UNIVERSITÀ DEGLI STUDI DI PADOVA

CISAS G. COLOMBO

METHODS OF ANALYSIS FOR PLANETARY SURFACES AND LIBRATIONS

Scuola di Dottorato in Scienze Tecnologie e Misure Spaziali (STMS)
Curriculum: Misure Meccaniche per l'ingegneria e lo Spazio (MMIS)
Cicle XXXIV

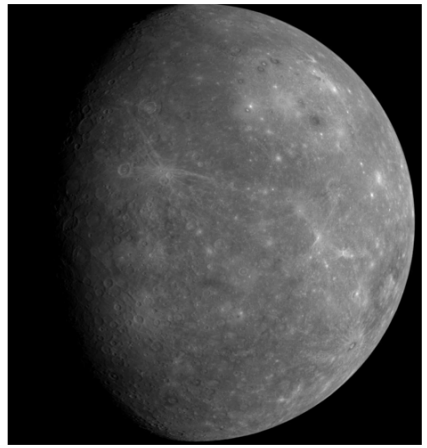
PhD Candidate:

Nicolò Borin

Index

- BepiColombo Mission
- BepiColombo Instruments
- Stereo Vision
- Research Proposal and tasks

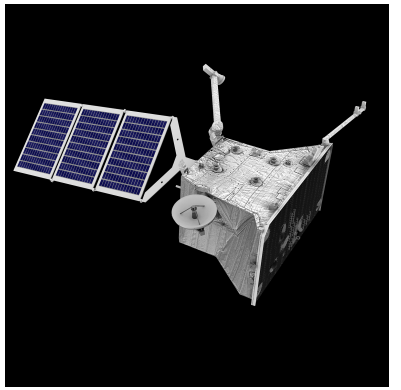
BepiColombo Mission



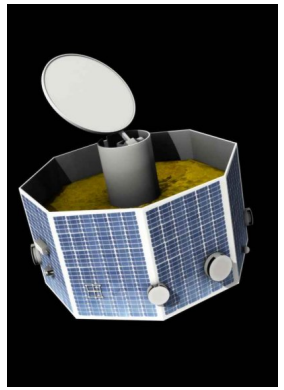
- **Collaboration between ESA and JAXA, launch 2018, arrival 2025**

- **Scientific goal: exploration of Mercury**
  - Geology
  - Volcanism
  - Origin of the planet
  - Nucleus of the planet
  - …

- **Two spacecrafts:** Mercury Planetary Orbiter MPO (ESA)
  Mercury Magnetospheric Orbiter MMO (JAXA)



MPO

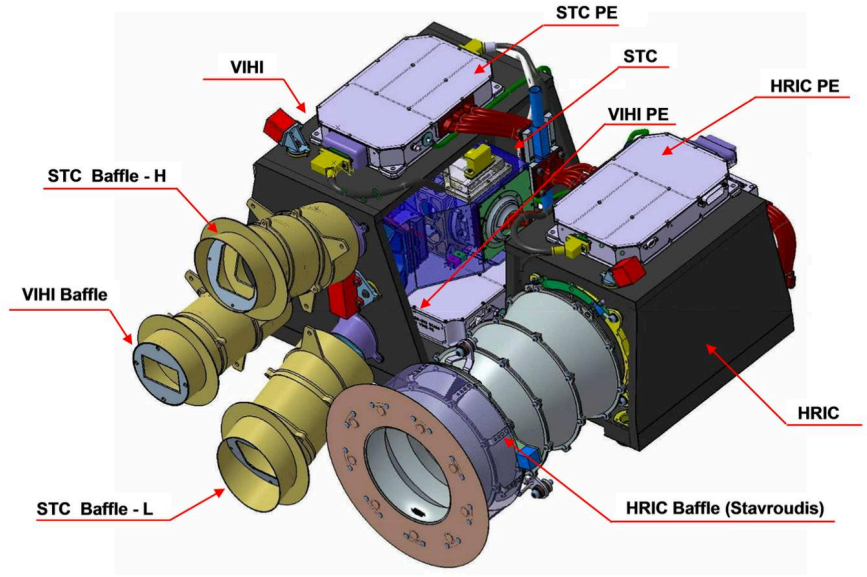


MMO

BepiColombo Instruments

- **Instruments:**

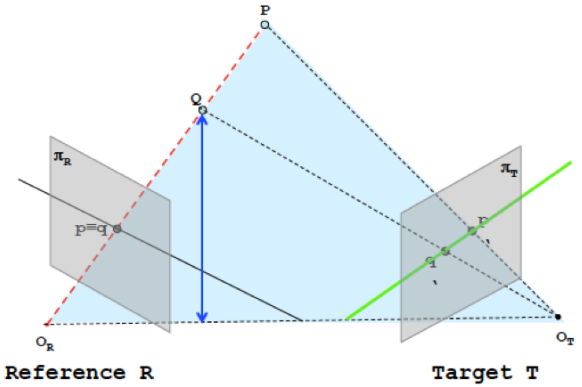
➢ Camera SIMBIO-SYS
  1. High Resolution Imaging Camera (HRIC)
  2. Stero Camera (STC)
  3. Visual and Infrared Hyper-Spectral Imager (VIHI)
➢ Accelerometer ISA
➢ Ultraviolet Spectrometer PHEBUS
➢ Laser Altimeter BELA
➢ …

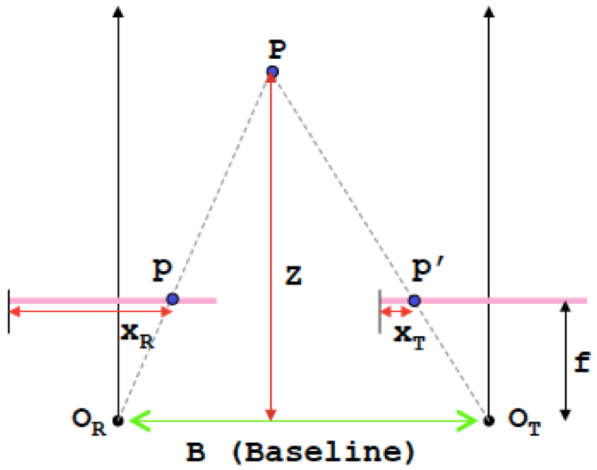


Stereo Vision

- Technique aimed at inferring depth from two or more cameras
- With two (or more) cameras is possible to infer depth, by means of **triangulation**, if it is possible to find corresponding points in the two images
- Alternatively, it is possible to use the same camera from two different points

Depth: $$Z = \frac{b \cdot f}{x_R - x_T} = \frac{b \cdot f}{d}$$



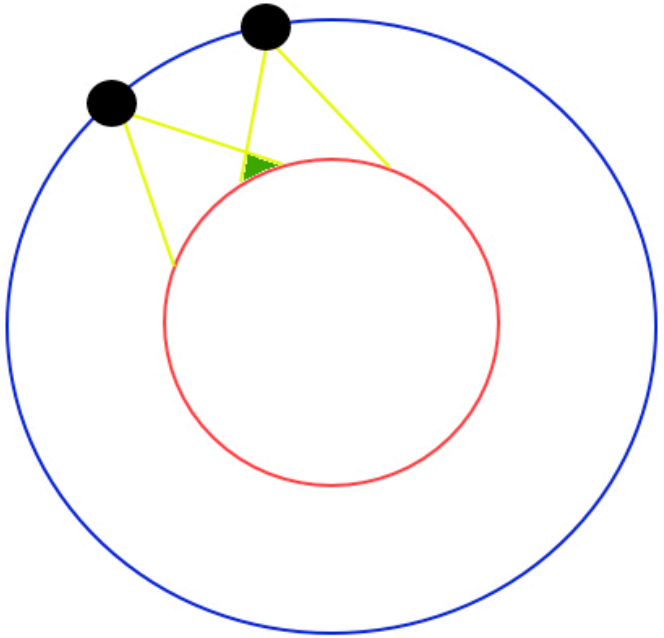


The Research: 3D model and Librations

- Acquiring 3D model of the surface with the HRIC (better performance)

- Librations: perceived oscillating motion of orbiting bodies relative to each other

- Studying the libration using the movements of markers on the surface



Tasks

- **Stereo Vision:** validation of methods and algorithms for the 3D mapping of the surface of planets
- **Libration:** calculate a model capable of describing the libration phenomenon on Mercury
- **Estimation of errors:** estimate the parameters and tolerances of the camera and the orbit for achieving the best image quality

Thank you for the attention

Questions?