

UNVEILING MERCURY'S MYSTERIES WITH BEPICOLOMBO

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Abstract

NASA's MESSENGER mission has fundamentally changed our view of the innermost planet. Mercury is in many ways a very different planet from what we were expecting. Now BepiColombo [1] has to follow up on answering the fundamental questions that MESSENGER raised and go beyond.

1. Introduction

BepiColombo is a joint project between ESA and the Japanese Aerospace Exploration Agency (JAXA). The Mission consists of two orbiters, the Mercury Planetary Orbiter (MPO) and the Mercury Magnetospheric Orbiter (MMO). The mission scenario foresees a launch of both spacecraft with an ARIANE V in October 2018 and an arrival at Mercury in 2025. From their dedicated orbits the two spacecraft will be studying the planet and its environment. The mission has been named in honor of Giuseppe (Bepi) Colombo (1920–1984), who was a brilliant Italian mathematician, who made many contributions to planetary research, celestial mechanics, including the development of new space flight concepts

2. Science goals of BepiColombo

BepiColombo will study the composition, geophysics, atmosphere, magnetosphere and history of Mercury, the least explored planet in the inner Solar System. In particular, the mission objectives are: • to understand why Mercury's density is markedly higher than that of all other terrestrial planets, Moon included • to understand and determine the status of the core of Mercury, and if the planet is still tectonically active today • to understand Mercury's magnetized environment and its intrinsic magnetic field • to investigate the permanently shadowed craters of the Polar Regions • to study the production mechanisms of the exosphere and to understand the inter-action between planetary magnetic field and the solar wind in the absence of an ionosphere • to obtain new clues about the composition of the primordial solar nebula

and about the formation of the solar system and • to test general relativity with improved accuracy, taking advantage of the proximity of the Sun.

In addition, the BepiColombo mission will provide a rare opportunity to collect multi-point measurements in a planetary environment. This will be particularly important at Mercury because of short temporal and spatial scales in the Mercury's environment. The foreseen orbits of the MPO and MMO will allow close encounters of the two spacecraft throughout the mission. Such intervals are very important for the inter-calibration of similar instruments on the two spacecraft.

3. Instruments

The MPO scientific payload comprises eleven instruments/instrument packages; The MMO comprises five instruments/instrument packages to study of the environment. Together, the scientific payload of both spacecraft will provide the detailed information necessary to understand Mercury and its magnetospheric environment and to find clues to the origin and evolution of a planet close to its parent star. The MPO will focus on a global characterization of Mercury through the investigation of its interior, surface, exosphere and magnetosphere. In addition, it will be testing Einstein's theory of general relativity. Major effort was put into optimizing the scientific return by defining the payload complement such that individual measurements can be interrelated and complement each other. The MMO will focus on studying the environment around Mercury. The BepiColombo mission will complement and follow up the work of NASA's MESSENGER mission by providing a highly accurate and comprehensive set of observations of Mercury.

References

[1] Benkhoff, J., et al.: Planet. Space Sci. Vol.58, pp. 2-20, 2010.