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# Abstract

## Hotspots and Hexagons: Saturn's Polar Circulation Systems

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The Cassini space probe's near-polar orbit during late 2006 and 2007 provided the first detailed views of the polar regions of the gas giant Saturn. These unparalleled views have demonstrated the existence of a symmetric pair of hot cyclonic vortices churning at each pole. Cassini's Composite Infrared Spectrometer (CIRS) provides thermal infrared spectra in the 7-1000 micron range, allowing the mapping of the atmospheric temperature field and trace-gas composition of Saturn's troposphere and stratosphere, which are directly related to the mean zonal, meridional and vertical motion of air.

The polar vortices exist under both summer and winter conditions, have cores which are depleted locally in trace gases and cold collars characterized by multiple convective cloud features. This suggests subsidence of air at the cores of each cyclone causing localised heating of the tropospheric gases, surrounded by regions of atmospheric upwelling. At the summer pole, the hotspot coincides with a hurricane-like eyewall and depressed cloud features, supporting the view of downwelling within the core. The existence of these polar circulation systems irrespective of huge seasonal changes in solar flux suggests that they may be general features of giant planet dynamics, an idea supported by the recent discovery of a similar south polar hotspot on Neptune.

But the polar symmetry is broken by the re-discovery of the fascinating hexagonal feature which surrounds the cold polar collar at the north pole, extending from the tropopause down to at least the 2-3 bar level. No such feature is visible in the southern hemisphere, and the origin of this persistent hexagonal wave remains a mystery, although we may speculate that it is rooted in the deep circulation of Saturn's atmosphere. These results and their implications for future missions will be discussed.