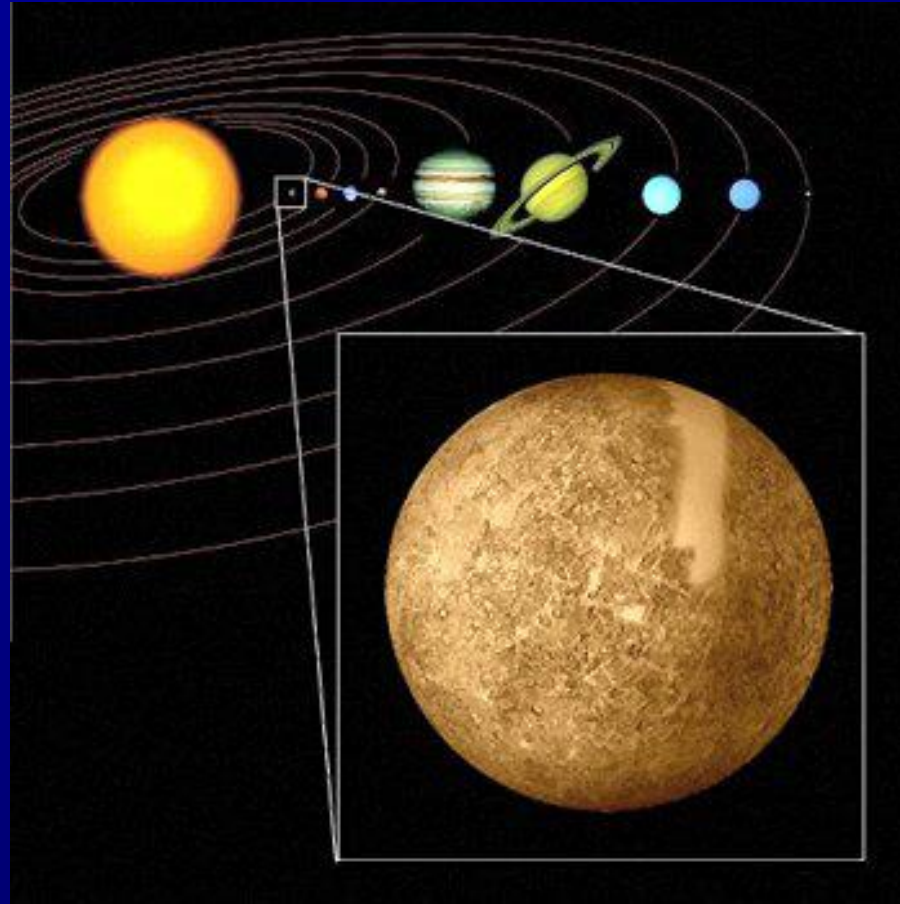


BepiColombo – Mission to Mercury

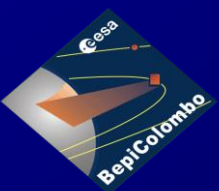


Updates

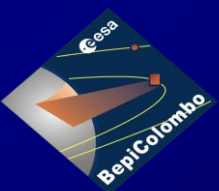
Mission

&

MPO Payload



Scientific Objectives



Origin and evolution of a planet close to the parent star

- **Mercury as a planet:**

 - form, interior, geology, composition

- **Origin of Mercury's magnetic field**

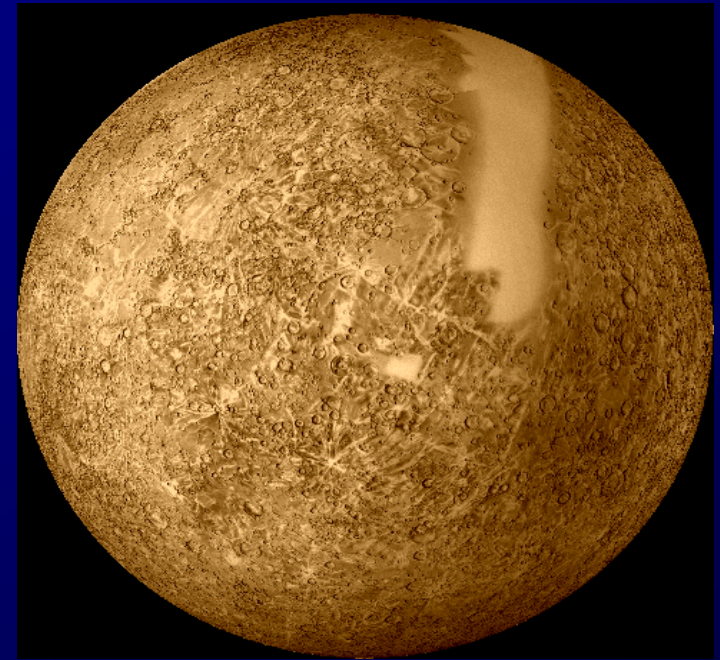
- **Exosphere:**

 - composition and dynamics

- **Magnetosphere:**

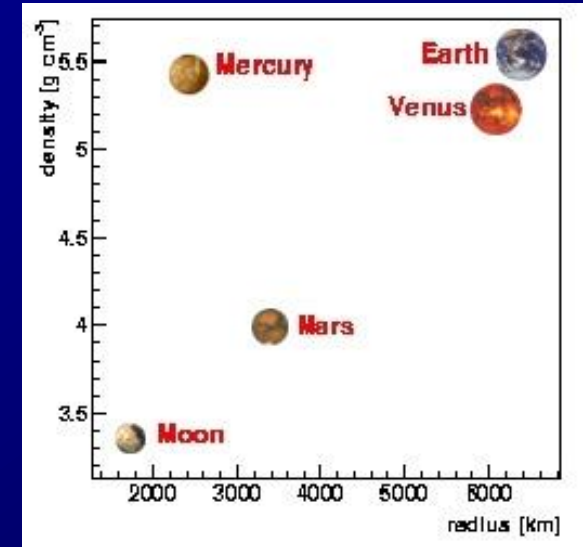
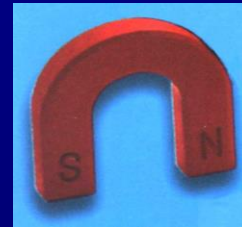
 - structure, dynamics, interaction with planet

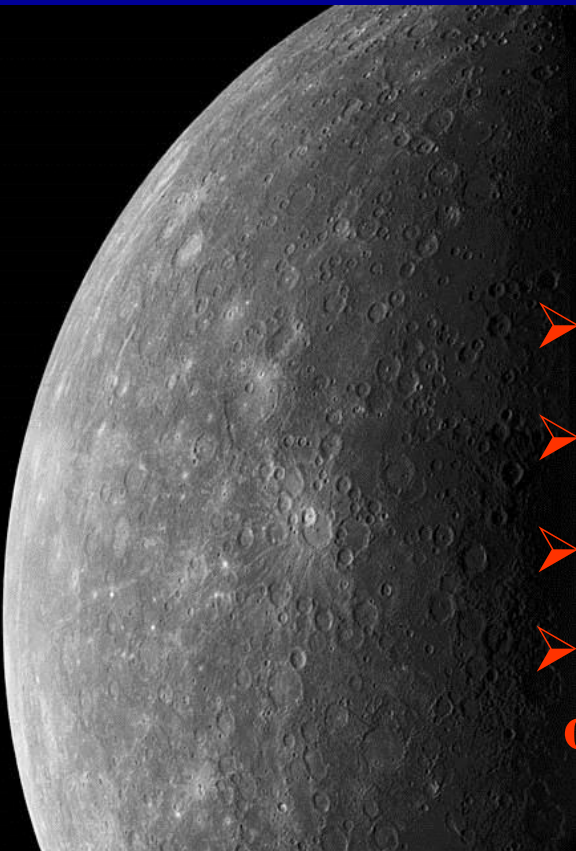
- **Relativity and Gravitational Physics**



Interior:

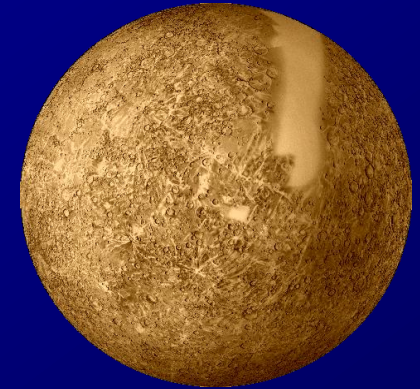
- mass, figure and moment of inertia
- chemistry of the surface
- surface heat flow
- moment of inertia factor C/MR^2
- ratio of moment of inertia factor of solid part of planet to total total moment of inertia
- second degree tidal Love number k
- map magnetic field, separation of internal/external sources





Surface:

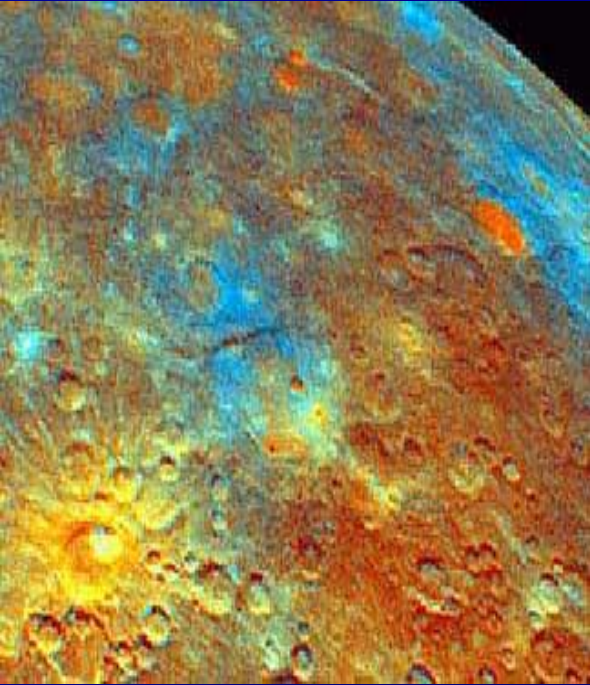
- **Map entire surface with a pixel size < 50 m**
- **Characterize main features - pixel size < 10 m**
- **Relate surface morphology to composition**
- **Map global height distribution to 10 m accuracy on 100 km scale**



Mineralogical and Elemental Composition:

- **Global surface mapping**
 - **global abundance of key elements**
 - **spatially resolved measurements of elemental abundances**
 - **identify expected minerals**
 - **abundances of detected minerals**
 - **correlate composition and features**
 - **search and identify signatures of unexpected species**

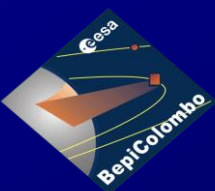
Exosphere:



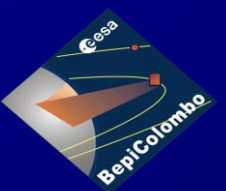
- **Composition and vertical structure**
Search for noble gases, isotopes, molecules, atoms from crustal origin
- **Dynamics**
 - day to night circulation
 - active and inactive regions
- **Surface release processes**
(e.g. regolith, meteorites, etc.)
- **Search for Ionosphere**
- **Exosphere/Magnetosphere exchange and transport processes**

Relativity and Gravitational Physics

- Test general relativity and alternative theories of gravity to a level better than 10^{-5} by measuring the time delay and Doppler shift of radio waves, and the precession of Mercury's perihelion
- Test the strong equivalence principle to a level better than $4 \cdot 10^{-5}$
- Determine the gravitational oblateness of the Sun (J_2) to better than 10^{-8}
- Set improved upper limits to the time variation of the gravitational "constant" G



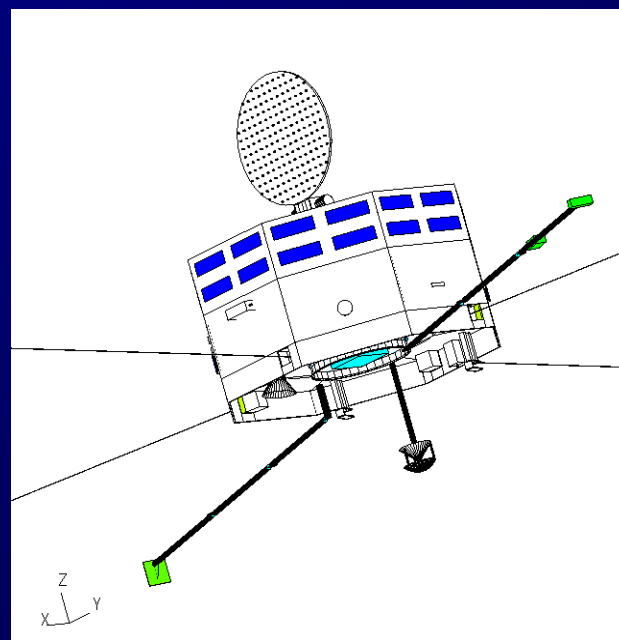
BepiColombo Elements



Mercury Planetary Orbiter

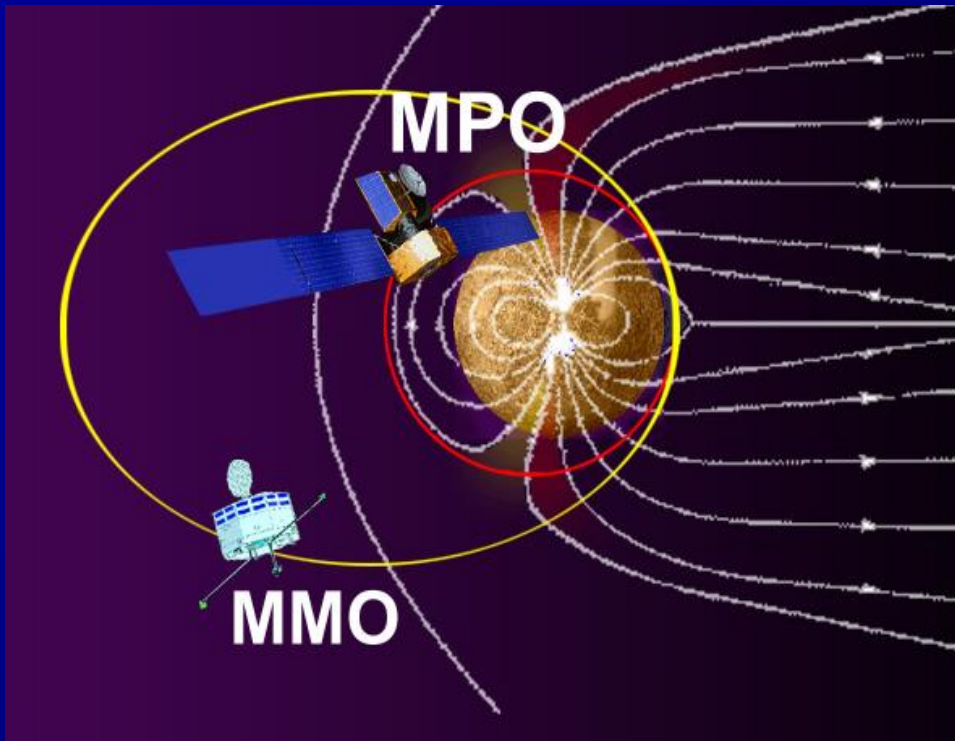


Mercury Magnetospheric Orbiter



BepiColombo

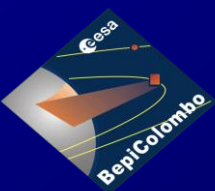
MMO & MPO on dedicated orbits



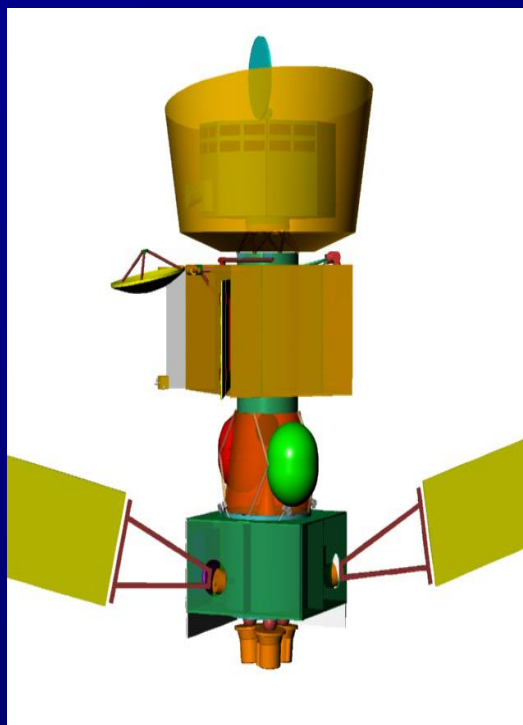
- ✓ MMO orbit optimized for study of magnetosphere
- ✓ MPO orbit optimized for study of planet itself

- High-accuracy measurements of interior structure
- Full coverage of planet surface at high resolution
- Optimal coverage of polar area
- Resolve ambiguities
 - exosphere
 - magnetosphere
 - magnetic field

BepiColombo Mission Scenario



Launch on Soyuz 2-1B/Fregat-M (13 April 2012)
Solar Electric Propulsion
Chemical Propulsion
Arrival: 4 April 2017



MMO
MPO
CPM
SEPM



Launch into high elliptical orbit

Interplanetary cruise to Mercury

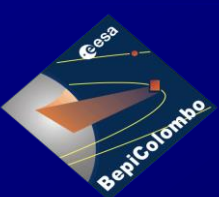
Lunar fly-by and one-year Earth-to-Earth gravity assist

2 Venus and 2 Mercury gravity assists

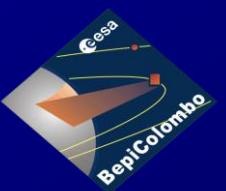
Intermediate Velocity Increment maneuvers by SEP

Low-thrust cruise adopted as baseline:

- Lower installed power mass for SEP
- Longer thrust arcs (almost constant thrusting after Venus flybys)



The MPO Payload



MPO Reference Payload

High Resolution Colour Camera }
Stereo Camera }

Limb Pointing Camera

Vis-Near-IR Mapping Spectrom.

TIR Map. Spectrom/Radiometer

X-ray Spectrom/Solar Monitor

γ-Ray Neutron Spectrometer

Ultraviolet Spectrometer

Neutral & Ion Particle Analyser

Laser Altimeter

Radio Science Experiment

Magnetometer

MMO Model Payload

Surface

Morphology
Topography
Composition
Temperature

Interior

State of Core
Core/Mantle
Composition
Magnetic Field

Exosphere

Composition
Dynamics
Surface Release
Source/Sink Balance

Magnetosphere

Structure, dynamics
Composition
Interactions



MPO Payload Selection by SPC (Nov. 2004)

BELA	Laser Altimeter	N. Thomas / T. Spohn
ISA	Radio Science Accelerometer	V. Iafolla
MERMAG	Magnetometer	A. Balogh
MERTIS	IR Spectrometer	E.K. Jessberger
MGNS or	Gamma Ray and	I. Mitrofanov
MANGA	Neutron Spectrometer	C. d'Uston
MIXS / SIXS	X-ray Spectrometer Solar Monitor	S. Dunkin J. Houvelin
MORE	Radio Science Ka-band Transponder	L. Iess
PHEBUS	UV Spectrometer	E. Chassefiere
SERENA (Elena, MIPA, PICAM, Strofio)	Neutral Particle Analyser/ Ion Spectrometers	S. Orsini
SIMBIO-SYS (HIRC, STC, VIHI)	High Res.+ Stereo Cameras visual and NIR Spectrometer	E. Flamini

