



UNIVERSITÀ  
DI TRENTO

Dipartimento di  
Fisica

# PhD Program in Space Science and Technology - SST

## The exploration of Solar System's innermost planet: Mercury from Mariner 10 to BepiColombo

**Specific Seminar – Curriculum 3**  
**2025, June 24, 11 a.m.**

### Speaker:

Dr. Fabrizio Capaccioni - INAF – Istituto di Astrofisica e Planetologia Spaziali

### Abstract:

Mercury is a planet of extremes: it is the smallest yet most dense, with a disproportionately large iron core. As the closest planet to the Sun, surface temperatures exceed 700K, yet ice exists in permanently shadowed polar craters. It follows the most eccentric orbit and is uniquely locked in a 3:2 spin-orbit resonance. Despite its scientific significance, only two NASA missions have visited it: Mariner 10 in the 1970s, which observed about half the planet and discovered its magnetic field and high core-to-mantle ratio, and MESSENGER, which revealed widespread volcanism, a secondary crust, pyroclastic deposits, and surface “hollows” likely formed by volatile loss. MESSENGER also found unusual elemental compositions (e.g., high sulfur, low iron and titanium), supporting a formation from highly reduced materials. The presence of graphite may explain Mercury’s low reflectance and extensive tectonic scarps. Topographic features suggest large-scale changes occurred after early geological evolution. Earth-based radar and MESSENGER data indicate ice mixed with dust in permanently shadowed regions. Mercury’s internal structure includes a silicate crust and mantle, a solid iron-sulfide layer, and a partially liquid iron-rich core. MESSENGER answered many questions but left others open. The BepiColombo mission, a joint ESA–JAXA effort launched in 2018 and set to begin operations in 2027, will provide deeper insight into Mercury’s surface, interior, magnetosphere, and test general relativity.

### Online attendance:

ID riunione: 864 4144 0064

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Link di invito <https://unitn.zoom.us/j/86441440064?pwd=WQPfpvvhBv66xbWNCjxeEbSNLZKOid.1>

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