Thesis subject

Laboratory: Laboratoire d'Astrophysique de Marseille

Thesis supervisor: Olivier Groussin (HDR)

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Title of the thesis subject: Thermal properties and surface geomorphology of Mercury from the Bepi-Colombo mission data

Description of the thesis subject:

Mercury, the innermost planet in our solar system, is an extreme case in planetary formation and evolution. It offers a unique analog for many exoplanets that orbit close to their stars. It is the smallest and densest planet, with one of the oldest preserved surfaces, which has been shaped by impacts and space weathering. Despite its importance in understanding the early conditions of terrestrial planet formation, Mercury remains the least explored telluric planet. To date, only two NASA missions have visited Mercury: Mariner 10 (1974-1975) and MESSENGER (2011-2015). Our understanding of Mercury's origin and evolution is therefore limited. Its surface thermal properties, mineralogical composition and spatial variation remain largely unknown, as does their relation to geological structures.

The ESA-JAXA Bepi-Colombo mission (2026-2029) will provide an unprecedented dataset on Mercury. The mission will arrive at Mercury in December 2026, at the beginning of this thesis. This thesis aims to study Mercury's surface geomorphology (mainly craters) and thermal properties by making full use of data from two Bepi-Colombo instruments: 1) MERTIS, a thermal (7 – 14 μm) infrared spectro-imager, and 2) SYMBIO-SYS, an imaging and spectroscopic instrument in the visible and near-infrared (0.4 – 2.0 μm). The two co-directors of this thesis are Co-Investigators on MERTIS (O. Groussin) and SYMBIO-SYS (L. Jorda), ensuring direct access to the data.

The research for this thesis will be conducted at the Laboratoire d'Astrophysique de Marseille. Working with unique and recent data from a space mission and exploiting it scientifically within an international team of world-leading experts, would be a valuable experience for a student. This thesis offers an excellent opportunity to gain in-depth knowledge of space mission data analysis and develop an international network in this field — a great foundation for a future career in planetary science.

References:
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Hiesinger, H. et al. SSR 216 (2020) – https://link.springer.com/article/10.1007/s11214-020-00732-4