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The surface of Titan as seen by Cassini Radar

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The Cassini Titan Radar Mapper is one of the prime investigations to explore Titan's surface from orbit. Titan has shown itself to be an intriguing object for study, with a variety of unusual candidate materials (e.g., water-ammonia and other ices, hydrocarbons, tholins). Because of its almost opaque atmosphere, microwave remote sensing contributes uniquely to that investigation. The Radar Mapper operates as a passive radiometer, scatterometer, altimeter, and synthetic aperture radar (SAR).

In this paper we will review the first looks at Titan by the radar, which reveal a complex surface with areas of low relief and a variety of geologic features; there are very few candidates for impact craters and none that can be positively identified as such. A large, roughly circular feature about 180 km in diameter has suggestions of a volcanic construct, possibly a dome, although it could have impact related orgin. It has rough flanks that are radar-bright along its edges and appears to have a central depression, about 20 km in its longest dimension, that resembles a volcanic crater rather than a central peak. Several sinuous channels and/or ridges radiate from the central feature, consistent with cryolava channels carrying material down from the higher central part of the dome. Other dark patches in the SAR images are perhaps frozen hydrocarbons. Scattering and dielectric properties suggest porous ice or organic solids and/or liquids. The radiometry and scatterometry data show an intriguing combination of both specular and volume scattering and high emissivity. Microwave brightness temperatures show SAR-dark areas to be warmer. From even this limited view of its smallest details, it is clear that Titan's surface is surprisingly complex and young, although it should be noted again that we have seen only 1% of it. As we progress through the mission we expect SAR coverage of more than 25% of the planet, providing increas-

ingly instructive information about the processes at work on Titan.

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