BepiColombo on its cruise to Mercury – Status, results and upcoming activities

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Introduction:

Launched on 20 October 2018 from the European spaceport Kourou in French Guyana it has successfully performed several flybys (at Earth, twice at Venus and Mercury). BepiColombo with its state of the art and very comprehensive payload will perform measurements to increase our knowledge on the fundamental questions about Mercury's evolution, composition, interior, magnetosphere, and exosphere [1]. BepiColombo consists of two orbiters, the Mercury Planetary Orbiter (MPO) and the Mercury Magnetospheric Orbiter (Mio) and is a joint project between the European Space Agency (ESA) and the Japanese Aerospace Exploration Agency (JAXA).

Cruise status:

Since the two spacecraft are in a stacked configuration during the cruise only some of the instruments will perform scientific observations. Mio and MPO are connected to each on-top of the Mercury Transfer Module (MTM). The MTM contains a solar electric propulsion engine and will bring the two spacecraft to Mercury. In late 2025, this 'stack' configuration is abandoned, the MTM will be jettisoned, and the individual elements spacecraft are brought into their final Mercury orbit: 480x1500km for MPO, and 590x11640km for Mio.

Despite the reduced instrument availability, scientific and engineering operations has been scheduled during the cruise phase, especially during the swing-bys. BepiColombo has finished more than 50% of its about seven year-long cruise-phase. Through the first two flybys of Mercury, it has obtained valuable measurements achieved at very unusual geometry and distances

Recent Results from Venus flybys #1 and #2:

Recently, [2] reported on results obtained during the second Venus flyby of BepiColombo with several instruments onboard of both spacecraft MPO and Mio which offered a unique opportunity to make a complete tour of one of the few gas-dynamics dominated interaction regions between the supersonic solar wind and a Solar System object. These rare multipoint synergistic observations and stable conditions experimentally confirm what was previously predicted for the barely explored stagnation region close to solar minimum. It was shown that the atmosphere of Venus, despite being non-magnetized can withstand the solar wind under low dynamic pressure.

Results from Mercury flybys #1 and #2:

Mercury's southern inner magnetosphere is an unexplored region as it was not observed by earlier space missions. BepiColombo SERENA instrument ion sensors could perform measurements when the spacecraft passed through this region during its first flyby and found that the dayside magnetopause and bow-shock crossing were much closer to the planet than expected, a signature of a highly eroded magnetosphere [3]. The valuable scientific observations obtained during the flyby are still under investigations and further results are to be expected in the coming years.

During the second flyby of Bepicolombo in 2022, images of the surface of Mercury were obtained through the Monitoring Cameras, Figure 1 and 2. The BepiColombo Science working Team took the opportunity of the second flyby to name a new feature on the surface, challenger rupes.

Next activities:

While continuing its cruise, observation of Mercury's surface and its environment are scheduled. The flyby is scheduled to happen on June 20th of this year with observations done by numerous sensors onboard the spacecraft

During the conference, a status of the mission and instruments, science operations plan during cruise, and first results of measurements taken in the first four years since launch will be given.

References:

[1] Benkhoff et al., SSRV, 2022, [2] Persson et al., Nature communications, 2022, [3] Orsini et al., Nature communications, 2023

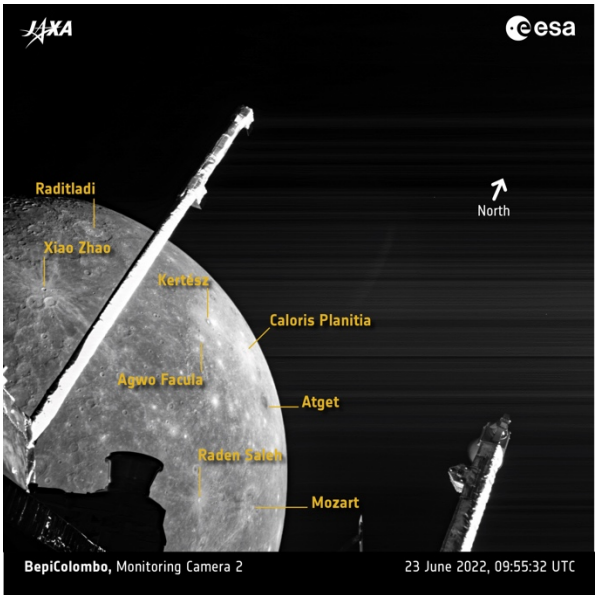

Figure 1: Monitoring Camera (MCAM) view of the Caloris Basin from the second flyby of BepiColombo.

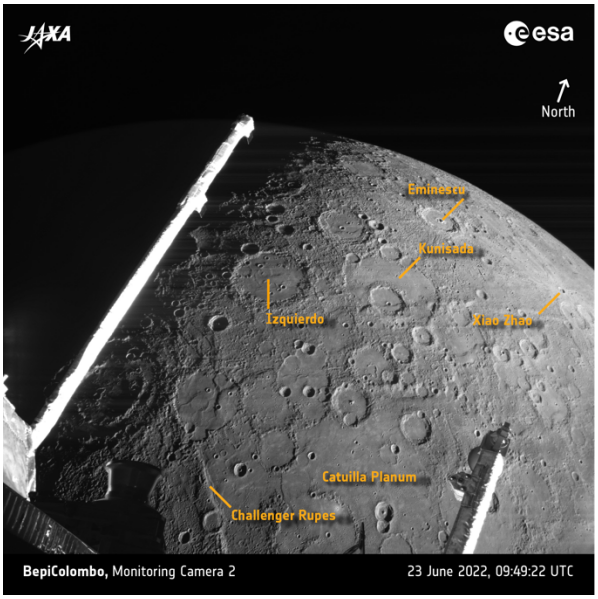

Figure 2: Monitoring Camera (MCAM) view of the newly named Challenger Rupes from the second flyby of Bepi-Colombo.