Freie Universität Berlin

Einladung zum Vortrag

Radargrammetry of Titan and the Moon

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Der Vortrag dauert 45 min und findet in englischer Sprache statt.

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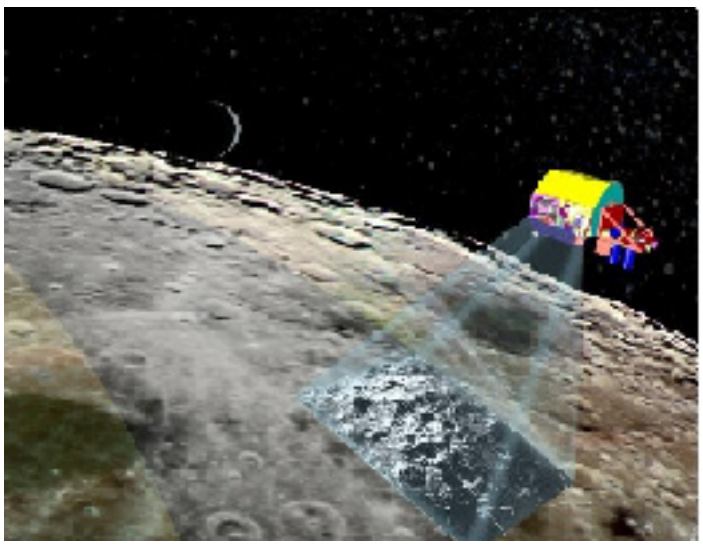
Synthetic Aperture Radar (SAR) can provide useful images where passive optical imaging cannot, either because the microwaves used can penetrate atmospheric clouds, because active imaging can “see in the dark”, or both. These abilities have led to the use of SAR on several planetary missions, beginning with the Magellan Venus orbiter. More recent instruments have flown on Cassini at Titan (RADAR), and the Chandrayaan-1 and LRO lunar orbiters (Mini-RF). As participants in these missions, we have developed radargrammetry software and techniques and used them to map the Solar System’s darkest and cloudiest places. Radargrammetry -- the science of making geometric measurements from SAR images, analogous to photogrammetry -- yields digital topographic models (DTMs) from stereopairs, and can improve the positional accuracy of map products by bundle adjustment to ground control (usually derived from global altimetry data) and orthorectification to remove parallax distortions. To achieve these ends, we use both the USGS cartographic software ISIS and a commercial stereo package (SOCET SET ® from BAE Systems) and “teach” them to understand the unique geometry of each SAR instrument by implementing “sensor model” software that translates between image and ground coordinates.

The presentation will focus on recent developments and current results for Cassini RADAR and Mini-RF. RADAR has imaged slightly more than half of Titan in SAR mode and obtained stereo covering ~10%. From this, we have so far made 58 DTMs covering 5% of Titan. Despite the small area, these are of inestimable value in understanding the diverse features that can be quite enigmatic in individual images. Examples to be shown include seas, lakes, empty basins that may represent paleolakes, impact craters, possible (and not-so-possible) cryovolcanoes, and the boundary between the equatorial sand sea and the bright “continent” of Xanadu. We have also developed a stereo DTM capability for Mini-RF and shown that it can usefully compliment laser altimetry, but our primary focus is on creating very large controlled mosaics of the lunar poles. When complete, these will provide an undistorted and shadow-free view of the 70°–90° zones with multiple illuminations and polarization data useful for quantitative studies of possible ice deposits. Bistatic images of a few areas, with transmission from Earth and reception on the LRO spacecraft, will further constrain such deposits, so we are currently working toward controlling these very complex observations.

BIO:

Randolph Kirk has worked at the Astrogeology Science Center of the USGS in Flagstaff since receiving his Ph.D. in Planetary Science from Caltech in 1987. His professional interests include both planetary geology/geophysics and planetary cartography/remote sensing. In the scientific arena, his primary interest is Saturn’s giant moon Titan and its diverse geologic processes. In the latter area, he has helped direct the USGS program of planetary mapping since the early 1990s, and has been responsible for developing practical methods of shape-from-shading and for adapting commercial stereomapping techniques and software for planetary use. He has participated in numerous missions to the Moon, Venus, Mars, asteroids and comets, and the satellites of the outer solar system as a member or associate of their optical and radar imaging teams. In particular, he has been an associate of the HRSC team since 1992 and a Co-Investigator since 2001. His roles on the team include coordination of HRSC mapping with the NASA Mars program by advising on cartographic standards and practices and providing geodetic control information, and the development of an independent cartographic and stereo processing chain for HRSC images to increase their utility to the NASA Mars community.



Artist's rendition of Mini-RF imaging
(image credit: NASA, JHU/APL)