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The Juno Mission: A Call for Continued Support from Amateur Observers

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Introduction

The Juno mission continues to expand its science goals beyond those of the prime mission and the first extended mission. Atmospheric studies will continue to be among Juno's science goals and an area in which the world-wide community of Jupiter observers can provide significant contextual support. A series of radio occultation measurements derive vertical profiles of electron density and the neutral-atmospheric temperature over several atmospheric regions.

Physical Details of the Mission

Figure 1 shows the sequence of orbits and key investigations of the primary and extended missions.

igure 1. Progression of Juno orbits viewed from above Jupiter's north pole with respect to local time of day. "PJ" designates a "perijove", the closest approach to Jupiter on each numbered orbit. Following a Ganymede flyby on PJ34 (green orbit), the orbital period decreased from 53 days to 43-44 days (green + blue orbits). The "Great Blue Spot" (blue) orbits map an isolated patch of intense magnetic field. Following a close Europa flyby on PJ45 (aqua orbit), the period decreased to 38 days (orange orbits). Following close flybys of Io on PJ57 and PJ58 (black orbits) the period decreased to 33 days (red orbits). In reflected sunlight, Jupiter mostly appears as a crescent at perijoves following PJ58, but closer to its original phase angle by P110.

Some characteristics of perijoves of the extended mission for the year starting in September, 2026, are shown in Table 1. We caution that while the day of year for the perijoves is reasonably fixed, the exact times may change.

Role of Amateur Astronomers

We've noted at previous EPSC and EPSC-DPS meetings how the amateur community can contribute to the Juno mission via their collective world-wide 24/7 coverage of Jupiter. This applies also to the cadre of professional astronomers supporting the Juno mission. For example, this community has provided the context of different regions over which Juno's Microwave Radiometer (MWR) has sensed plumes and "hot spots" (Fletcher et al. 2020). They have also alerted observers to strong interactions between the Great Red Spot and smaller anticyclones (Sanchez-Lavega et al. 2021) and the occurrence and evolution of prominent and unusual vortices, such as "Clyde's spot" (Hueso et al. 2022). The continued tracking of outbreaks in the southern part of the North Equatorial Belt (NEB)

also greatly informed the Juno team and supporting astronomers regarding the systematic longitudinal distribution of outbreaks and the range of atmospheric features they generate. A perijove-by-perijove summary of Juno-supporting observations is available at the following web site: https://www.missionjuno.swri.edu/planned-observations.

After PJ50, Juno's perijoves migrated to the nightside. From now through the end of the mission, images from this community will be extremely useful to provide a context for several investigations, such as as the MWR measurements of thermal emission from the deep atmosphere that includes mid-to-high latitude coverage. Observations from the amateur community will also provide the visible-wavelength context for anticipated continuation of JIRAM's 5-μm maps of much of the southern hemisphere. They will also support the Microwave Radiometer (MWR) observations. Finally, the observations will also provide contextual support for a series of measurements to determine a local temperature profile by tracking the phase shift in Juno's high-gain antenna signal as the spacecraft goes behind Jupiter (known as "ingress") and as it emerges from behind Jupiter (known as "egress"). Figure 2 summarizes graphically all of the successful and planned radio-occultation sequences.

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We dedicate this work to the memory of Dr. Candice Hansen, who was the Juno instrument lead for JunoCam through most of the mission. She provided operational insight and guidance for both the public access to Juno observations envisioned for this instrument and for the strong quantitative scientific results it brought to the mission.

Fletcher et al. 2020. *J. Geophys. Res.* **12**5, 306399.

Hueso et al. 2022. *Icarus* **380**,114994

Sanchez-Lavega et al. 2021. *J. Geophys. Res*. **126**, e006686.

Table 1. Perijove properties for a portion of Juno's extended mission for a year, covering PJ87-PJ98. Information for previous perijoves and a summary of observations at large telescopes is listed in: https://www.missionjuno.swri.edu/planned-observations.

PJ	Date	Approx. Spacecraft Event Time	PJ lat. (centric)	PJ long. (System III)	Solar Elongation
87	2026 Sep 9	05:16	72°	324°	31°
88	2026 Oct 11	21:25	73°	325°	56°
89	2026 Nov 13	12:43	73°	296°	85°
90	2026 Dec 16	04:11	74°	272°	118°
91	2027 Jan 17	19:31	75°	244°	151°
92	2027 Feb 19	10:43	75°	210°	171°
93	2027 Mar 24	01:57	76°	178°	134°
94	2027 Apr 25	16:50	76°	133 °	103°
95	2027 May 28	08:48	77°	127°	73°
96	2027 Jun 30	00:24	77°	108°	47°
97	2027 Aug 1	17:06	78°	129°	23°
98	2027 Sep 3	09:10	78°	127°	2°