Polarimetry of Saturn and Titan from Pioneer, Voyager and Cassini/Huygens

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Over a span of more than 30 years, photopolarimeters on five spacecraft have returned data on cloud and haze properties of Saturn and Titan. On Saturn, as on Jupiter, polarimetry has helped establish the pressure levels and optical properties of the upper tropospheric cloud layer and the optical depth and optical properties of the overlying stratospheric haze. Saturn's tropospheric clouds are characterized by very weakly negatively polarizing ice crystals. The center-to-limb behavior of the polarization provides constraints on cloud top pressure even if the cloud particle properties are not understood. In the stratosphere the haze optical depth is quite small, but at the poles a distinctive layer of highly polarizing absorbing particles is present in the auroral latitudes. West and Smith (*Icarus* **90**, 330-333, 1991) proposed that Jupiter's high-latitude stratospheric haze particles and Titan's haze were aggregates of small 'monomers' based on combined high polarization and strong forward scattering, and the same is true for Saturn's polar haze. The Descent Imager and Spectral Radiometer on the Huygens Probe put new constraints on the Titan haze from inside the atmosphere and showed that the aggregate structures are present down to the lowest altitudes (30 km) observed by the polarizing channels (Tomasko et al., *Icarus* **204**, 271–283, 2009). Cassini Imaging Science Subsystem observations are now revealing changes in haze and cloud structure on Saturn and Titan. Part of this work was performed by the Jet Propulsion Lab, Cal. Inst. of Tech. under contract with the National Aeronautics and Space Administration.