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Searching for Outer Planet Debris Disks/Rings with WISE

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Abstract

The NASA Wide-Field Infrared Survey Explorer (WISE) imaged the entire celestial sphere at 3.4, 4.6, 12, and 22μm during its 9 month cryogenic survey mission with typical 5-sigma sensitivity for point source detection near the ecliptic of 0.08, 0.11, 1, and 6 mJy (Wright et al. 2010). In addition to the detection of hundreds of millions of stars and galaxies as well as a vast number of known and new asteroids (Mainzer et al. 2011), WISE was sensitive to extended emission from warm dust in the Solar System, for example from zodiacal dust bands and comet debris trails. WISE also scanned all of the superior planets during its mission, encountering them serendipitously during normal Survey operations. This paper presents the result of searches for dust emission originating from irregular satellite impact debris or activity around Jupiter, Saturn, Uranus and Neptune, primarily in the longest wavelength band at 22μm. WISE delivered angular resolution of 6 arcseconds in the three shorter-wavelength bands and 12 arcseconds in the band most suited for outer Solar System dust detection at 22μm. Jupiter and Saturn heavily saturate the detectors and scattered light limits the inner radius for analysis. Since WISE acquired its observations over many days, and in some cases weeks, we have constructed deep coadds in the frame of the moving planet rather than using standard WISE Atlas Image Coadds. WISE typically dedicated about 70 sec of observation to each point on the sky near the ecliptic plane, so WISE observations are not nearly as sensitive as those possible with the Spitzer Space Telescope during its cryogenic mission. All of the giant planets were located in a region of the sky scanned in the second half of WISE's all-sky coverage. As a result none of these fields was included in the 57% of the sky covered in the April 2011 WISE Preliminary Data Release. At the time of the WISE Final Data Release, planned for Spring 2012, the individual calibrated "Level 1" frames contributing to these observations will become available through the Infrared Science Archive (IRSA). The release of these calibrated single frames was made possible by NASA support for the NEOWISE project (Mainzer et al. 2011).

References

[1] Wright, E.L. et al., Astron. J., Vol. 140, pp. 1868-1881, 2010.

[2] Mainzer, A. et al., Ap. J., Vol. 731, pp. 53-65, 2011.