field of view of Solar Orbiter

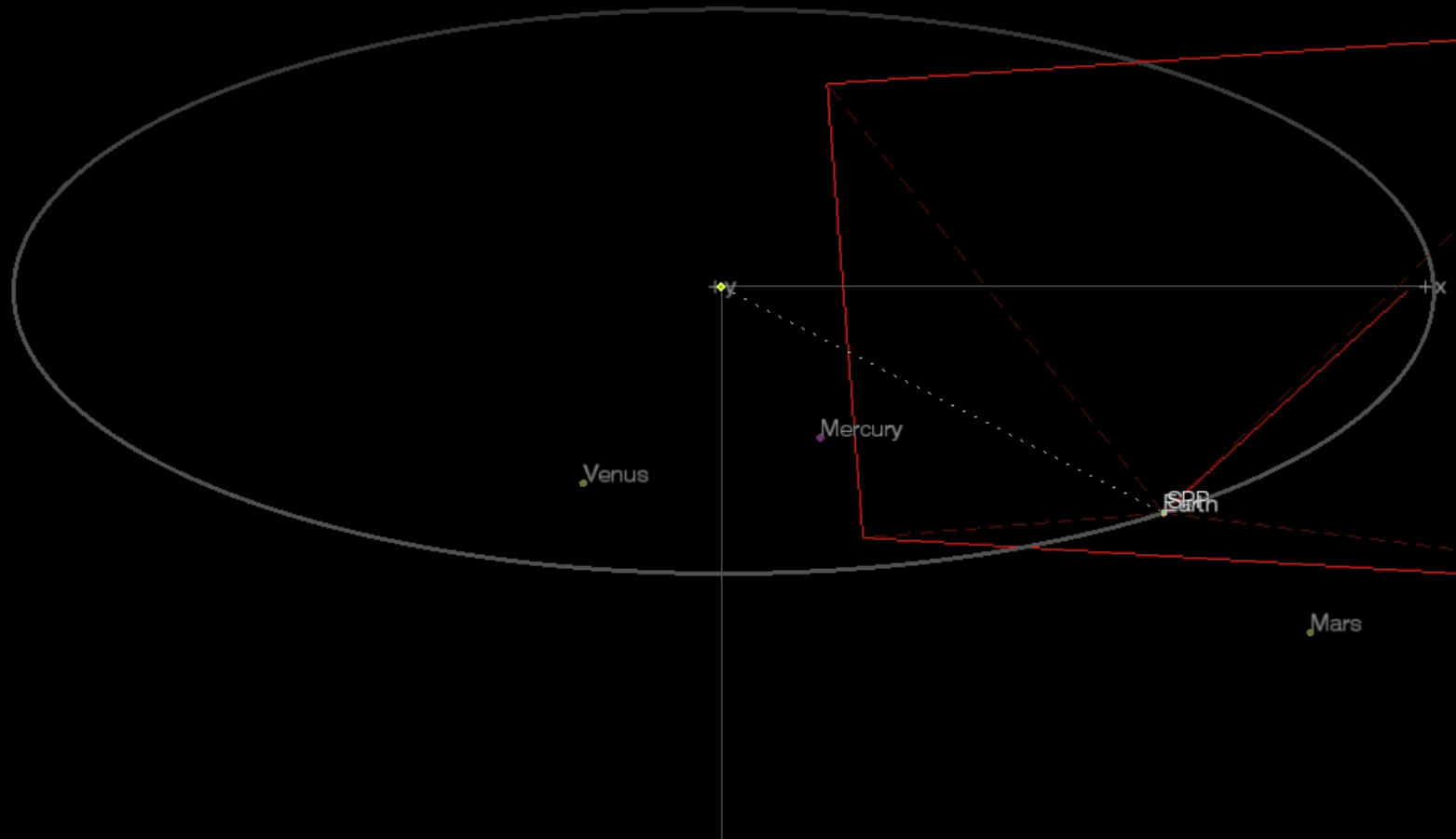


METIS

SOLO-HI



2018-07-31 09:00:00

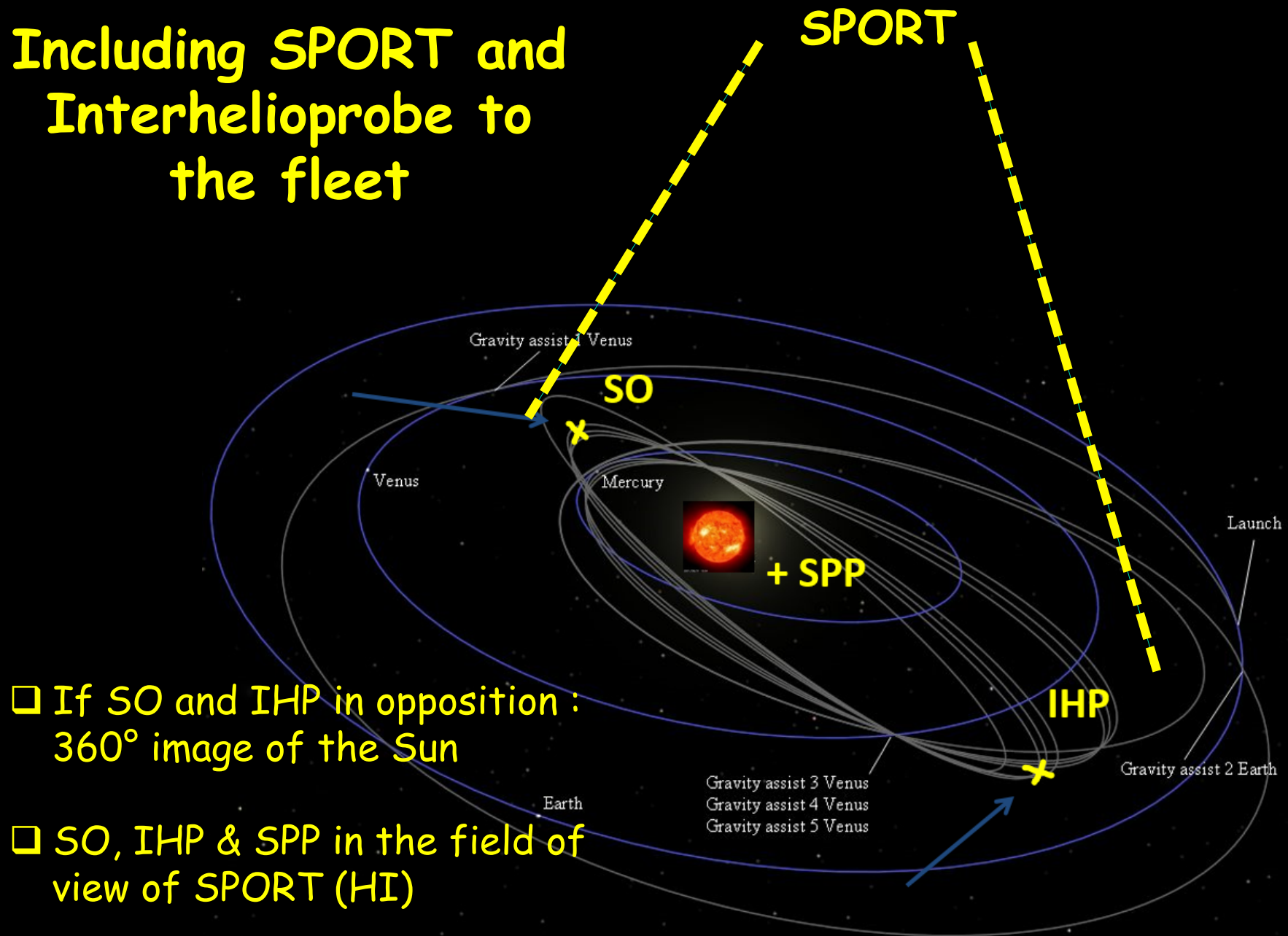


Examples of SPP/SO Encounters configurations

SPP Perihelion	Date	SO/Earth position	SPP Distance	Time within			
				30	20	15	10
	10-21/05/2021	SO-E-SPP 360 (3D mapping of inner heliosphere)	~0.5 AU				
9	05/08/2021	SPP/S/E (occ) conj SO 120 West	16	108.6	47.8	0	0
	15/09/2011	S/SO/E conj SPP 40 East	~0.6-0.7 AU				
10	16/11/2021	S/SPP/SO 15/11 S/SPP/E 16/11 – SO and Earth separated by ~15° at same distance (possible tomography)	13.3	107.3	55.1	24.5	0
11	21/02/2022	S/SPP/E conj SO 140 West	13.3	107.3	55.1	24.5	0
	25/05/2022	S/SPP/SO conj FRS E 130 East					
12	28/05/2022	SO/SPP/E 360 31/05 S/SPP/E on FRS (3D mapping of inner heliosphere)	13.3	107.3	55.1	24.5	0
13	01/09/2022	SO/SPP 90 SPP/E 135 02/09 S/SPP/SO conj FRS	13.3	107.3	55.1	24.5	0
14	07/12/2022	03/12 S/SPP/SO 05/12 S/SPP/E FRS	13.3	107.3	55.1	24.5	0
15	13/03/2023	E/S/SO 100 S/SPP/SO S/SPP/E conj	13.3	107.3	55.1	24.5	0
16	17/06/2023	SPP/E/SO 360 23/06 S/SPP/E conj	13.3	107.3	55.1	24.5	0
	05/08/2023	S/E/SO-SPP quad SPP Aph S/SO/SPP conj	~0.7 AU				

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Including SPORT and Interhelioprobe to the fleet

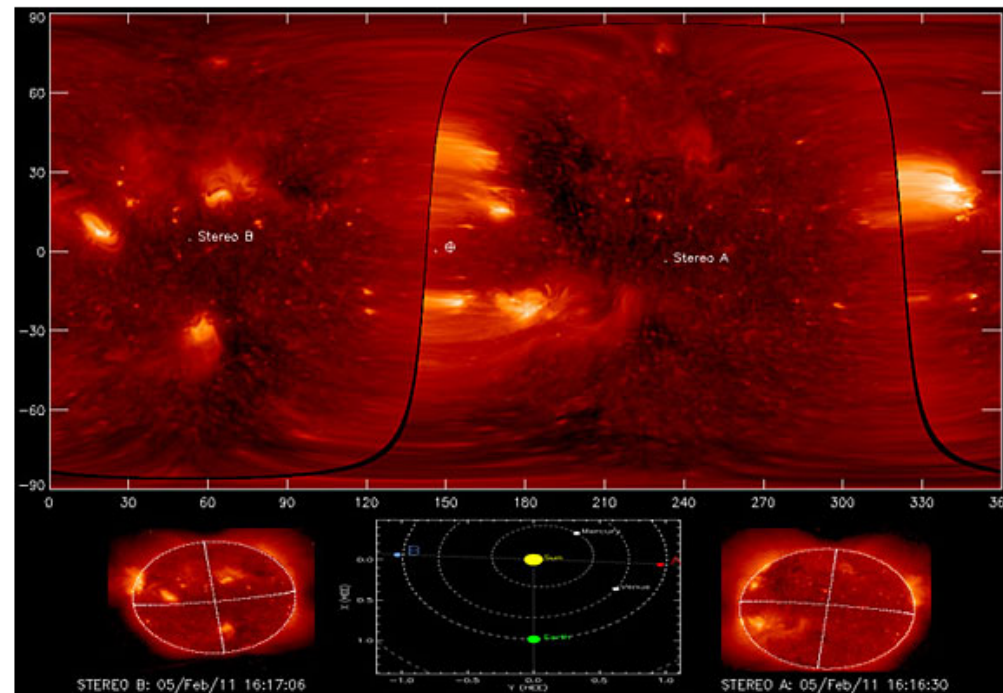


□ If SO and IHP in opposition :
360° image of the Sun

□ SO, IHP & SPP in the field of
view of SPORT (HI)

Added science with SPORT & IHP

- Largely increased number of conjunctions/ alignments !
- If SO and IHP in opposition : 360° image of the Sun



- SO, IHP & SPP in the field of view of SPORT (HI) from a polar perspective !
- Many more science topics will emerge from the community.

Missions phasing

