

Detection and Characterization of Minor Planets using WISE/NEOWISE

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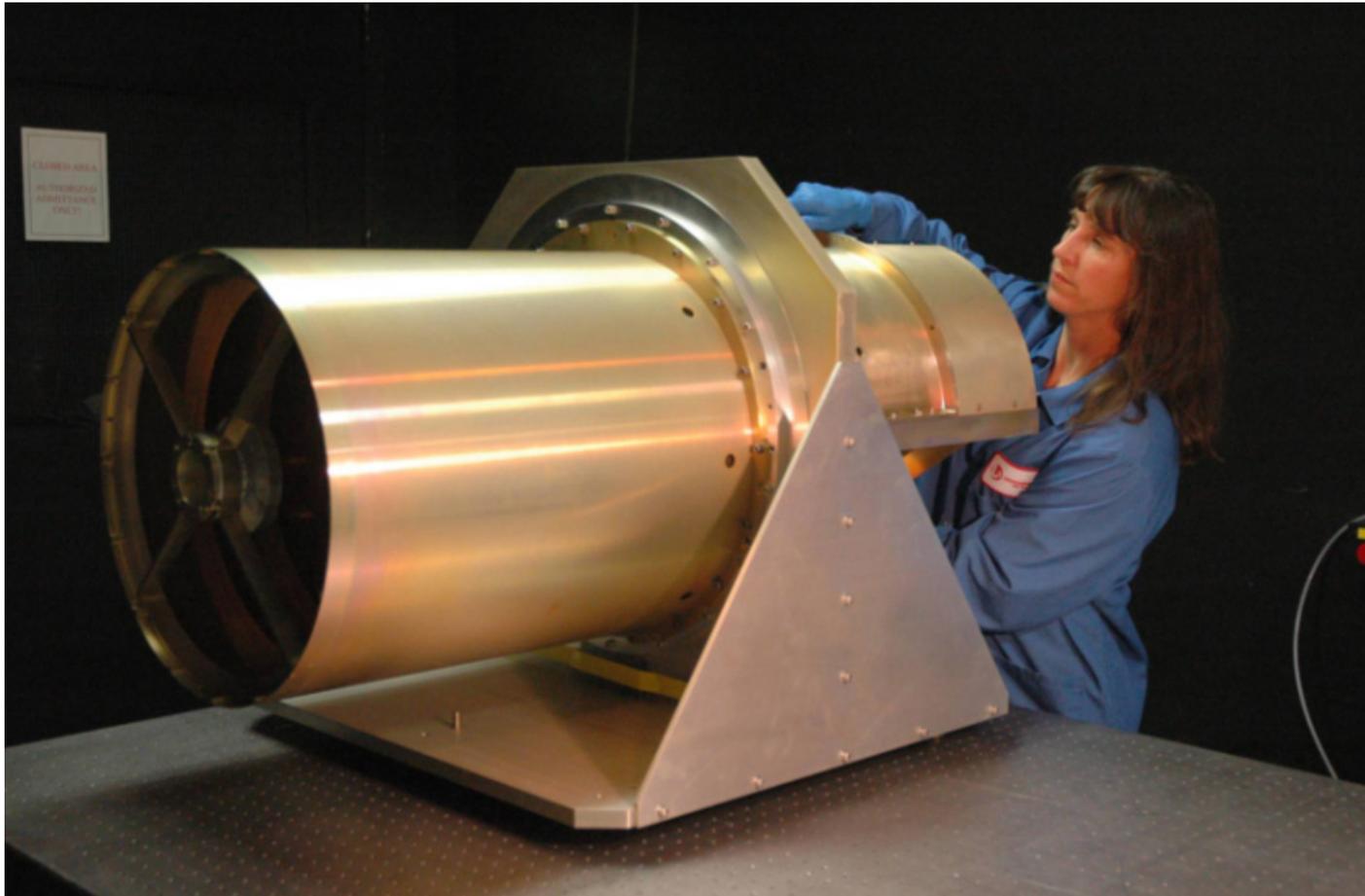
COSPAR 2018 emily.kramer@jpl.nasa.gov



Jet Propulsion Laboratory
California Institute of Technology

The Original WISE Mission

- WISE = Wide Field Infrared Survey Explorer



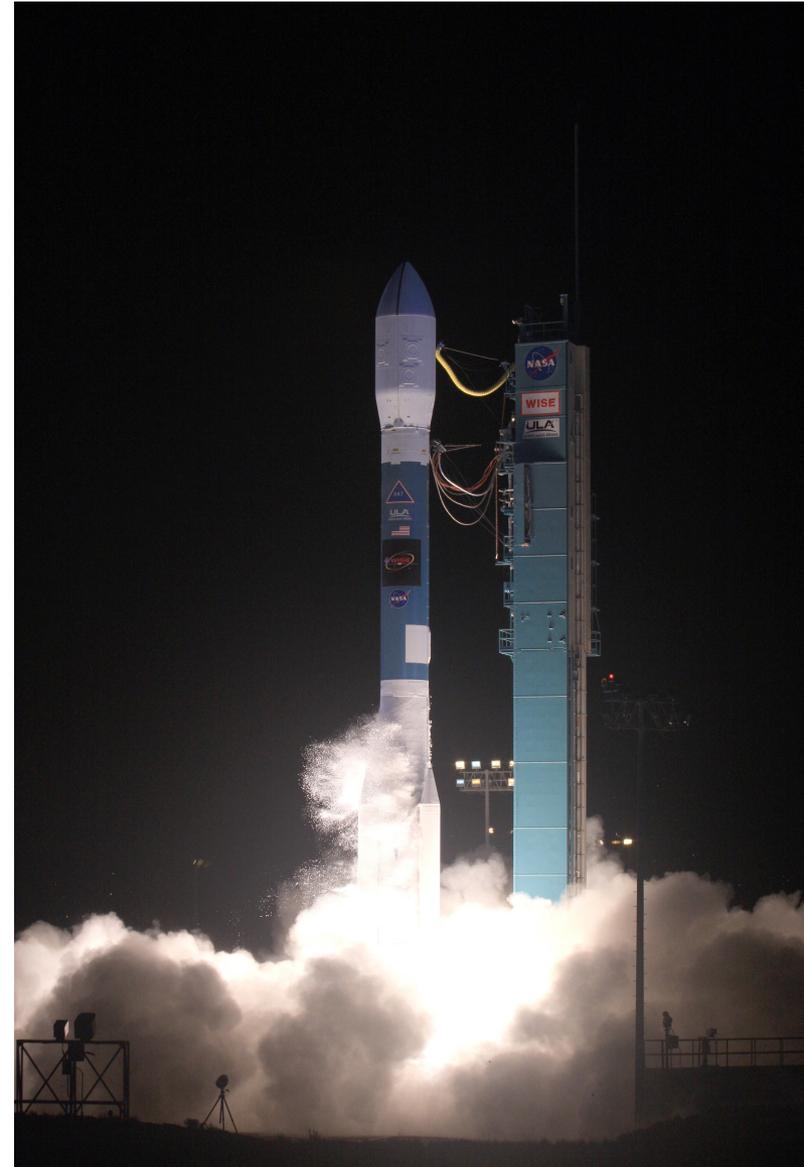
The Original WISE Mission

- Astrophysics Explorer Class mission
- Goals: map sky in 3.4, 4.6, 12, and 22 μm
- Search for ULIRGS and brown dwarfs
- Make a single co-added map of the sky in each band
- 6 month mission



The Original WISE mission

- Launch Dec. 2009
- Fully cryo survey Jan. – Sep. 2010
- Continued post-cryo survey to Feb. 2011 funded by NASA PSD

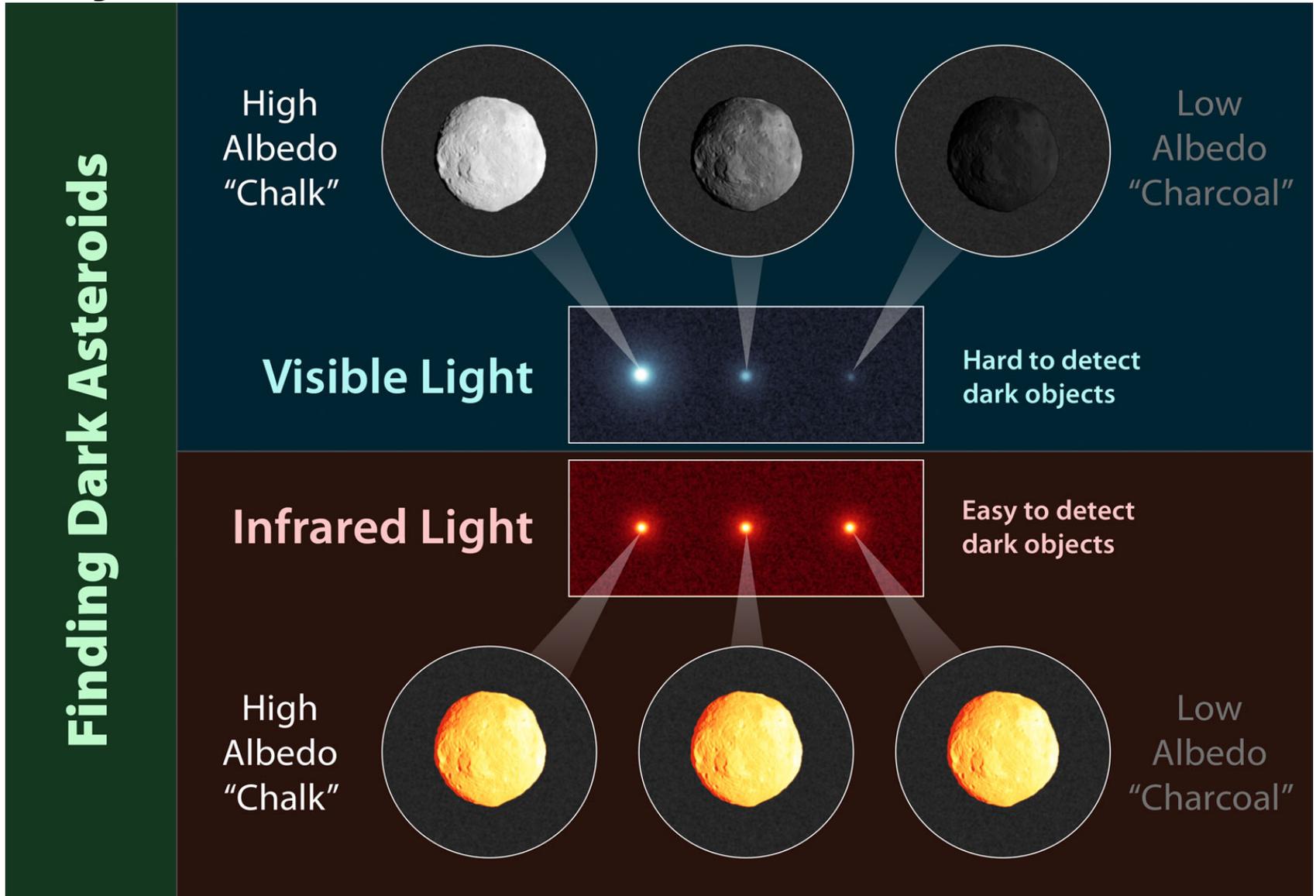


NEOWISE enhancements to prime mission

- Near Earth Object Wide Field Infrared Survey Explorer
- Save individual exposures
- Searchable databases
- Search for solar system objects/NEOs

The screenshot displays the IRSA NEOWISE search interface. At the top, there is a navigation bar with 'IRSA | DATA SETS | SEARCH | TOOLS | HELP' and a 'Login' link. Below this is a secondary bar with 'WISE' logo, 'Searches', 'History', 'Help', and 'Background Monitor' buttons. The main content area is titled 'Position' and is divided into two columns. The left column contains a 'General' section with links for 'Position' and 'Solar System Object/Orbit', and an 'Advanced' section with links for 'Scan ID/Frame (Single Exposure)', 'Coadd ID (Atlas)', and 'WISE Source ID'. The right column contains a search form with a 'Single Object' / 'Multi-Object' toggle, a 'Name or Position' input field with a 'Try NED then Simbad' dropdown, and example coordinates. Below this are 'Search Type (Region Intersection):' with a dropdown set to 'Image contains target', 'Return Image Size (leave blank for full images):' with a text input '600' and a dropdown 'arcseconds', and 'Return only the most centered image containing the target:' with radio buttons for 'Yes' (selected) and 'No'. The 'Image Set:' section includes checkboxes for 'AllWISE (multi-band)' (checked), 'All-Sky (4 band)', '3-Band Cryo', 'Post-Cryo (2 band)', and 'NEOWISE-R'. There are also expandable sections for 'Obsolete preliminary release data', 'Data Product Level:' with 'Atlas' checked, and 'Return the following bands:' with 'W1', 'W2', 'W3', and 'W4' all checked. At the bottom of the form are 'Search' and 'Clear' buttons. The footer contains 'Contact', 'Privacy Policy', and 'Acknowledge IRSA' links, along with logos for 'ipac', 'Caltech', 'JPL', and 'NASA', and the URL 'jpl.nasa.gov'. A small version number '5.4 Final, Built On: Tue Apr 17 18:18:57 PDT 2018' is visible in the bottom right corner.

Why infrared for asteroid detection?



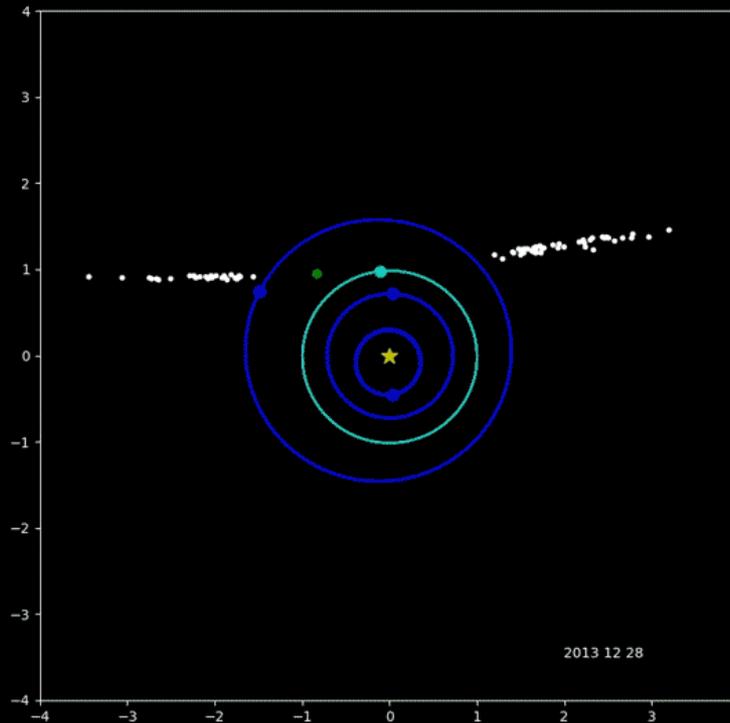
NEOWISE restarted mission

- Funded by NASA NEO Observation Program
- Taken out of hibernation in late 2013 to restart survey operations
- Still running now!
- 3.4 and 4.6 μm only
- Orbit is precessing, but still getting good data

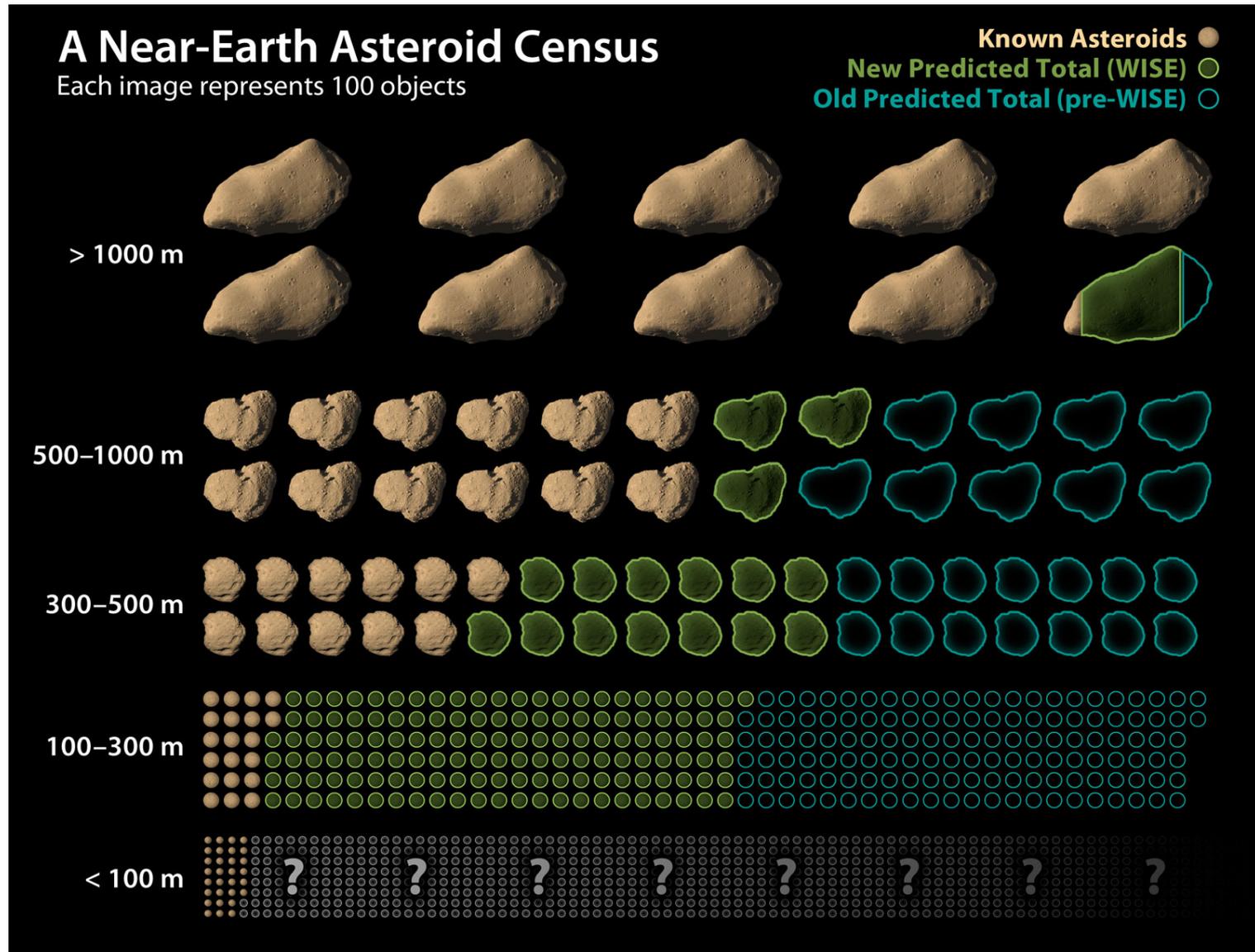
NEOWISE restarted mission

Color Key:

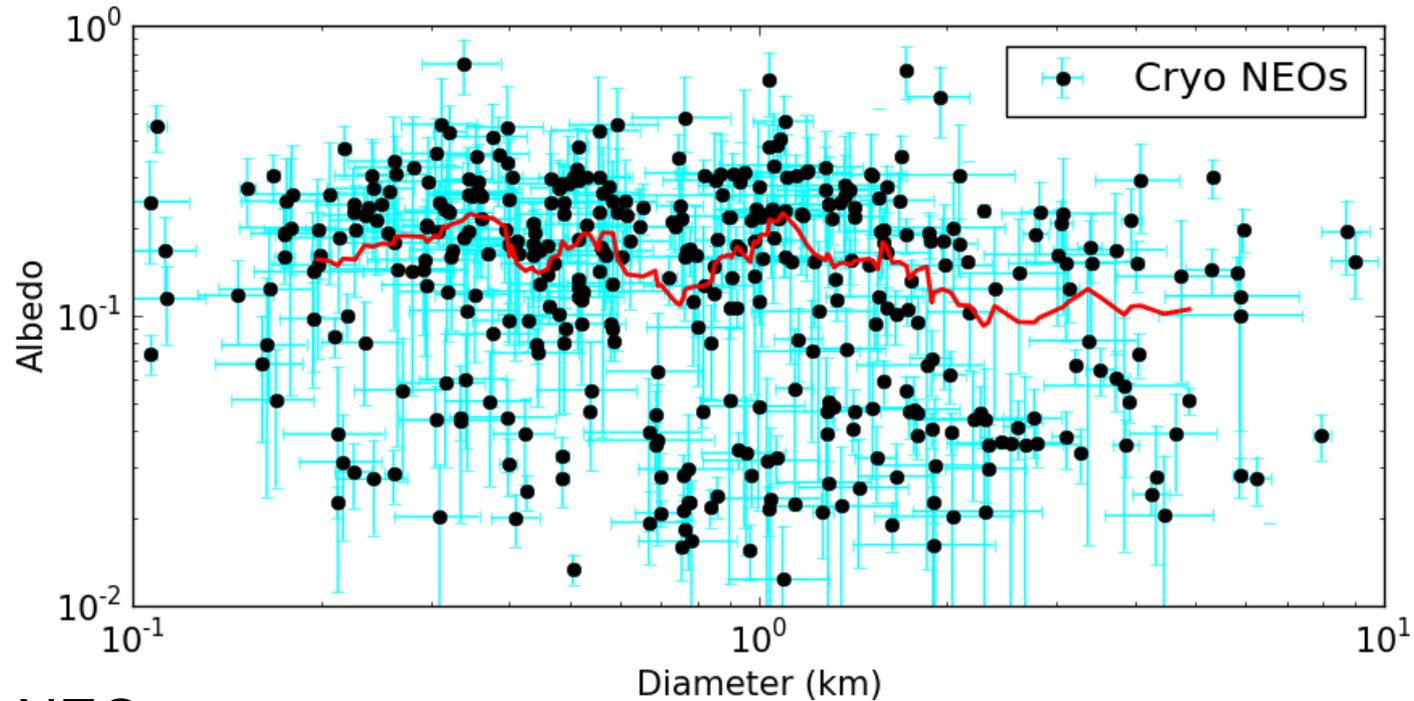
- Main Belt Asteroids
- Near Earth Asteroids
- Comets
- Initial Detection
- Earth/WISE
- Planets



NEO discovery statistics

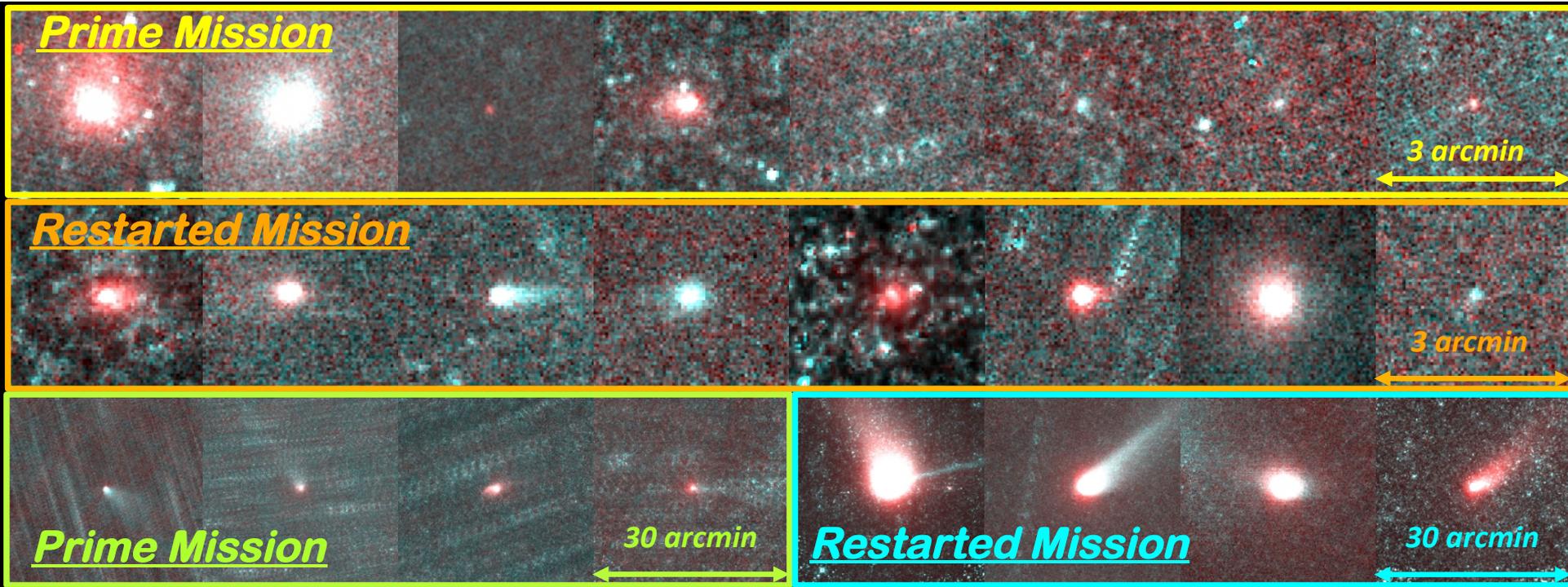


Near Earth Object Discoveries

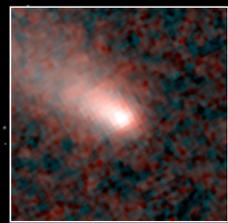


- ~430 NEOs
- No significant change in reflectivity vs. diameter
 - Study reveals existence of smaller, dark NEOs
- Contrary to previous studies made using visible light

Comets

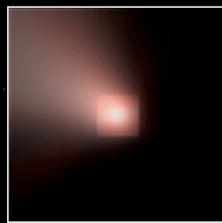


Comets



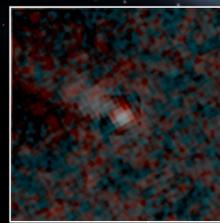
Comet
Data

—



Dust
Model

=

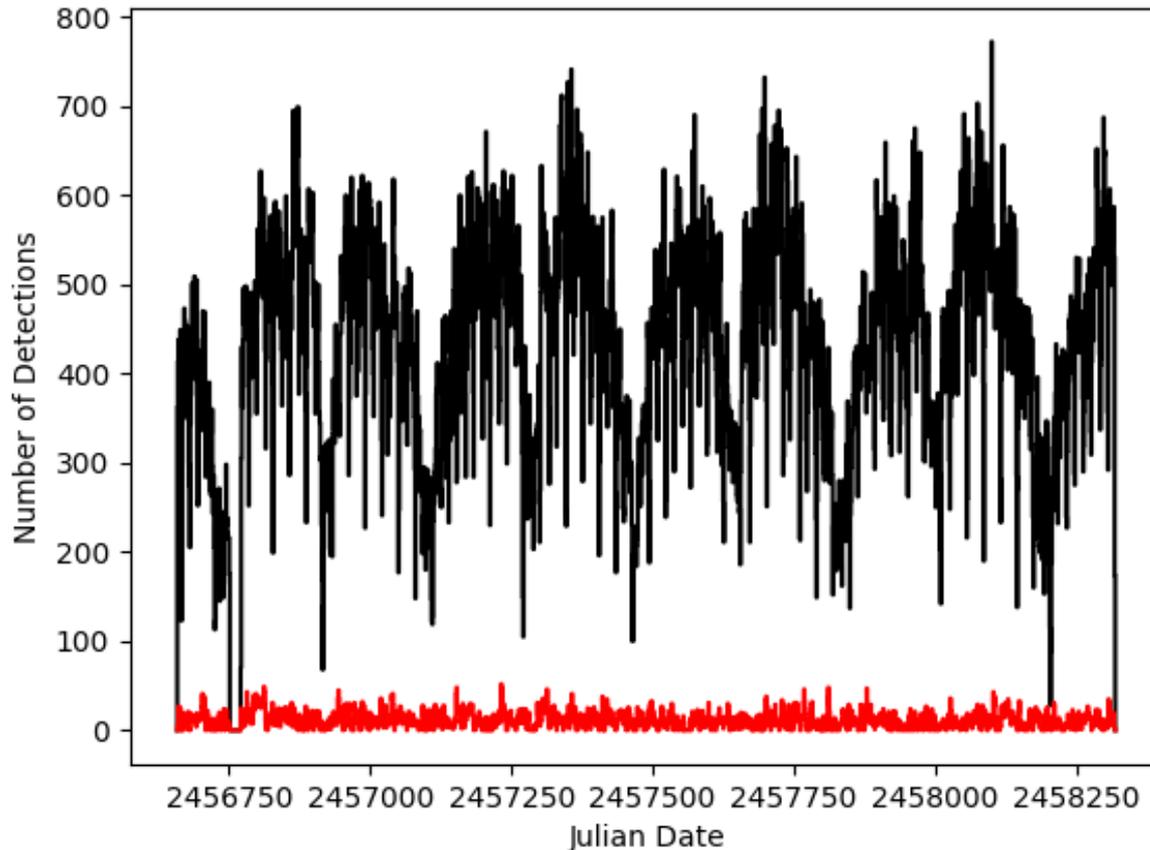


Core



What's next for NEOWISE?

- Still taking data, processing three times per week
 - Two new NEO candidates discovered TODAY!
- Data still high quality: no drop in performance



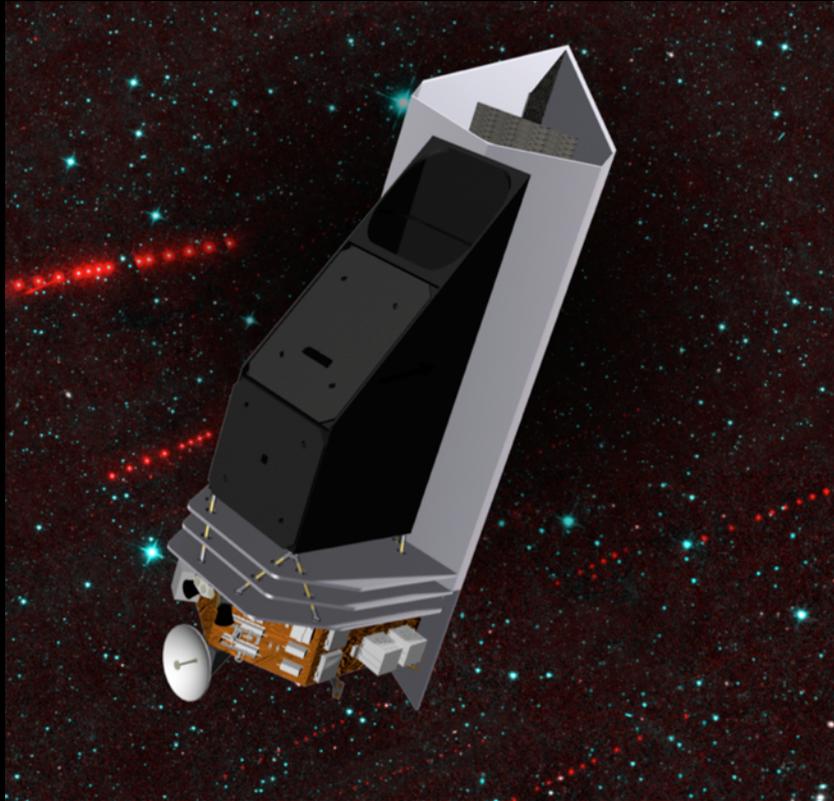
What's next for NEOWISE?

- Most recent data release: April 19, 2018
- Halfway through 5th year of restart, just finished 11th pass over entire sky during restarted mission
- Mission funded to keep taking data through end of 2018

<http://wise2.ipac.caltech.edu/docs/release/neowise/>

<http://irsa.ipac.caltech.edu/Missions/wise.html>

NEOCam Is Optimized for Finding NEOs



NEOCam is a telescope operating in a single survey mode.

- 50 cm telescope
- Two 16 megapixel HgCdTe focal planes at 4-5.4 & 6-10 μm simultaneously imaged
- Detectors passively cooled to 40K
- Sun-Earth L1 orbit
- First proposed 2005
- Awarded technology development funding in 2011 Discovery
- Awarded Extended Phase A in 2016
- System Requirements Review/Mission Definition Review passed 2/28/18



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