

Junocam Imaging Jupiter: Results from PJ1 through PJ8

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Abstract

Juno's imaging system, JunoCam, has acquired images of Jupiter's poles for each of the first eight orbits of the mission, providing a significant quantitative improvement in our coverage of Jupiter's poles and revealing very different atmospheric structure than at the lower latitudes.

1. Introduction

The highly elliptical inclined orbit of the Juno spacecraft, with perijove 5000 km above the cloud tops, provides a geometry for polar imaging much more favorable than previous missions. Juno's imaging system, Junocam, has acquired color images of each of Jupiter's poles for 7 of the first eight perijove passes (PJ1 through PJ8, but not PJ2). These images show an atmospheric circulation very different from the banded structure of the lower latitudes ($< \sim 60^\circ$), and the variability of that circulation was sampled at the 53-day period of Juno's orbit.

2. JunoCam Instrument

JunoCam has a single CCD detector with an integral color-strip filter that enables the instrument to image in four color bands—blue, green, red and the 889-nm methane band. The Junocam lens maps a field of view of 58° across the width of the detector, which is perpendicular to the scan direction from spacecraft rotation. Repeated readout of the filtered sections of the CCD with rotation allows Junocam to build up a color image. Junocam's CCD can be operated with Time Delay Integration (TDI) to improve signal levels. Because of the much lower signal levels in the methane band, those images are acquired separately from the RGB images, and with much more TDI. Details are given by Hansen et al. (1)

3. Junocam Polar Imaging

Around each perijove pass of the Juno spacecraft, JunoCam acquires multiple half-disk color images of the North and South Poles at high emission angle ($> 70^\circ$). These images have a spatial scale at the cloud tops of ~ 50 km/pixel. The geometry of the orbit accommodates the acquisition of multiple images of the poles over a period of up to one hour enabling the acquisition of brief time-lapse movies of polar features.

The key morphologic feature of Jupiter's polar regions is a breakdown of the east-west banded structure that dominates latitudes less than $\sim 60^\circ$. In the polar regions, the structure is dominated by many discrete, compact features against a background that is darker and more uniform than the structure equatorward of $\sim 60^\circ$ latitude in either hemisphere.

The following discrete features have been observed by JunoCam (and are visible in Figures 1 and 2):

- Circumpolar cyclones: bright, circular, spiral features immediately around the poles. Time-lapse image sequences show they rotate counterclockwise.
- Ovals: bright, oval features with a distribution of diameters down to the Junocam resolution limit (< 100 km).
- Folded filaments: bright, amorphous, apparently turbulent features 4,000 to 7,000 km in extent. These appear similar to the much smaller "folded filaments" seen at lower latitudes.

Junocam samples the time development of these features on two different timescales: imaging the

poles multiple times on the same orbit (limited by orbital geometry to < 1 hour) and imaging on successive Juno orbits (separated by 53 days).



Figure 1: Jupiter imaged by Junocam just after the fifth perijove pass (PJ5). The South Pole is about three-quarters of the way to the lower limb. The lower albedo region extends from the pole to $\sim 60^\circ\text{S}$ latitude. Northward of that boundary, the belt-and-zone structure is seen, foreshortened.

4. Summary and Conclusions

JunoCam has acquired observations of Jupiter's poles on eight successive Juno orbits, revealing very different atmospheric features than pertains at lower latitudes. JunoCam will continue these observations for the rest of the Juno Mission. Orton et al. (2) provide a more detailed discussion of the features, as observed in Juno's first perijove.

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References

- [1] Hansen, C. J., et al. Junocam: Juno's outreach camera. *Space Sci. Rev.* 2014. doi10.007/s/11214-014-0079-x
- [2] Orton, G. S., et al. The first close-up images of Jupiter's polar regions: Results from the Juno mission JunoCam instrument. *Geophys. Res. Lett.* 44, 2017. doi: 10.1002/2016GL072443.



Figure 2: Jupiter's North Pole, imaged by Junocam just before Juno's fifth perijove pass (PJ5). As with the South Pole view in Figure 1, the North Pole is surrounded by a lower albedo region with two well-developed folded filaments near the albedo boundary.