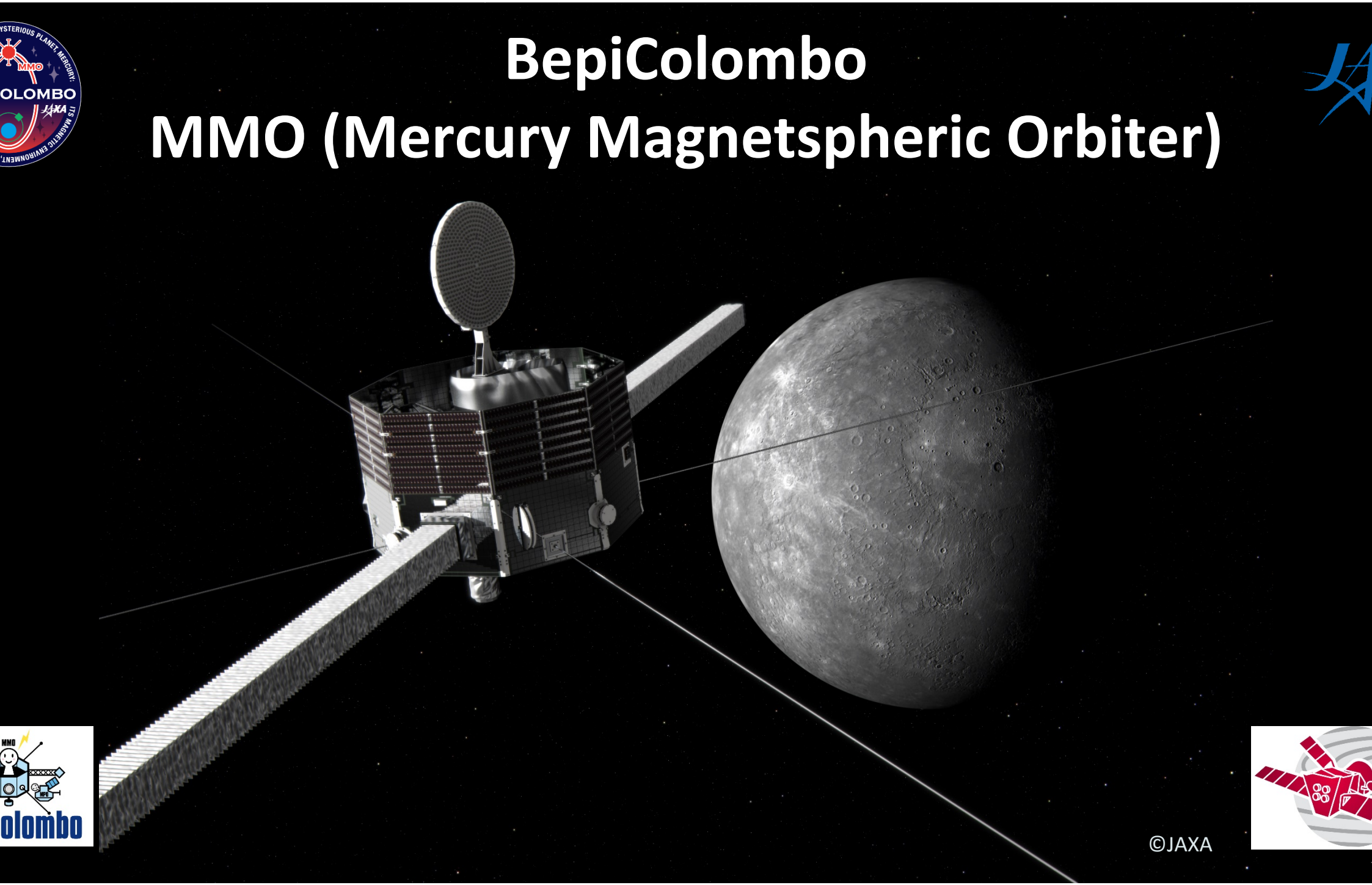
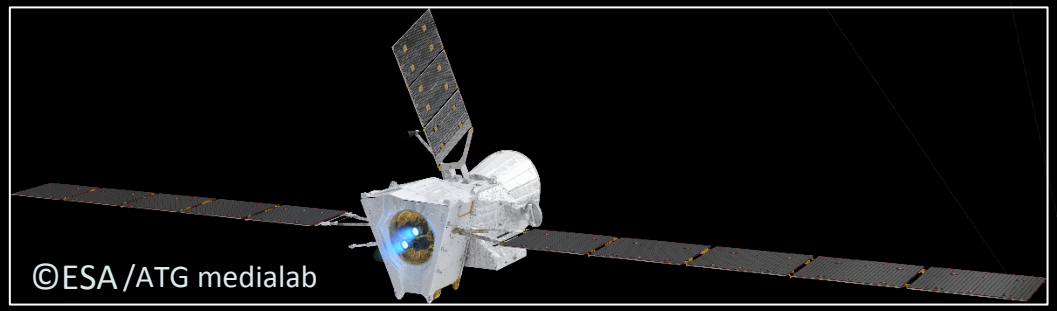
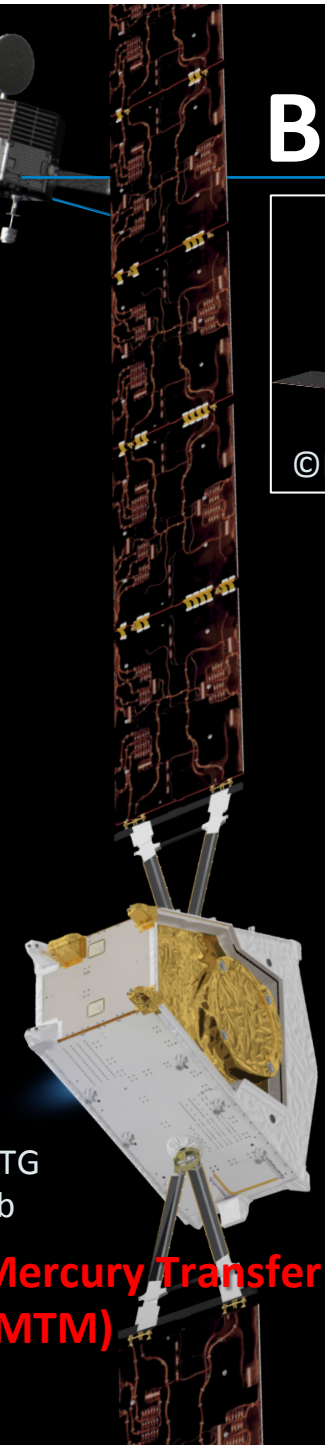
BepiColombo
MMO (Mercury Magnetspheric Orbiter)



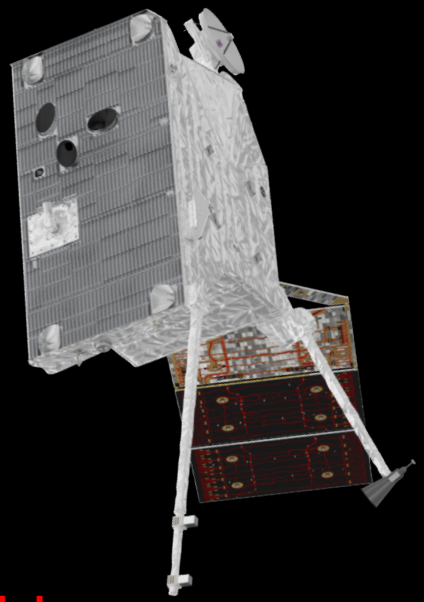
BepiColombo Spacecraft Configuration



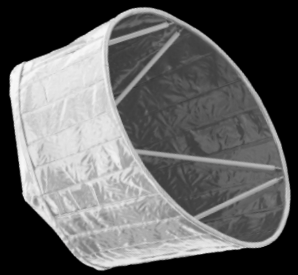


TG
b

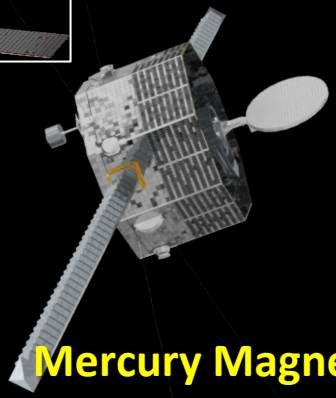
Mercury Transfer Module
MTM)



Mercury Planetary Orbiter
(MPO)

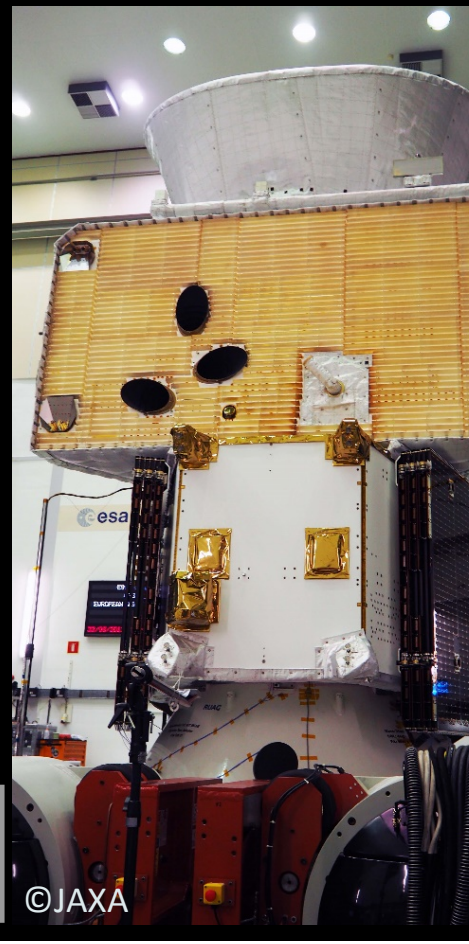


Magnetospheric Orbiter
Sunshield and Interface
Structure (MOSIF)

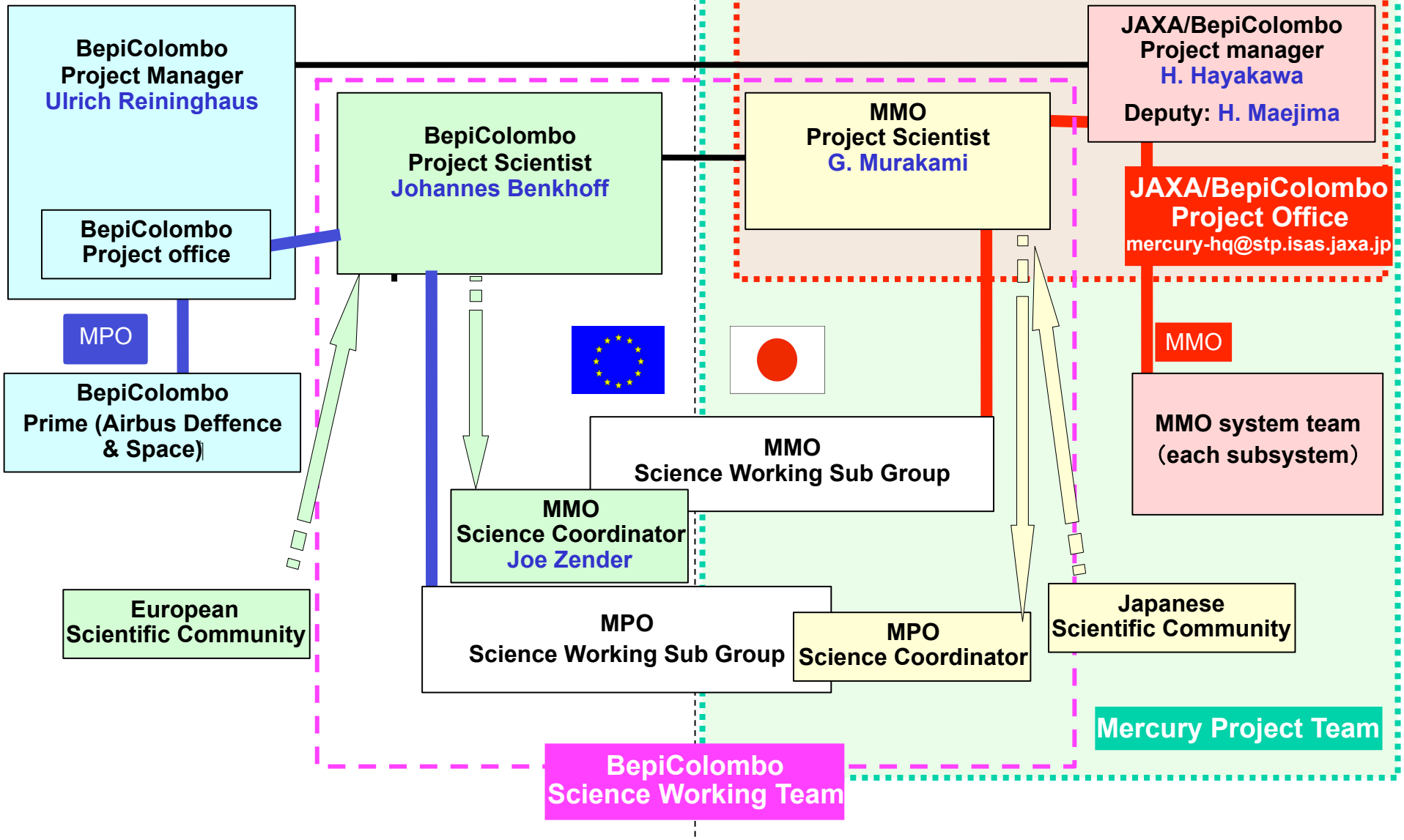


Mercury Magnetospheric
Orbiter (MMO)

Yellow: JAXA
Red: esa



BepiColombo Spacecraft Configuration



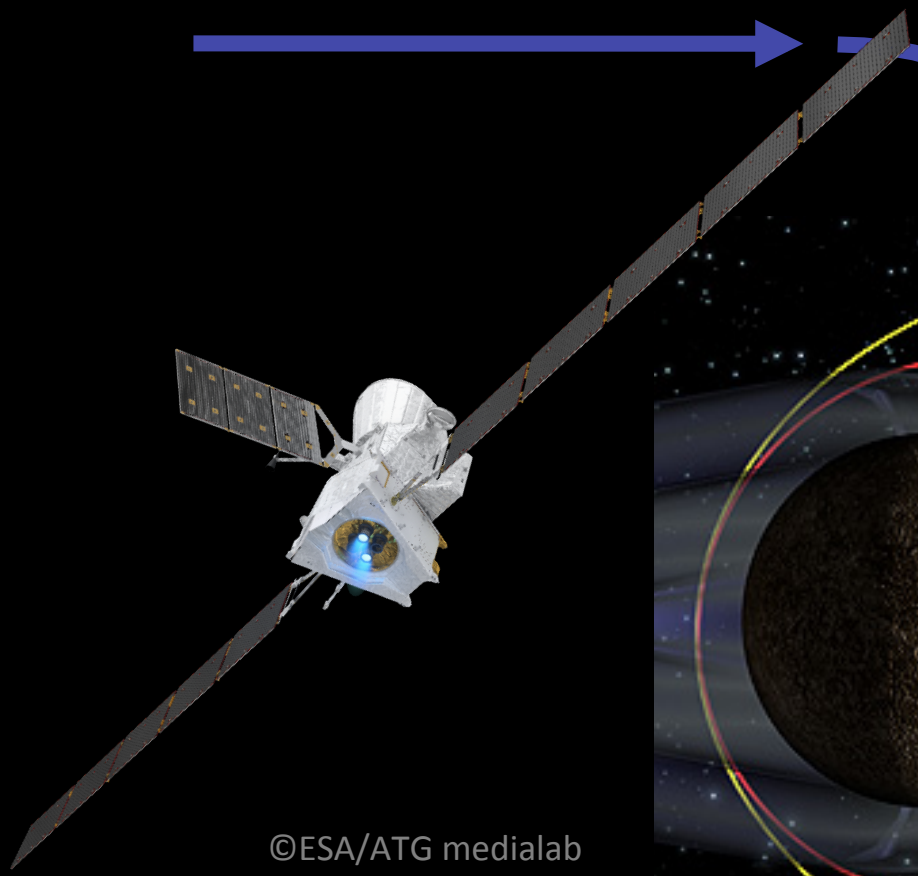
BepiColombo mission plan

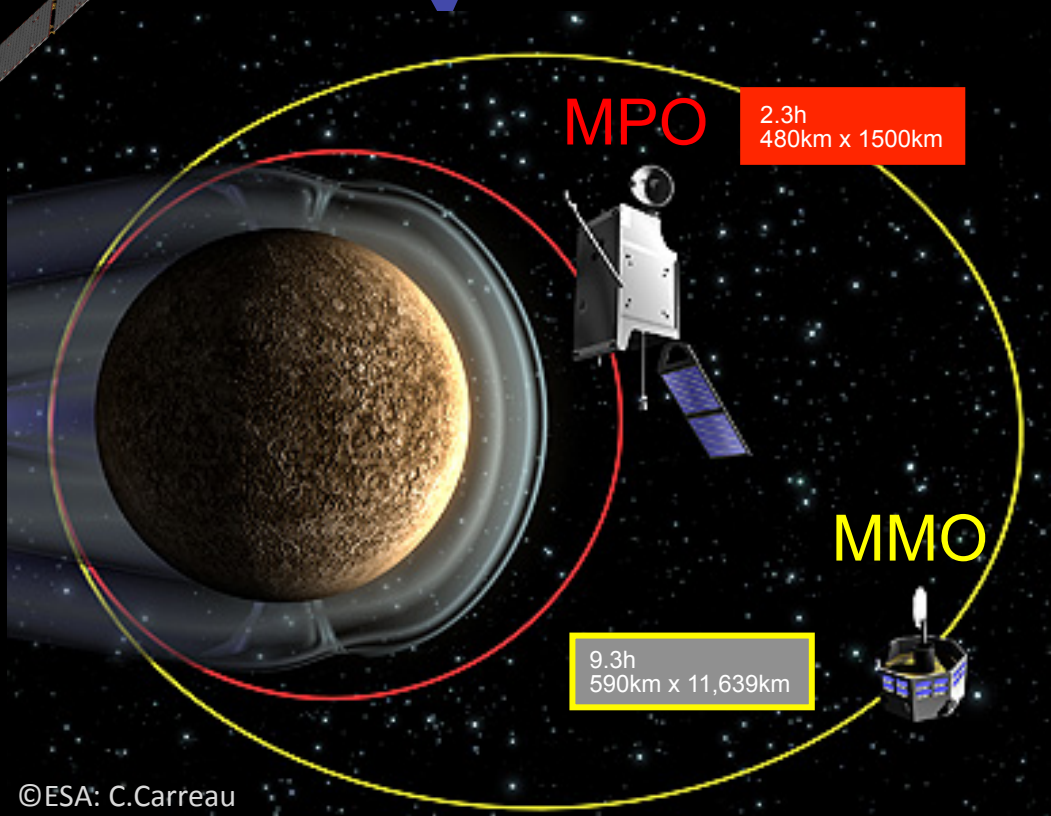
Launch: Oct. 2018

Earth swing-by x 1
Venus swing-by x 2
Mercury swing-by x 6

Arrival: Dec. 2025

Ariane-5:
MPO+MMO

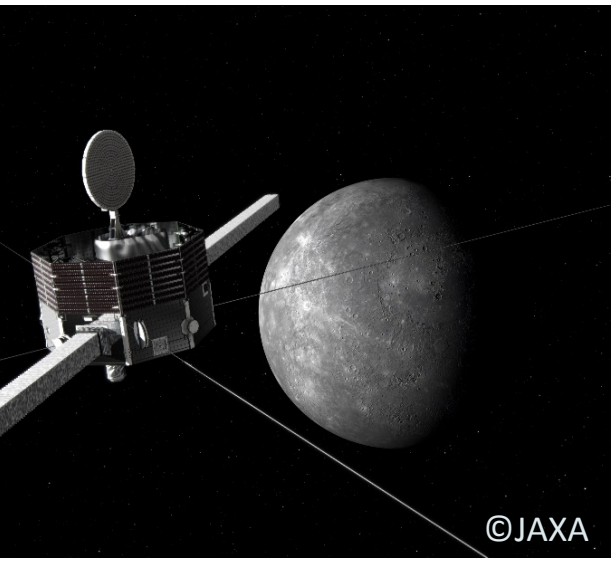




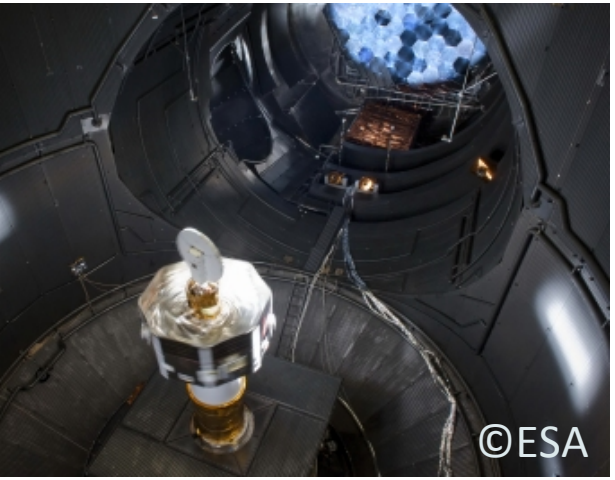
Yellow: JAXA
Red: esa

Observation: 1 Earth year (+Extension)

MMO: Mercury Magnetospheric Orbiter



・Developed by JAXA
・Spin stabilized spacecraft (4sec/spin)
⇒spin axis is nearly perpendicular (nominally 92deg) to Mercury's equator plane
・To observe Mercury's magnetic field, plasma environment ar Mercury (incl. interaction between magnetosphere and solar wind), and Sodium atmosphere.



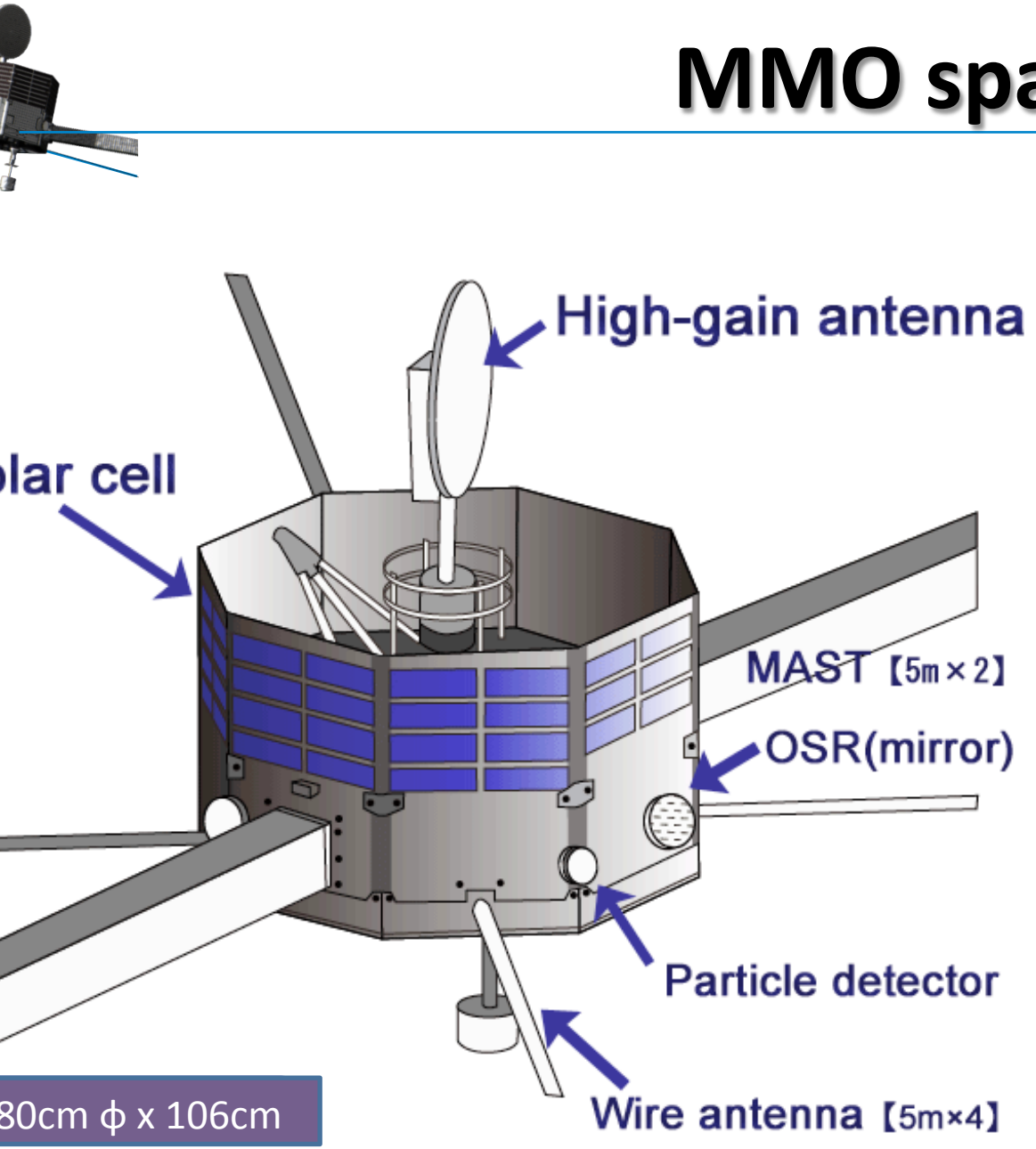
・An octagonal column shape inscribed in a circle with a diame of 1.8 m
・Two 5m extendable mast (DC and AC magnetic field)
・Two pairs of 15m antenna (DC and AC electric field)

・Height : approx. 2.4m include HGA and MGA
(Side panel height is 1.06m)
・Weight : approx. 255kg (S/C) + 20kg (separation device)

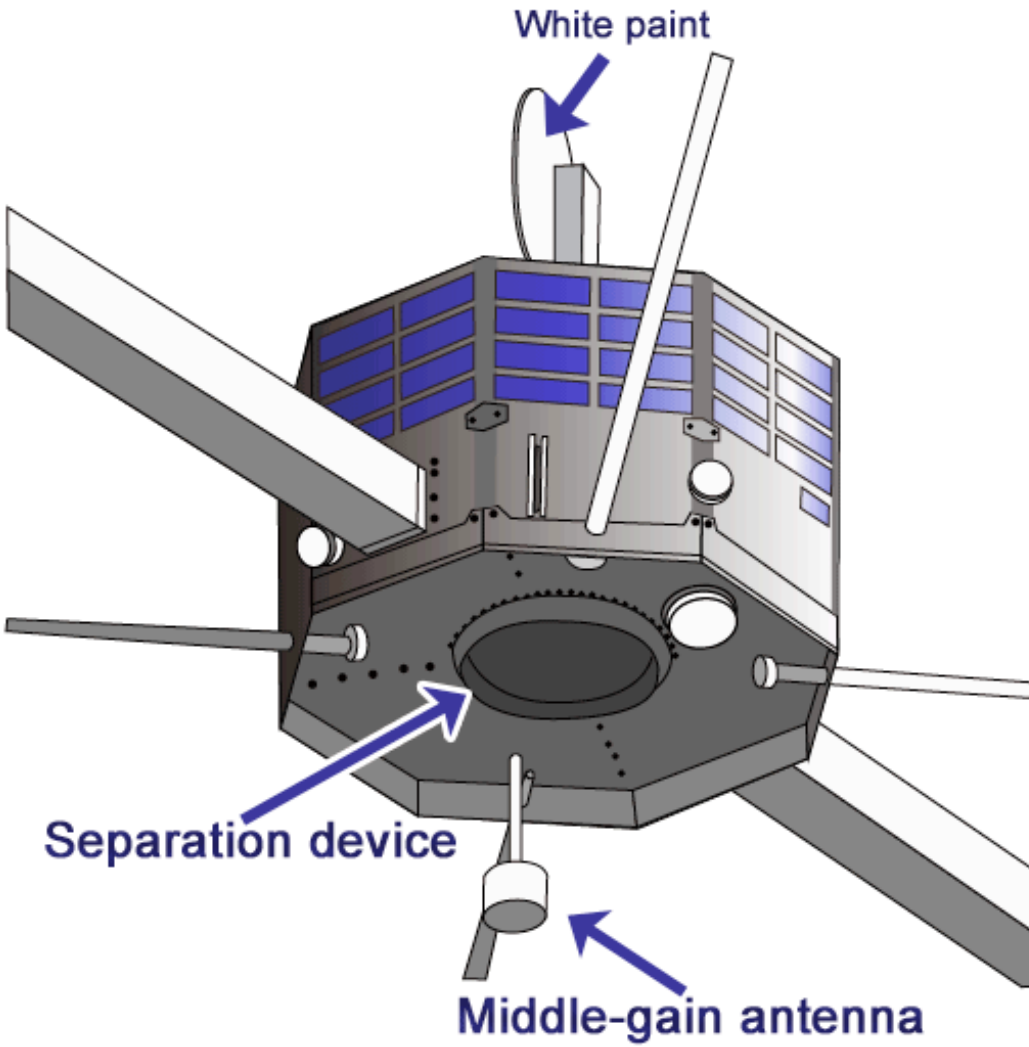
MMO instruments and PIs

PI	Instrument		Measurements
W. Baumjohann, Austria	Mercury Magnetometer / Magnetometer – Fluxgate	MERMAG-M / MGF	Detailed description of Mercury's magnetosphere and of its interaction with the planetary magnetic field and the solar wind.
Y. Saito, Japan	Mercury Plasma Particle Experiment	MPPE	Study low- and high-energetic particles in the magnetosphere.
I. Yoshikawa, Japan	Mercury Sodium Atmospheric Spectral Imager	MSASI	Measure the abundance, distribution and dynamics of sodium in Mercury's exosphere.
Y. Kasaba, Japan	Plasma Wave Investigation	PWI	Detailed analysis of the structure and dynamics of the magnetosphere.
M. Kobayashi Japan	Mercury Dust Monitor	MDM	Study the distribution of interplanetary dust in the orbit of Mercury.

MMO spacecraft

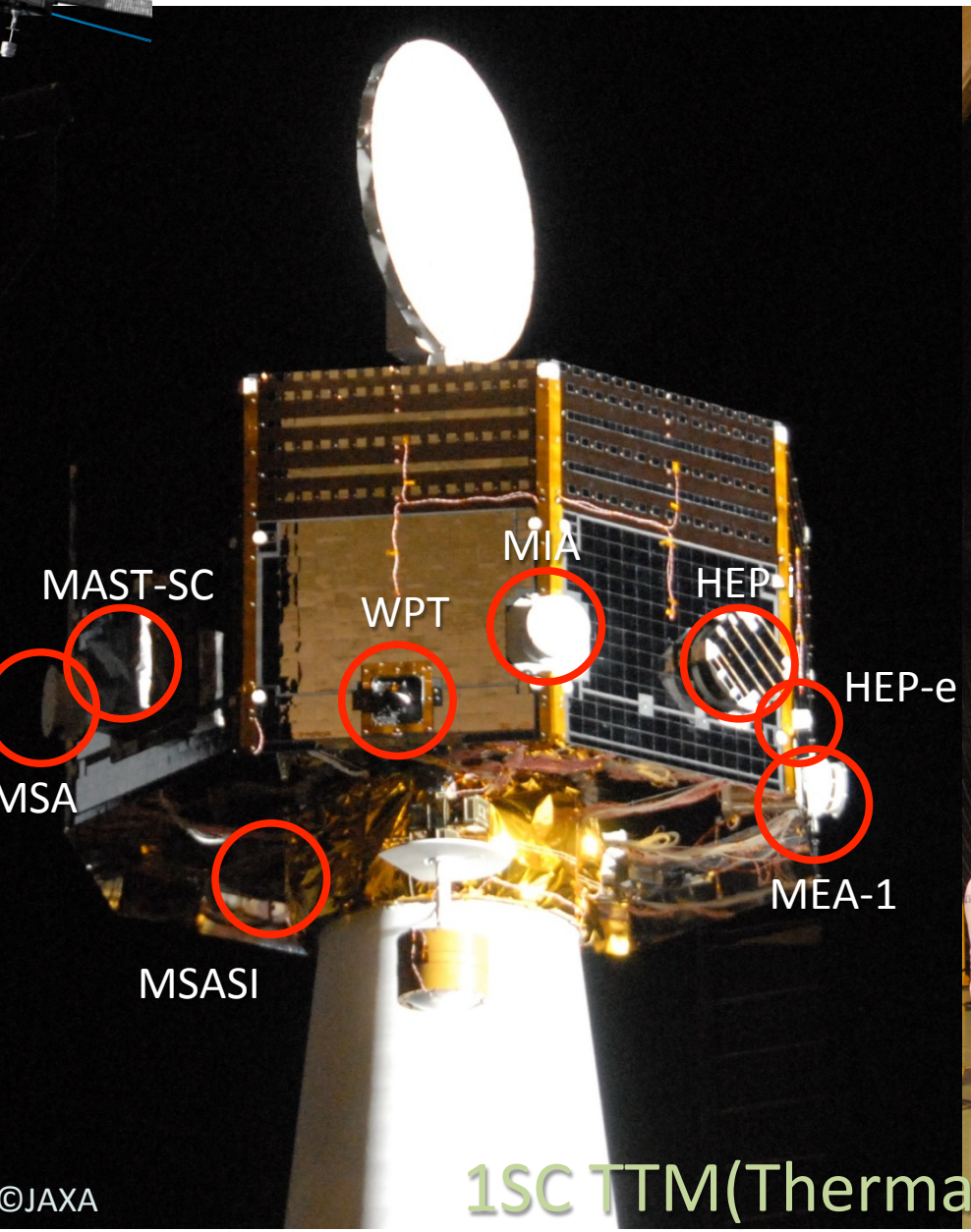


80cm ϕ x 106cm



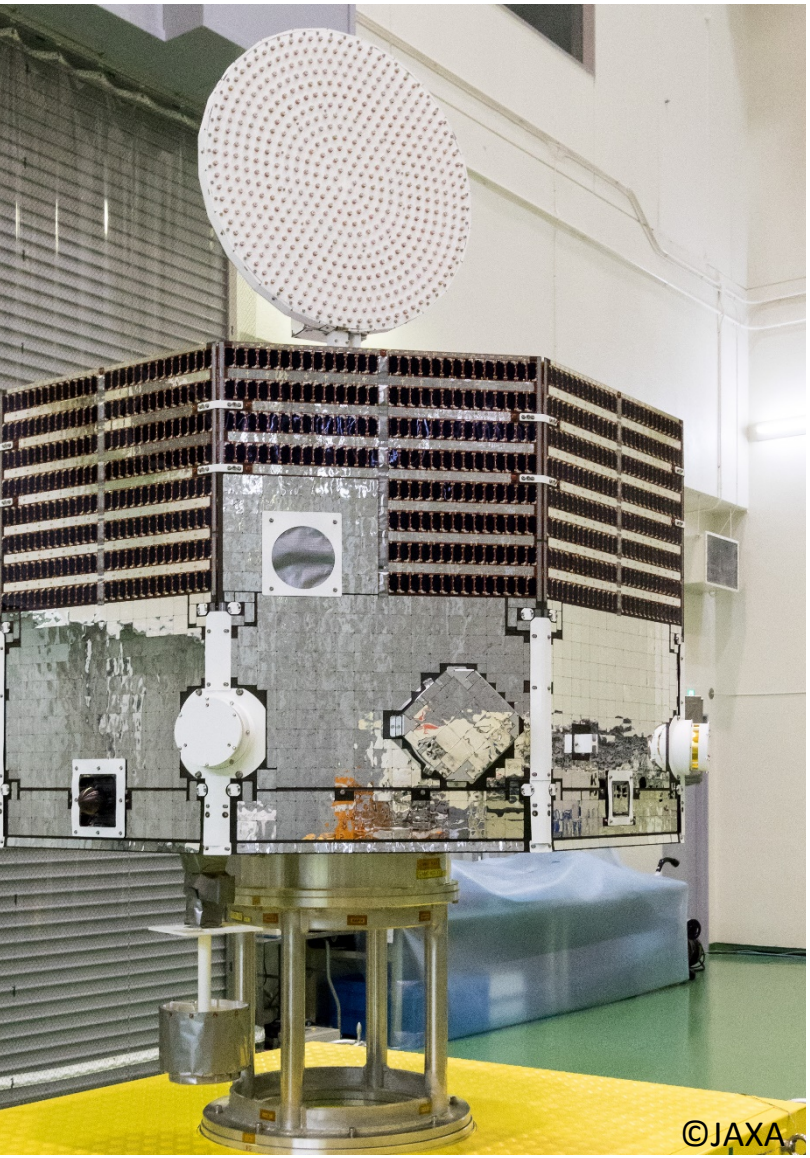
A

MMO spacecraft



1SC TTM(Thermal Test Model) Test @TKSC

Thermal design



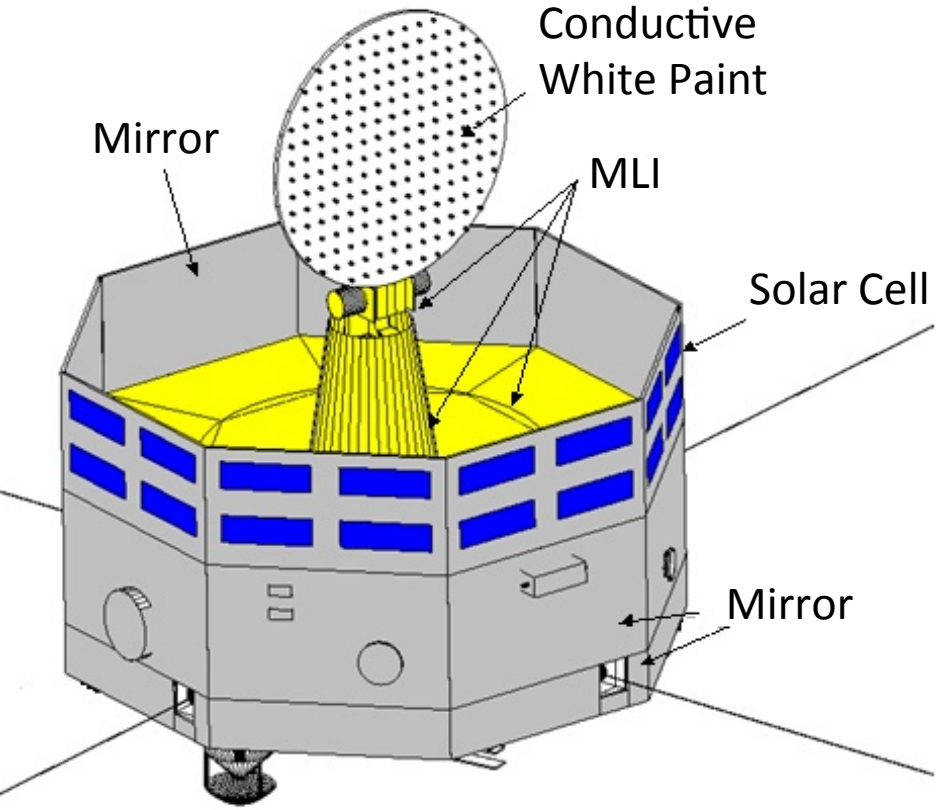
・Use mirror to minimize heat input from Sun and increase infrared radiation to space.

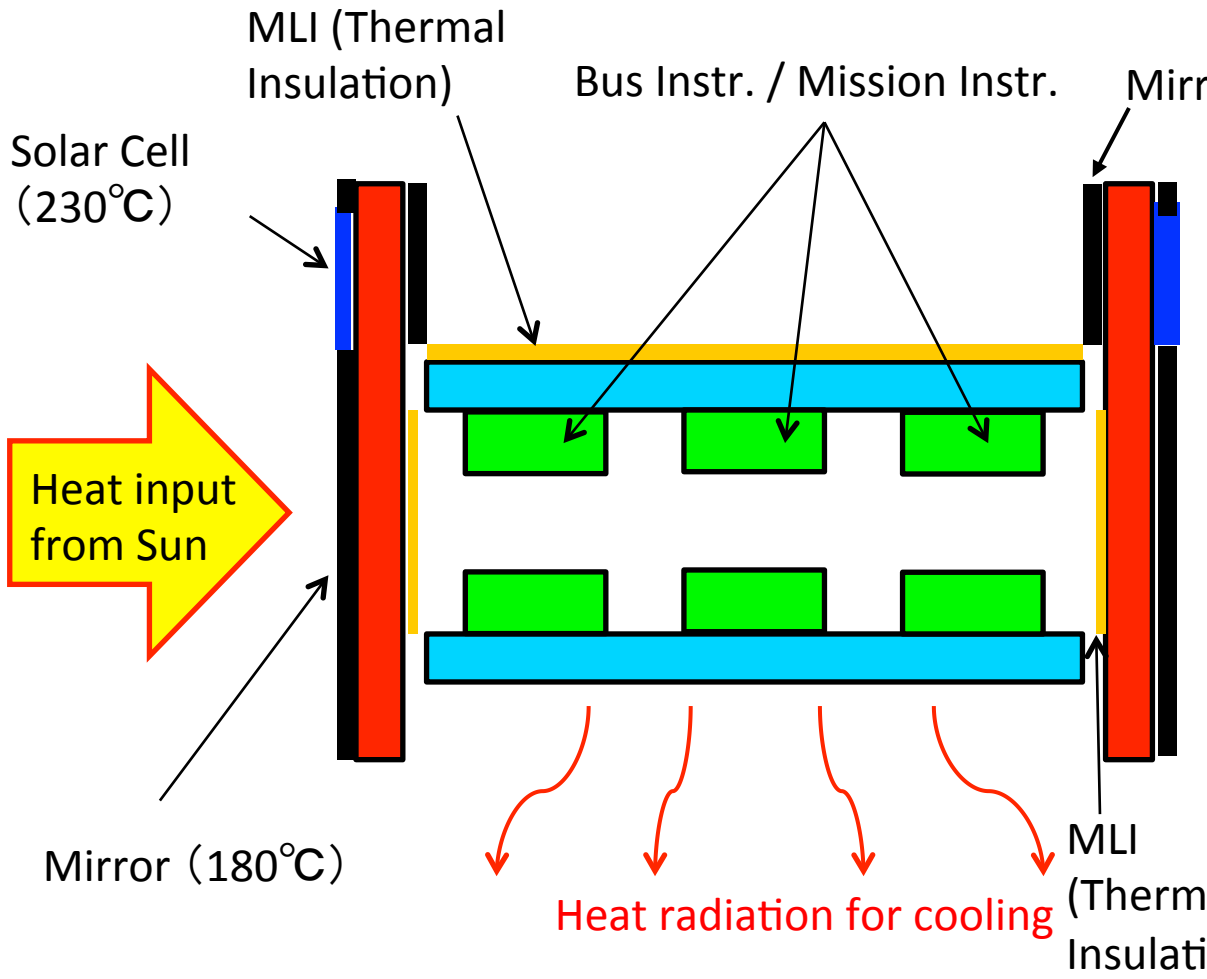
・Use sunshield to minimize heat input through expos instrument.

・ In areas where mirrors can not be used, specially developed conductive white paint is used to suppress temperature rise

・ Using special high temperature multilayer insulation using titanium for the back side of the high gain antenna (expected maximum temperature of 400 deg Celsius)

Thermal design

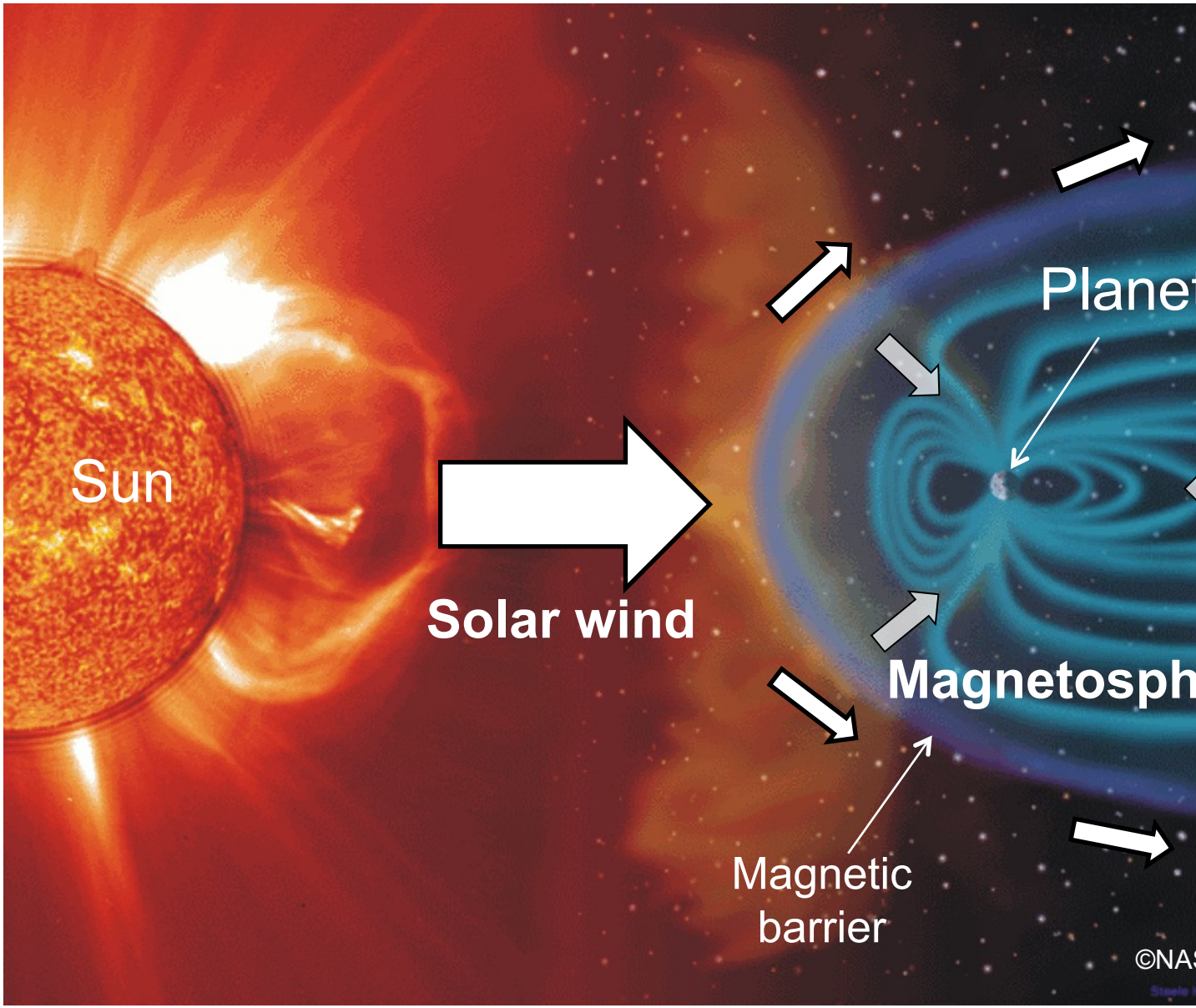




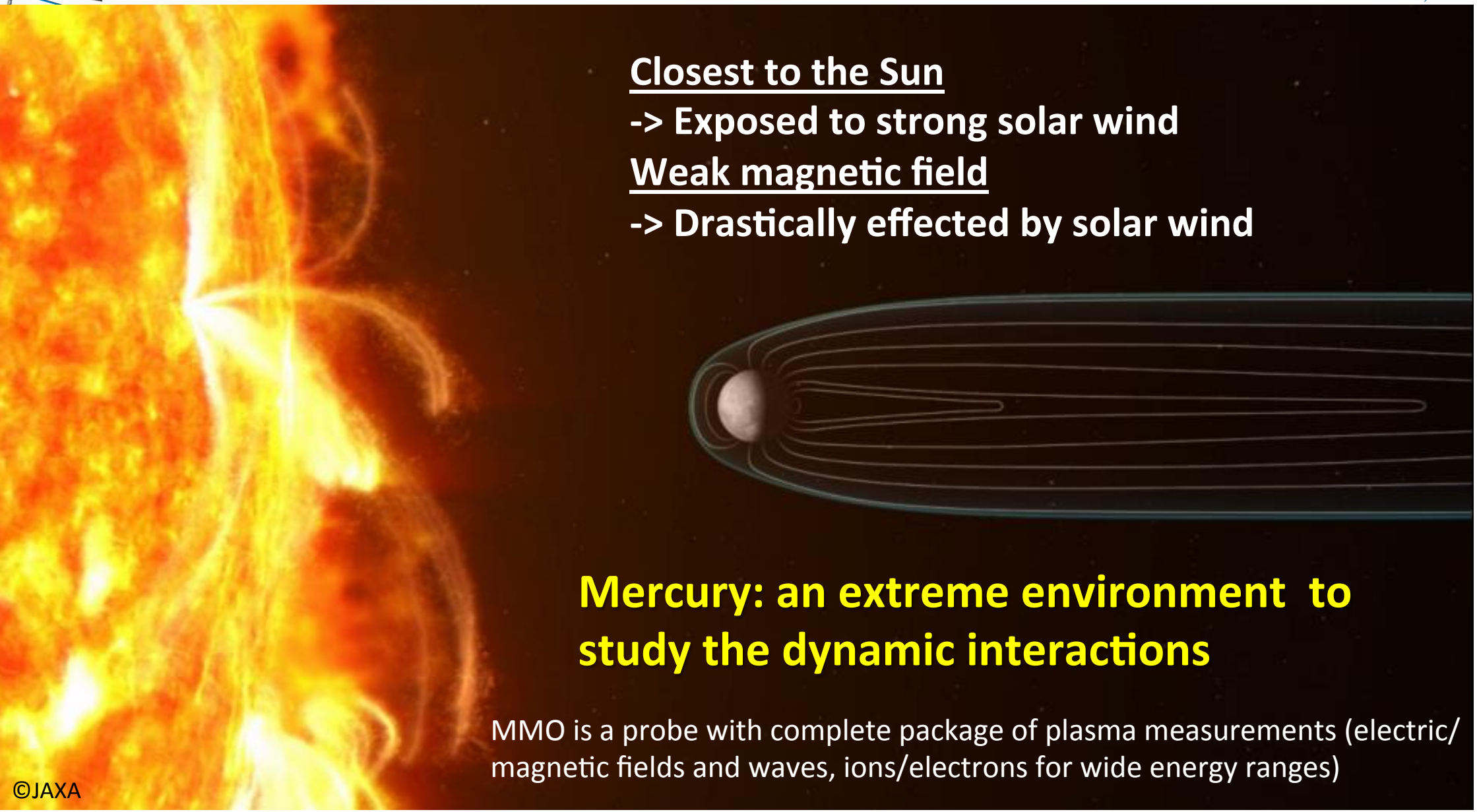
Planetary magnetosphere

ar wind: fast plasma flows
00 km/s) from the Sun

netosphere: regions
inated by planetary
netic fields against the solar
l



Mercury's magnetosphere



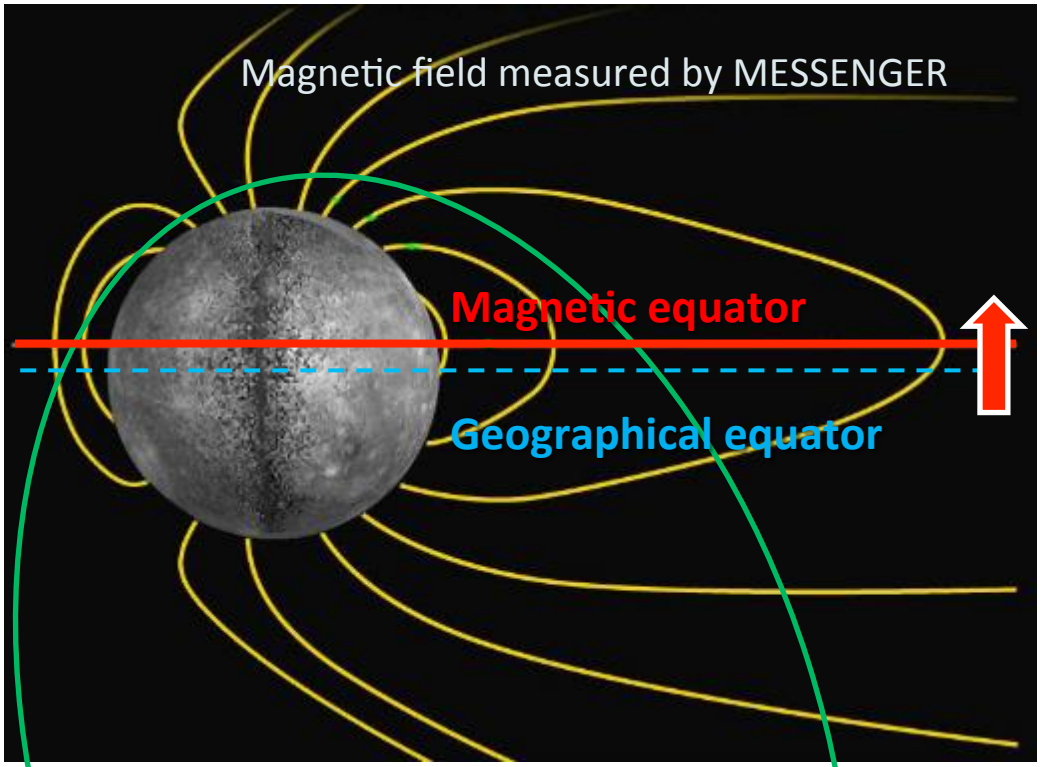
Closest to the Sun
-> Exposed to strong solar wind
Weak magnetic field
-> Drastically effected by solar wind

Mercury: an extreme environment to study the dynamic interactions

MMO is a probe with complete package of plasma measurements (electric/ magnetic fields and waves, ions/electrons for wide energy ranges)

Mercury's curious magnetic field

North ward shift (by 0.2 Mercury's radii) of the magnetic equator: why?



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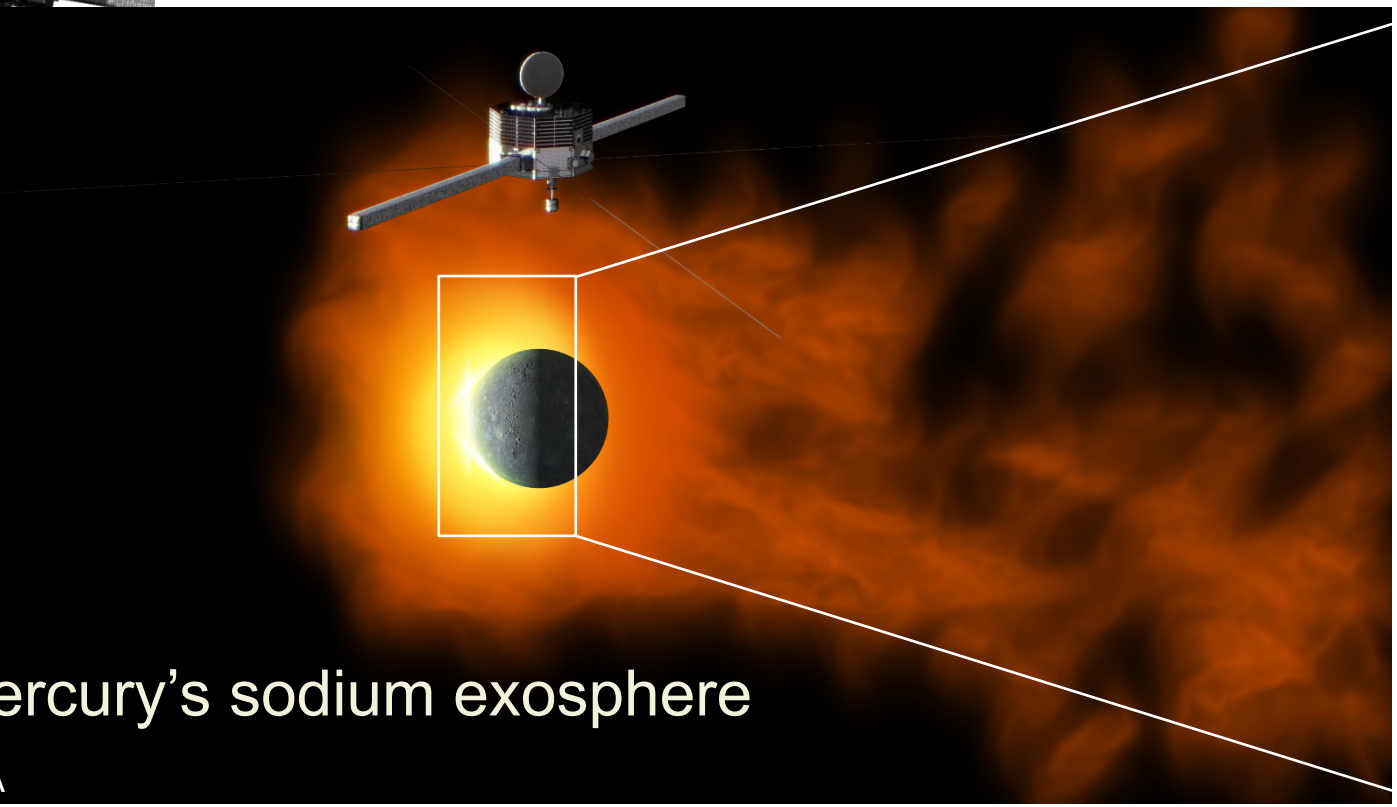
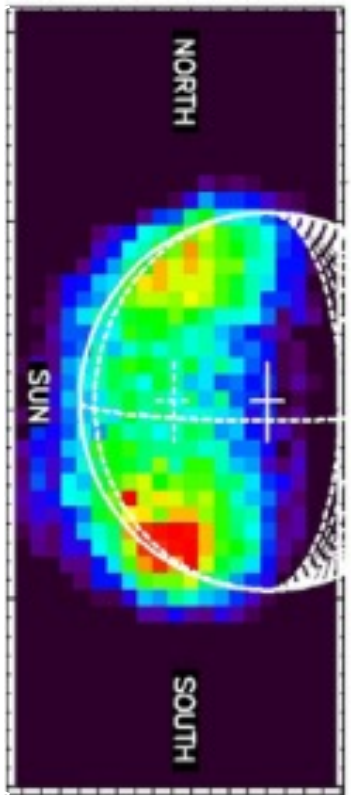
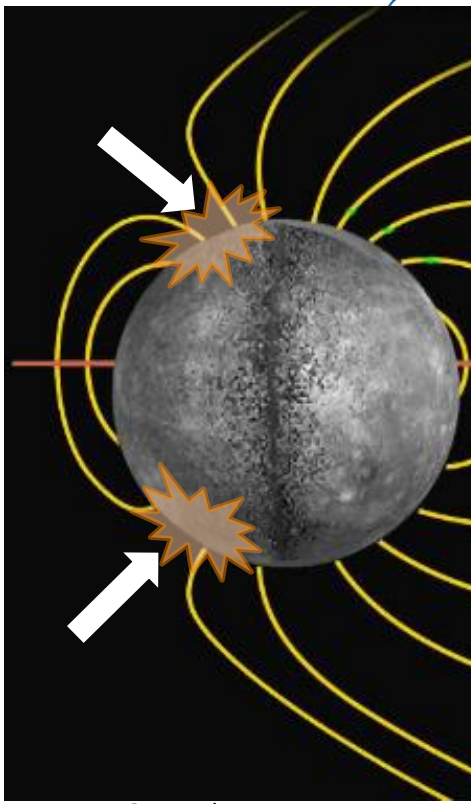
BepiColombo can
-measure the global magnetic field at b
hemispheres
-distinguish the planetary and external
fields by two spacecraft

Interaction between surface and environment





[Mangano et al., 2013]



Mercury: ©NASA/Johns Hopkins Universit
Physics Laboratory/Carnegie Institution of

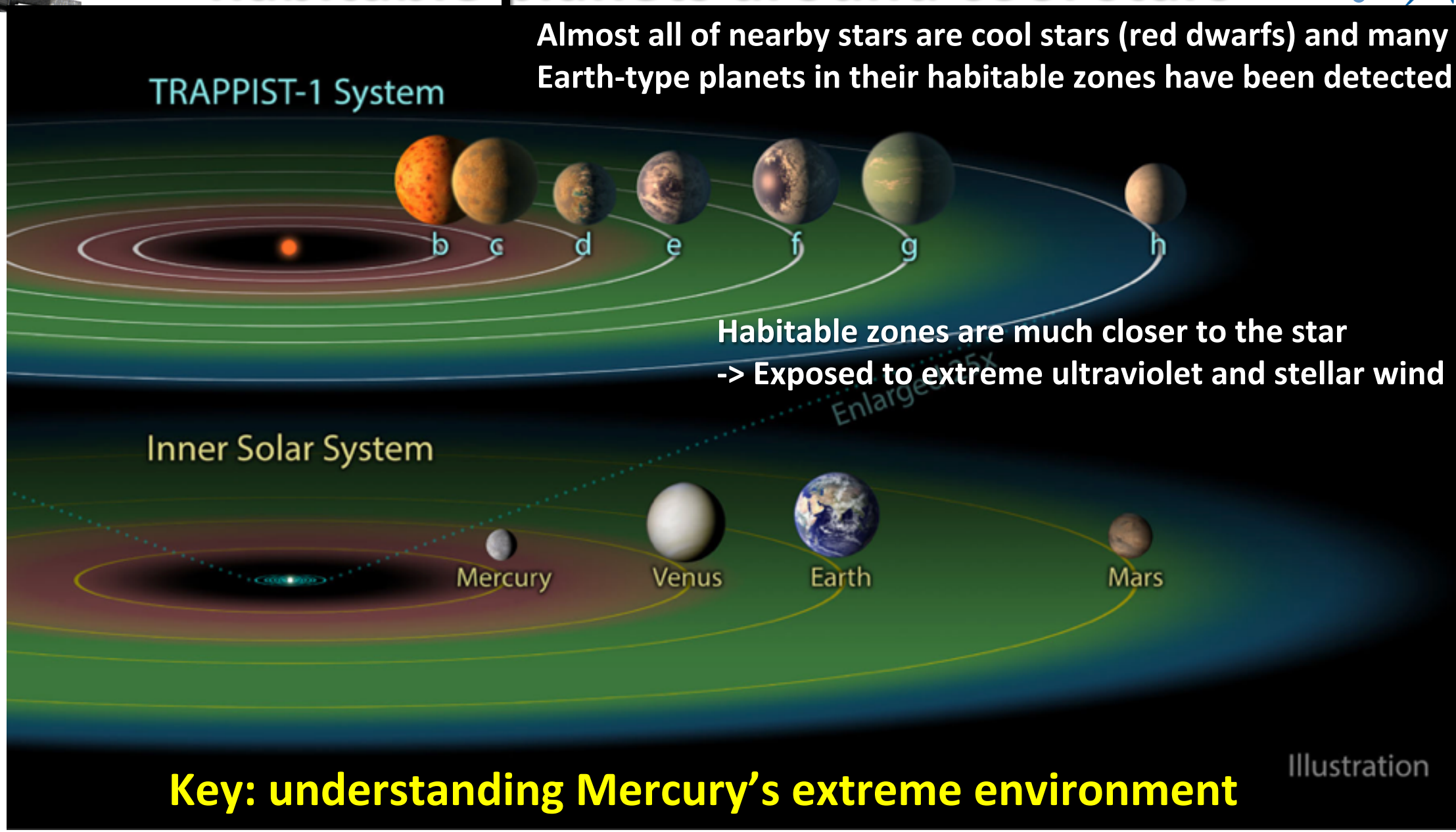
ercury's exosphere consists of heavy atoms: what is the source mechanism?

Interaction between Mercury's surface and solar wind?

MO investigates the interaction by monitoring the exosphere and ercury's environment

Science after Mercury: habitable planets around cool stars

Almost all of nearby stars are cool stars (red dwarfs) and many Earth-type planets in their habitable zones have been detected



Key: understanding Mercury's extreme environment