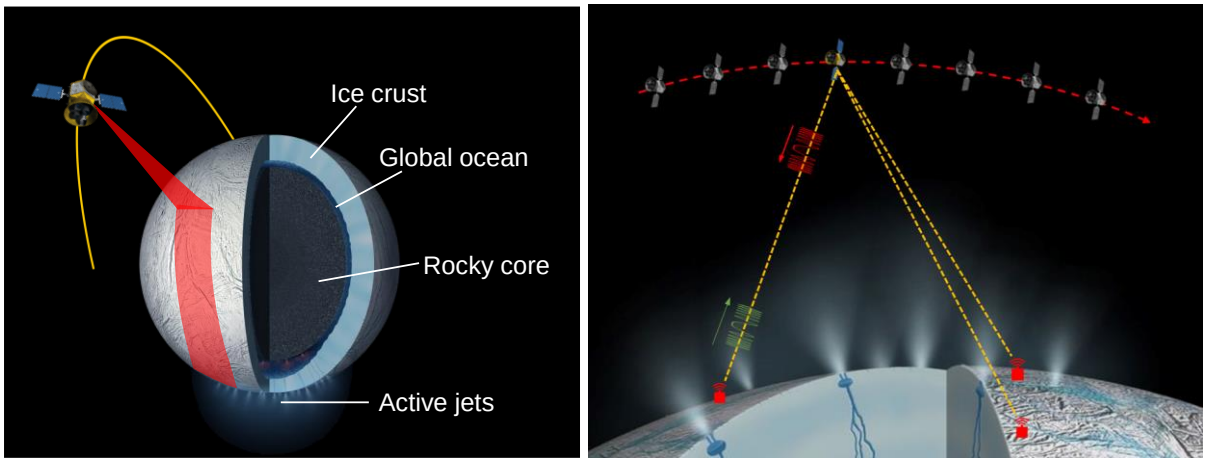
PhD Position

Radar-Based Orbit Determination and Navigation for Planetary Exploration in the Frame of an Enceladus Mission

Telecommunications Engineering, Electrical Engineering, Computer Science,
Physics, Mathematics



Saturn's icy moon Enceladus is a primary target for future exploratory missions. Radar systems are key instruments used in planetary observations and offer a great potential for improving the orbit determination and navigation beyond classical navigation concepts for planetary missions.

Starting date
Immediate

Duration of contract
3 years

Remuneration
According to TV-L 13

Your mission:
Saturn's moon Enceladus is one of the primary targets for future planetary exploration missions. One of the key questions is to determine the habitability of Enceladus, in particular of its sub-glacial ocean. Important observables to constrain the habitability are the geophysical properties of Enceladus, e.g., the thickness of the ice crust, the surface and subsurface composition of the ice crust, the tidal deformation, the topography, and many more. Measuring those observables using radar imaging, optical imaging, altimetry, or gravity measurements potentially requires a very accurate knowledge of the spacecraft position along its orbit and precise navigation. In Earth observation, GNSS allows a highly accurate positioning of satellites. For planetary applications, spacecrafts are classically tracked from Earth, resulting in rather coarse localization and navigation solutions, due to the large distance between the spacecraft and Earth.

The PhD is in the frame of a joint project between FAU Erlangen, TU Berlin, and DLR that is hosted by the German Space Agency at DLR, targeting a mission concept for Enceladus. The goal of the PhD is to develop novel approaches for using radar imaging systems to drastically improve the orbit determination and navigation of spacecrafts in planetary missions compared to classical solutions. The main aim is to exploit radar measurements between the spacecraft and small radar transponder beacons on the surface of Enceladus that are developed within the fame of the project. Beyond, also the use of synthetic aperture radar (SAR) imagery and more advanced techniques like SAR interferometry are to be investigated. This will allow an accurate localization of the spacecraft. The developed concepts will be tested in several measurement campaigns using DLR's airborne radar sensor F-SAR and potentially also radar satellites.

The work entails the following main tasks:

- Literature research on general orbit determination concepts in planetary missions, radar transponder concepts, radar-based (SAR, InSAR) concepts, as well as relevant signal processing approaches
- Development of radar processing approaches for the transponder-based methods
- Support in the conceptional development of the radar transponder beacons with colleagues from FAU Erlangen
- Development of orbit determination approaches using SAR and InSAR methods
- Development of a combined framework for radar-based orbit determination and navigation
- Design, planning, and execution of measurement campaigns as well as processing and analysis of the data
- Documentation of results in form of software and technical notes
- Presentation of the results on national and international conferences, as well as publishing in scientific journals

Your qualifications:

- experience with scientific programming languages (e.g., Python or C)
- good knowledge of English (written and oral)
- knowledge of radar theory and processing is beneficial

Your benefits:

Room for developing creative tasks and abilities in a dynamic and challenging hi-tech environment.

Location: DLR Oberpfaffenhofen (Germany)

Contact:

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