

# The BepiColombo Mercury Imaging X-ray Spectrometer: science goals, instrument performance and operations.

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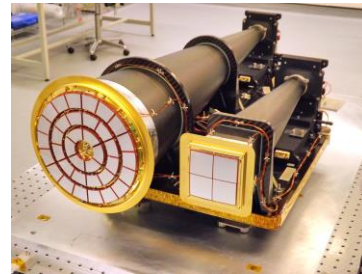
## Abstract

Following the successful launch of the ESA/JAXA BepiColombo spacecraft in October 2018, we are now looking forward to a new mission to Mercury beginning in 2025. This mission will follow on from, and build upon, the various scientific findings of the successful NASA MESSENGER mission which orbited the planet from 2011-2015. The BepiColombo stack is carrying two spacecraft whose payloads are specifically designed for comprehensive exploration of the planet Mercury and its surrounding space environment.

The Mercury Imaging X-ray Spectrometer (MIXS) is a novel instrument that has been designed to measure X-ray emissions from the surface of the planet. On the dayside, MIXS will remotely sense fluorescent X-rays produced through interaction between solar X-ray photons and individual surface atoms. This technique reveals the details of the planet's elemental composition on global and local scales. The MIXS instrument is capable of both spectroscopy via a collimator (MIXS-C), and true imaging at X-ray wavelengths using a focusing telescope (MIXS-T). In addition to the main scientific focus of the instrument described above, MESSENGER results have shown that the interaction of charged particles with the surface also produces characteristic X-ray emission (e.g. Starr et al. [2012], Lindsay et al., [2016]). Therefore observations of nightside (unlit) regions of the planet will reveal the structure and dynamics of the magnetosphere through the impact and interaction of magnetospheric particles with Mercury's surface.

Here we will describe the scientific goals and novel design of the MIXS instrument in the context of our existing knowledge - as derived from observations undertaken by NASA's MESSENGER spacecraft (see e.g. Solomon et al. [2018]). We will also present results of the scientific performance of MIXS

resulting from calibration campaigns prior to launch, and from preliminary commissioning. Finally, we will describe the plans for the scientific operation of the instrument once in orbit at Mercury.



**Figure 1: The MIXS flight model**

**BepiColombo MIXS Science Team**

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**Table 1: MIXS Science Team**

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