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The Saturn system viewed through the infrared eyes of Cassini CIRS

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Abstract

CIRS thermal-infrared spectra have been used to retrieve temperatures and atmospheric composition within the Saturn system. We review several major findings, including: *Saturn.* a) The outburst of a major storm at northern latitudes, resulting in an enhancement of tropospheric phosphine [1] and a depletion of para-hydrogen [2], and a perturbed stratosphere, characterized by anticyclonic structure with high-temperatures, associated with large-amplitude vertical motions [3], and enhanced ethylene [4]. The perturbed structure of the stratosphere is long-lived, persisting after the visible tropospheric disturbance has decayed. b) The structure and descending pattern of a stratospheric oscillation at the equator [5], [6]. c) Evidence for descent over both winter and summer poles, leading to warm temperatures and depleted phosphine [7]. *Titan*. a) The structure and seasonal behavior of the circumpolar vortices, as seen in temperatures, zonal winds, trace gas distribution, and condensates [8], [9]. [10], [11], [12], [13], [14]. b) The polar offset of cyclostrophic flow in the stratosphere [15], [16]. c) The spatial variation of stratospheric methane [17]. d) The meridional and seasonal variation of surface temperatures [18], [19]. e) The first detection of propylene [20]. *Rings*. a) The existence of a population of ring particles in the main rings that are relatively large, spin slowly, and have a low enough thermal inertia to provide a thermal response that is rapid compared to the particle rotation period [21]. b) The determination of minimum ring temperatures, seen at equinox [22]. c) The temperature modulations in the A ring caused by self-gravity wakes [23], [24]. *Icy Satellites.* a) The discovery of warm temperatures and endogenic thermal emission in the major fissures around Enceladus's south pole [25], [26]. b) The identification of the pac-man features on Mimas and Tethys, indicative of variations in thermal inertia that are likely caused by electron bombardment over the course of the satellites' orbits [27], [28].

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