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Cassini UVIS Results from Saturn, Titan, Icy Satellites and Rings

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The Cassini Ultraviolet Imaging Spectrograph (UVIS) team reports new findings in all aspects of Saturn science: Saturn, its rings, Titan and the icy satellites, and the Saturn magnetosphere. Dynamic interactions between neutrals, ions, rings, moons and meteoroids produce a highly structured and time variable Saturn system The UVIS instrument includes channels for extreme UV (55 to 110nm) and far UV (110 to 190nm) spectroscopic imaging, high speed photometry of stellar occultations, solar EUV occultation, and a hydrogen/deuterium absorption cell. UVIS has detected neutral oxygen, which dominates the Saturn inner magnetosphere, in contrast to Jupiter. The O is probably the product of water physical chemistry, and derived ultimately from water ice. Observed fluctuations indicate close interactions with plasma sources. Sputtering from the satellites' water ice surfaces is insufficient to supply the observed mass. Stochastic events in the E ring may be the ultimate source. Saturn's aurora varies by at least a factor of 4, associated with solar wind shocks and kilometric radio emission. Prior to Cassini's orbit insertion at Saturn, UVIS detected the spectral signature of water ice on Phoebe and in Saturn's rings, mixed nonuniformly with darker constituents. Recent observations of Enceladus, Mimas, Tethys, Dione, Rhea and Iapetus allow us to begin to compare the surfaces of Saturn's icy satellites. Titan spectra reveal emissions from atomic, molecular and ionized nitrogen. Haze layers have been detected in reflected light from Titan's atmosphere, and show a difference in structure between the equator and the poles. The spacecraft made a close flyby of Titan on 13 December 2004 and stellar occultations of alpha Vir (Spica) and lambda Sco were observed. The occultation probed the night side of Titan in the southern hemisphere. Six hydrocarbon species were identified, CH_4, C_2H_2, C_2H_4, C_2H_6, HCN, and C_4H_2. The UVIS derived temperature at the top of the atmosphere agrees within about 10% with the results of the in situ Ion Neutral Mass Spectrometer obtained on the second encounter with Titan (TA). The transition from convective to diffusive separation occurs between 800km and 1100km. Additionally, we find a previously unobserved 80km layer at 1350km, showing abundances of CH_4 and C_2H_4 a factor of ~5 above the ambient underlying distribution.