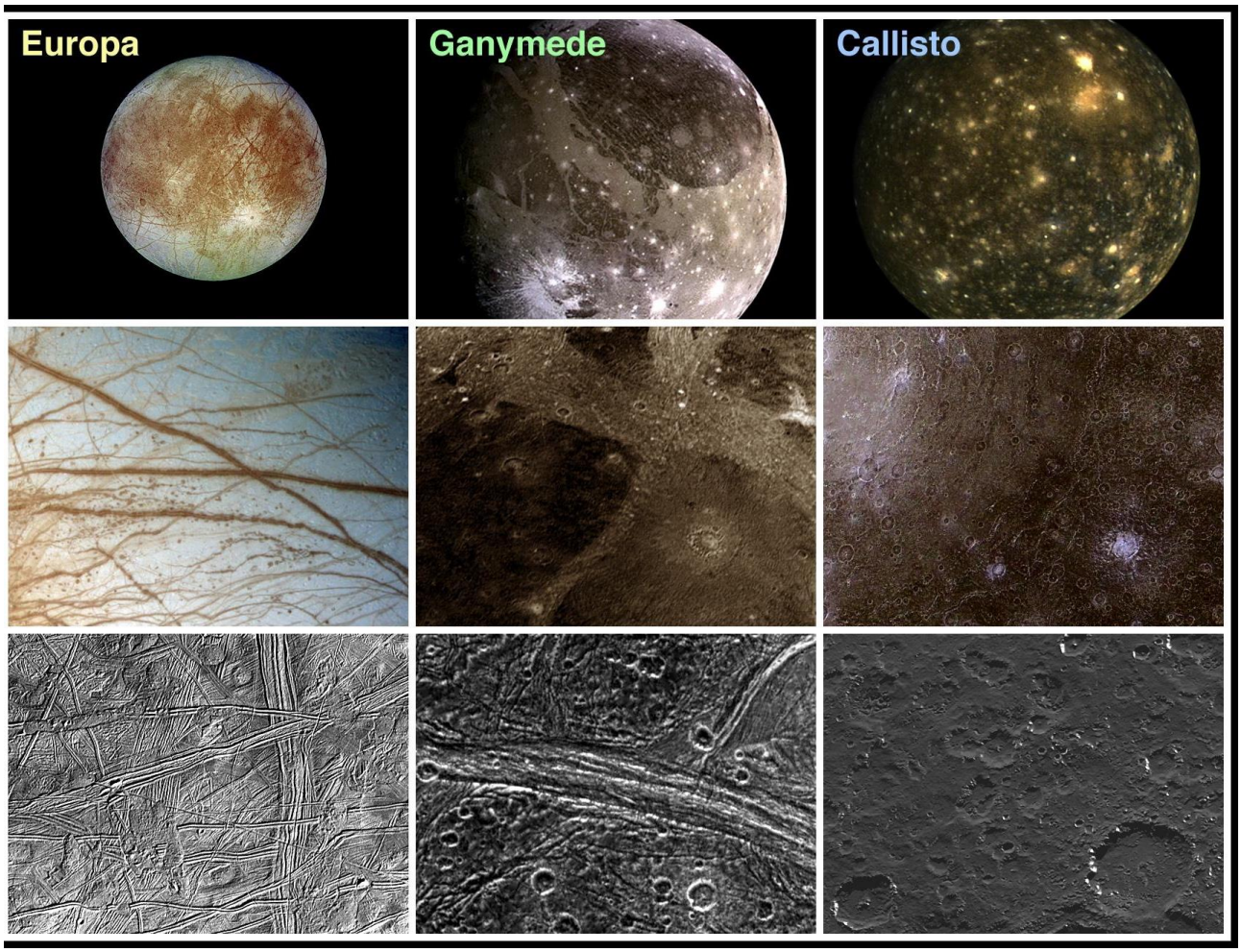
Geological and Structural Evolution of Icy Satellites
(Proposers : prof. Matteo Massironi UNIPD, Dr. Alice Lucchetti INAF-OAPD)

The icy satellites of the outer Solar System display a remarkable diversity of surface geology, shaped by complex endogenous and exogenous processes. These bodies are also prime astrobiological targets, as many are considered “ocean worlds” with potential subsurface oceans. The Ph.D. project aims to conduct a comprehensive comparative analysis of these satellites to identify both common and distinctive geological processes driving surface evolution. Through detailed geomorphological and structural analyses, the project will develop tectonic models to understand stress fields, surface deformation, and fluid circulation mechanisms. It is foreseen detailed geological mapping to distinguish terrain types and reveal active surface processes and 3D geo-modeling that, from accurate satellite topography, will enable the reconstruction of subsurface geology. The research approach combines structural geology, remote sensing and 3D geo-modeling methods, including cartography of geological features using remote sensing data, statistical analysis of spatial and geometric properties, reconstruction of past stress and deformation patterns, 2D and 3D modeling of structural evolution and deformation. By integrating multidisciplinary approaches and leveraging data from past space missions, this research will advance our understanding of the geodynamic evolution of icy satellites, providing critical insights for future exploration missions.



The Ph.D. candidate is expected to develop new approaches for structural analysis on planetary surfaces and should be proficient in remote sensing, GIS, digital mapping, and 3D modelling software. Familiarity with programming languages (Python, MATLAB) and statistical techniques for structural analysis will be beneficial. Experience in geological mapping and teamwork within

international research collaborations is highly desirable.

The candidate will actively participate in the ESA JUICE mission, contributing to target selection and operational planning.

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