

Seasonal Variation of the Radial Brightness Contrast of Saturn's Rings Viewed in Mid-infrared

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To investigate the mid-infrared (MIR) characteristics of Saturn's rings, we collected and analyzed MIR high spatial resolution images of Saturn's rings obtained in January 2008 and April 2005 with COMICS mounted on Subaru Telescope (Figure 1), and investigated the spatial variation in the surface brightness of the rings in multiple bands in the MIR (Figure 2). We also composed the spectral energy distributions (SEDs) of the C, B, and A rings and the Cassini Division, and estimated the temperatures of the rings from the SEDs assuming the optical depths measured from stellar occultation observations by Cassini/UVIS.

We find that the C ring and the Cassini Division were warmer than the B and A rings in 2008. This could be accounted for by the lower albedos, lower optical depths, and smaller self-shadowing effect in the C ring and the Cassini Division than the B and A rings.

We also find that the C ring and the Cassini Division were considerably brighter than the B and A rings in the MIR in 2008, and the radial contrast of the ring brightness is the inverse of that in 2005. This temporal variation is probably caused by seasonal changes of the elevations of the Sun and observer above the ring plane as varying angles will lead to differing filling factors and temperatures of the particles in the rings.

Reference

[1] Fujiwara, H., et al.: 2017, *A&A*, **599**, A29.

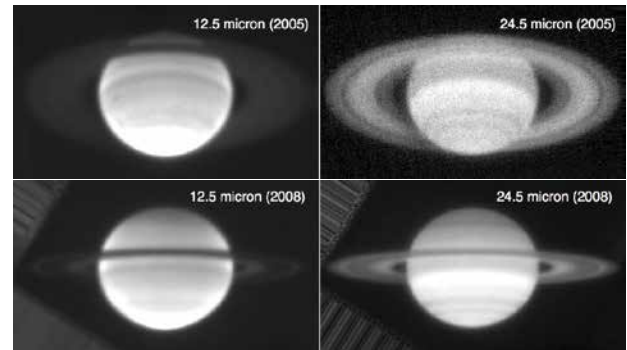


Figure 1: Comparison of MIR images of Saturn's rings in April 2005 (top) and January 2008 (bottom). 12.5 μm (left) and 24.5 μm (right).

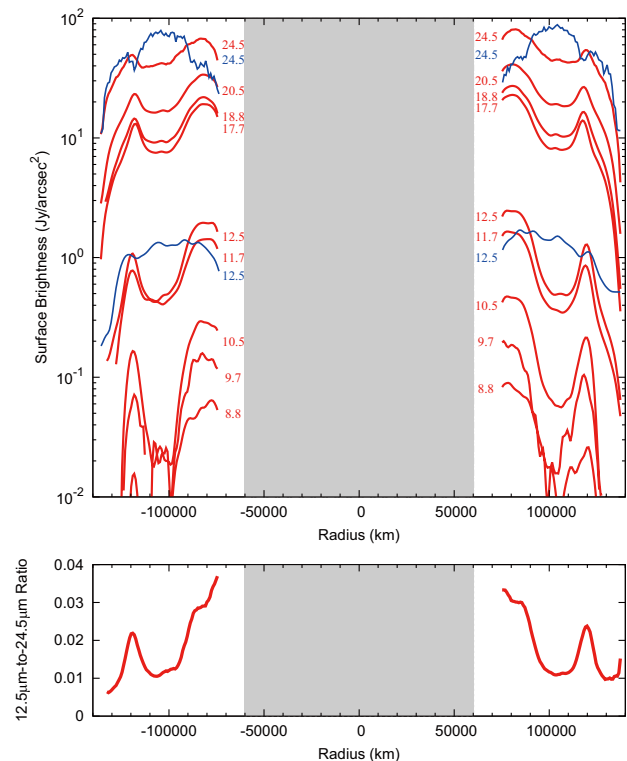


Figure 2: Top: profiles of surface brightness in all the bands in January 2008 (red) and April 2005 (blue). Bottom: profile of 12.5 μm -to-24.5 μm brightness ratio for Saturn's rings in 2008. Negative and positive value of the radius is for the east and west side, respectively. Region of the planetary body is shown in gray.