Radar, or radio detection and ranging, has been crucial in planetary science. It involves transmitting an electromagnetic signal to a target, with the reflected signal providing data on the target's distance, size, properties, and velocity. Radars on Earth are used for a variety of purposes, from scientific research to defense. Antennas on moving platforms, such as aircraft, detect distant targets, while Ground-Penetrating Radars (GPRs) are designed for subsurface detection, with penetration ranging from a few meters to several tens. Radio telescopes also image space objects, such as Near-Earth Objects (NEOs), for trajectory and collision assessments. Though the basic radar principles remain consistent, parameters like frequency and waveform shape vary depending on the application.

During my PhD, I'm focusing on analyzing radar data from two areas: MARSIS observations of Mars and radar data of NEOs collected by ground-based telescopes.
The Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) is aboard the Mars Express spacecraft, which has been orbiting around MARS for more than 20 years. Its main goal is investigating the subsurface of the planet, looking for the possible presence of liquid water.
The ESA project "NEO Observation Concepts for Radar Systems" aims to define the functional requirements for a planetary radar system, both for scientific and planetary defense purposes.

In this context, my work involves processing raw radar data to produce highly focused 2D and 3D images of the regions of interest. Classical seismic data analysis techniques, along with Range-Doppler and Microwave Tomography (MWT) algorithms, are tested and evaluated on the investigated domain to determine the most effective approach for each scenario.
Building a highly reliable 3D reflectivity map of a target is essential for understanding its nature—its shape, size, and major components. my research contributes to a deeper understanding of Mars' subsurface structure and improves ground-based radar observations of asteroids, enhancing our ability to characterize these celestial bodies with greater accuracy.