

# Juno Maps Water Ice Across Northern Ganymede

Infrared observations from instruments on the Juno spacecraft cover regions of Ganymede not visible to Earth-based telescopes.

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The Jovian Infrared Auroral Mapper aboard the Juno spacecraft captured these images of Jupiter's moon Ganymede on 26 December 2019. Credit: [NASA/JPL-Caltech/SwRI/ASI/INAF/JIRAM](https://www.nasa.gov/content/20200114main-juno-ganymede-20200114)

By Morgan Rehnberg © 14 January 2021

Jupiter's moon [Ganymede](https://solarsystem.nasa.gov/moons/jupiter-moons/ganymede/in-depth/) (<https://solarsystem.nasa.gov/moons/jupiter-moons/ganymede/in-depth/>) is the largest planetary satellite in the solar system. It's also one of the most intriguing: Ganymede is the only moon with [its own magnetic field](https://eos.org/features/a-field-guide-to-the-magnetic-solar-system) (<https://eos.org/features/a-field-guide-to-the-magnetic-solar-system>), it is the most differentiated of all moons, and it likely possesses a [subsurface ocean](https://eos.org/research-spotlights/jupiters-ocean-moons-raise-tidal-waves-on-one-another) (<https://eos.org/research-spotlights/jupiters-ocean-moons-raise-tidal-waves-on-one-another>) of liquid water. It was studied by the early Jupiter

flybys made by the Pioneer and Voyager spacecraft, but our understanding today rests largely on observations made by NASA's Galileo orbiter from 1995 to 2003.

*Mura et al.* (<https://doi.org/10.1029/2020JE006508>) now report some of the first in situ observations of Ganymede since the end of the Galileo mission. They used the Jovian Infrared Auroral Mapper (JIRAM ([https://pds-atmospheres.nmsu.edu/data\\_and\\_services/atmospheres\\_data/JUNO/jiram.html](https://pds-atmospheres.nmsu.edu/data_and_services/atmospheres_data/JUNO/jiram.html))) on board NASA's Juno ([https://www.nasa.gov/mission\\_pages/juno/main/index.html](https://www.nasa.gov/mission_pages/juno/main/index.html)) spacecraft to take images and spectra of the moon's north polar region. On 26 December 2019, Juno passed Ganymede at a distance of about 100,000 kilometers, enabling JIRAM to map this region at a spatial resolution of up to 23 kilometers per pixel.

As Juno flies past Ganymede, the spacecraft can observe physical locations on the moon's surface from a variety of angles. By comparing the brightness of these regions across a range of observation and illumination geometries, the authors developed a photometric model for Ganymede's surface reflectance. They observed that wavelength-dependent reflectance relationships sometimes break down in the vicinity of relatively fresh craters, perhaps because of a larger average size of ice grains in these regions.

Combining their model with spectral observations of the 2-micrometer water ice absorption band allowed the authors to map the distribution of water ice in the north polar region. Where these estimates overlapped with maps derived from Earth-based telescopic observations, the researchers found largely good agreement. This congruence enabled them to extend the global water ice map for Ganymede to much more northerly latitudes.

Observations in other spectral bands also revealed the presence of nonwater chemical species on the surface of Ganymede, including possible detections of hydrated magnesium salts, ammonia, carbon dioxide, and a range of organic molecules. The authors note that 2020 offered additional opportunities for Juno to make polar observations of Ganymede, as does 2021, and suggest that continuing observations from JIRAM will help set observation strategies in future observing campaigns like the Europa Clipper (<https://europa.nasa.gov/>) and Jupiter Icy Moons Explorer (JUICE (<https://sci.esa.int/web/juice>)) missions. (*Journal of Geophysical Research: Planets*, <https://doi.org/10.1029/2020JE006508> (<https://doi.org/10.1029/2020JE006508>), 2020)

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