Update on the NEOWISE project

Jan 30, 2019

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Mission Overview

Salient Features

- PI-led (PI: Amy Mainzer, JPL) mission under PDCO Program (Lindley Johnson, Planetary Defense Officer)
- Utilizes WISE S/C that was brought out of hibernation in October 2013
- 3.4 and 4.6 μm bands (W1 and W2) at ~75K
- Similar observing strategy to WISE/NEOWISE
  - Terminator-following pole-to-pole orbit
  - Surveys entire sky roughly every 6 months
- Survey began December 2013, expected to continue through June 2019

Science

- Expand the NEOWISE survey of Near-Earth Objects (NEOs) at mid-infrared wavelengths using WISE W1 and W2 channels
- Obtain physical characterization (including diameters and albedos) of these NEOs and the several thousand other small bodies detected by NEOWISE
- NEOWISE observations a key component to future mission planning (both human and robotic) as well as planetary defense preparation
Asteroid SEDs

- NEOWISE provides critical constraints on the thermal emission from NEOs and some MBAs, allowing for measurement of asteroid diameters, and albedos when combined with optical data.
NEOWISE Science Observation Summary

• Since the start of operations, NEOWISE has obtained over \(900,000\) infrared measurements of \(33,554\) solar system objects, including \(958\) NEOs (\(159\) NEO discoveries) and \(162\) comets (\(12\) discoveries)

• Recent NEO discovery \(2019\) \(AH7\) is a high eccentricity (\(e=0.57\)) PHA with a diameter of \(200\) m and \(V\) albedo of \(2\%\)

• Largest recent discovery: \(2018\) \(XY3\), PHA with \(D=700\) m, albedo=\(3\%\)

• Four annual data releases have already been successfully completed. Year 5 data release scheduled for March 2019 (target date).
Coverage Depth: All Frames - Scan 01034r (58463.5) to 02103r (58498.5)

Fraction of sky covered (frames)

- > 11: 100.00%
- > 22: 100.00%
- > 33: 100.00%
- > 44: 100.00%
- > 55: 100.00%
- > 66: 100.00%
- > 100: 99.88%
- > 150: 41.28%
- > 250: 10.94%

Ecliptic Aitoff Projection

- Min. coverage: 94.00 frames
- Med. coverage: 143.00 frames
- Mean coverage: 174.39 frames
- Max. coverage: 22730.00 frames

Coverage no.: 11
Fraction: 9.96%

Run time: 2019/01/15 12:00:00Z
Diameters and Albedos for NEOs
Detected During Five Years

Previously known

NEOWISE discoveries
R. Cutri, J. Masiero, S. Sonnett and A. Mainzer, in a recent Minor Planet Bulletin submission, describe the mid-infrared light curve parameters for (523806) 2002 WW17, an NEO with one of the largest rotational amplitudes observed by NEOWISE. 38 NEOWISE detections allowed for a period determination of 10.5106 hours, and an amplitude of 1.9 mags at one of the epochs.
Solar System Search Capabilities at the NASA/IPAC Infrared Science Archive

http://irsa.ipac.caltech.edu

- WISE/NEOWISE data served by on-line and machine-friendly IRSA services
- Solar-system object-specific search functions developed as part of the original NEOWISE program (2009-2011)
- Extended to IRSA’s data services for other missions including Spitzer and PTF
NEOWISE Data Use

• Total citation count using NEOWISE data & discoveries now >1000 refereed publications
  – Total citation count for WISE >3000 refereed publications

• NEOWISE is a time-domain mid-infrared all-sky survey, so its science spans many areas of astrophysics & planetary science. Other recent results include:
  – Asteroid Thermophysical Modeling
  – Precovery of potential impactors
  – Variable and Flaring Stars (e.g. FU Ori, Cepheids)
  – Quasar variability
  – Brown Dwarfs
  – Unusual exoplanets (e.g. Boyajian’s star)
Conclusion

- NEOWISE is discovering & characterizing small bodies
  - Diameters accurate to ±20%, albedos to ±45%

- Orbital precession will eventually force an end to the mission, however the quiet sun over the last few years has meant rate has been less than predicted, so survey can continue to at least June 2019

- Over 33,000 small bodies observed since restart

- Data access: irsa.ipac.caltech.edu
Backup
Single-exposure Source Database Characteristics

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<th></th>
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<th>W1</th>
<th>W2</th>
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<td><strong>Sensitivity (SNR=10)</strong></td>
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<tr>
<td>mag</td>
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<td>15.0</td>
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<td>microJy</td>
<td></td>
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<td>565</td>
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<td><strong>Completeness (&gt;90%)</strong></td>
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<td>15.8</td>
<td>14.4</td>
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<tr>
<td>microJy</td>
<td></td>
<td>150</td>
<td>300</td>
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<td><strong>Reliability (&gt;95%)</strong></td>
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<td>15.0</td>
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<tr>
<td>microJy</td>
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<td>680</td>
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<tr>
<td><strong>Astrometric Accuracy</strong></td>
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<td>(high SNR)</td>
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Instrument Performance

- Image quality, photometric accuracy, astrometry, sensitivity all unaffected by 32 month hibernation