

The background of the slide is a composite image of space. In the upper left, a bright sun or star is visible. In the lower left, the curved horizon of the Earth is shown with blue oceans and white clouds. In the center, the NEOWISE spacecraft is depicted, a large cylindrical telescope with various instruments and solar panels. The text is overlaid on this background.

Near Earth Object Wide-field Infrared Survey Explorer (NEOWISE)

NASA Small Bodies Assessment Group Update
June 13, 2017

J. Bauer, A. Mainzer, J. Masiero, R. Cutri, E. Kramer, C.
Nugent, T. Grav, S. Sonnett, B. Fabinisky and the
NEOWISE Team

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

NEOWISE Reactivation Mission Status



Mainzer et al. 2014 ApJ, 792, 30

- WISE brought out of hibernation in 2013, renamed NEOWISE
 - New mission to **detect and characterize asteroids and comets** that may pose hazards to the Earth
 - Funded by the NASA Planetary Science Div., **Planetary Defense Coordination Office**
- Surveying resumed on Dec. 13, 2013
 - Telescope passively cooled to **74-75K**
 - 3.4 μm (W1) and 4.6 μm (W2) detectors operating at near cryogenic sensitivity
 - Similar survey strategy as WISE mission, [with compensation for drifting orbit plane]
 - **7 complete sky** coverages as of Mid-June
- IPAC responsible for data processing, archiving and distribution
- **NEOWISE approved to survey until the end of 2017**

Solar System Detection Highlights

- 509 deliveries to the MPC as of 5/31/17
 - 637,948 detections of 26082 confirmed objects, including 698 NEOs and 121 comets
 - 416 discoveries, including 114 NEOs and 10 comets
- Two recent milestones reached:
 - As of April 25, a half million NEOWISE detections of small bodies have been confirmed by the MPC
 - The 500th tracklet delivery was made to the MPC on May 10

JPL's Annual Open House



Don Royer, Celebrity Operations Mission Manager

“Ticket to Explore” NEOWISE booth May 20-21 a big success

- 13,000 visitors per day.
- People very excited to hear about the planetary defense program at NASA.

What portions of the surface are seen in the thermal infrared?

- 3D thermal transport model, with roughness
- 0° and 45° obliquity
- Vary thermal parameter Θ over 4 orders of magnitude
- Details in Nugent et al., “Observed asteroid surface area in the thermal infrared,” **The Astronomical Journal**, vol. 153, Jan. 2017

$$\Theta = \frac{\Gamma \sqrt{\omega}}{\epsilon \sigma T^3}$$

Γ is thermal inertia, ω is rotation frequency, ϵ is emissivity, σ is the Stefan–Boltzmann constant, and T is sub-solar temperature.

Visible



High \cup

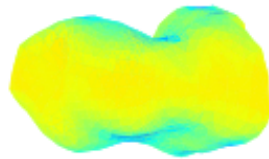
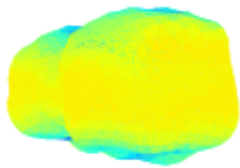


Low \cup



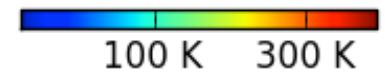
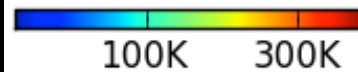
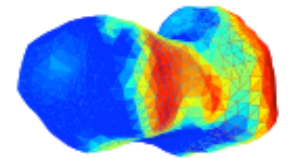
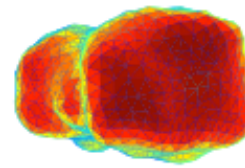
Opposition

90° phase angle



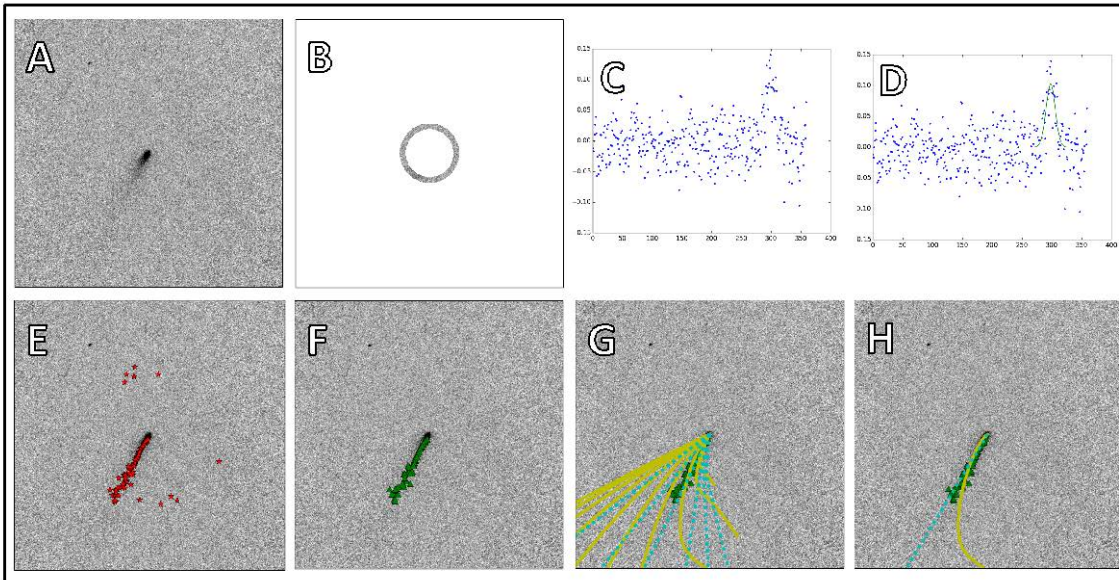
Opposition

90° phase angle



Automatic comet dust tail fitting and analysis

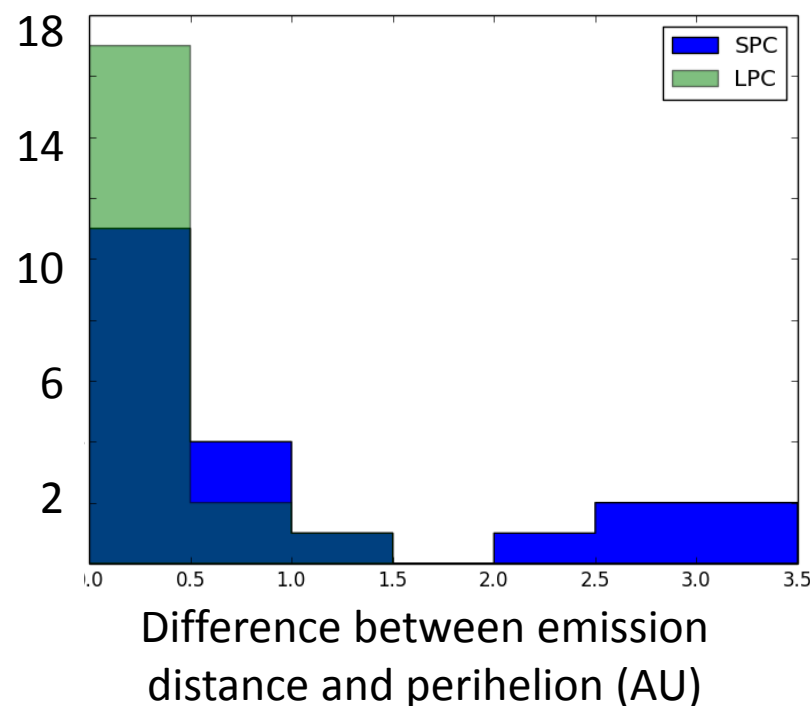
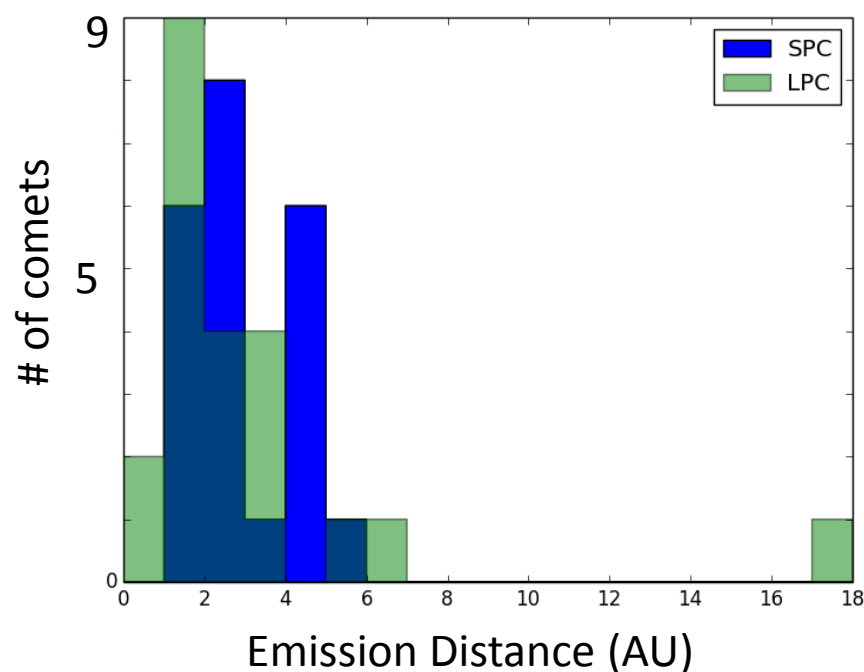
- Published March 2017 in ApJ (Kramer et al., **838:1**)



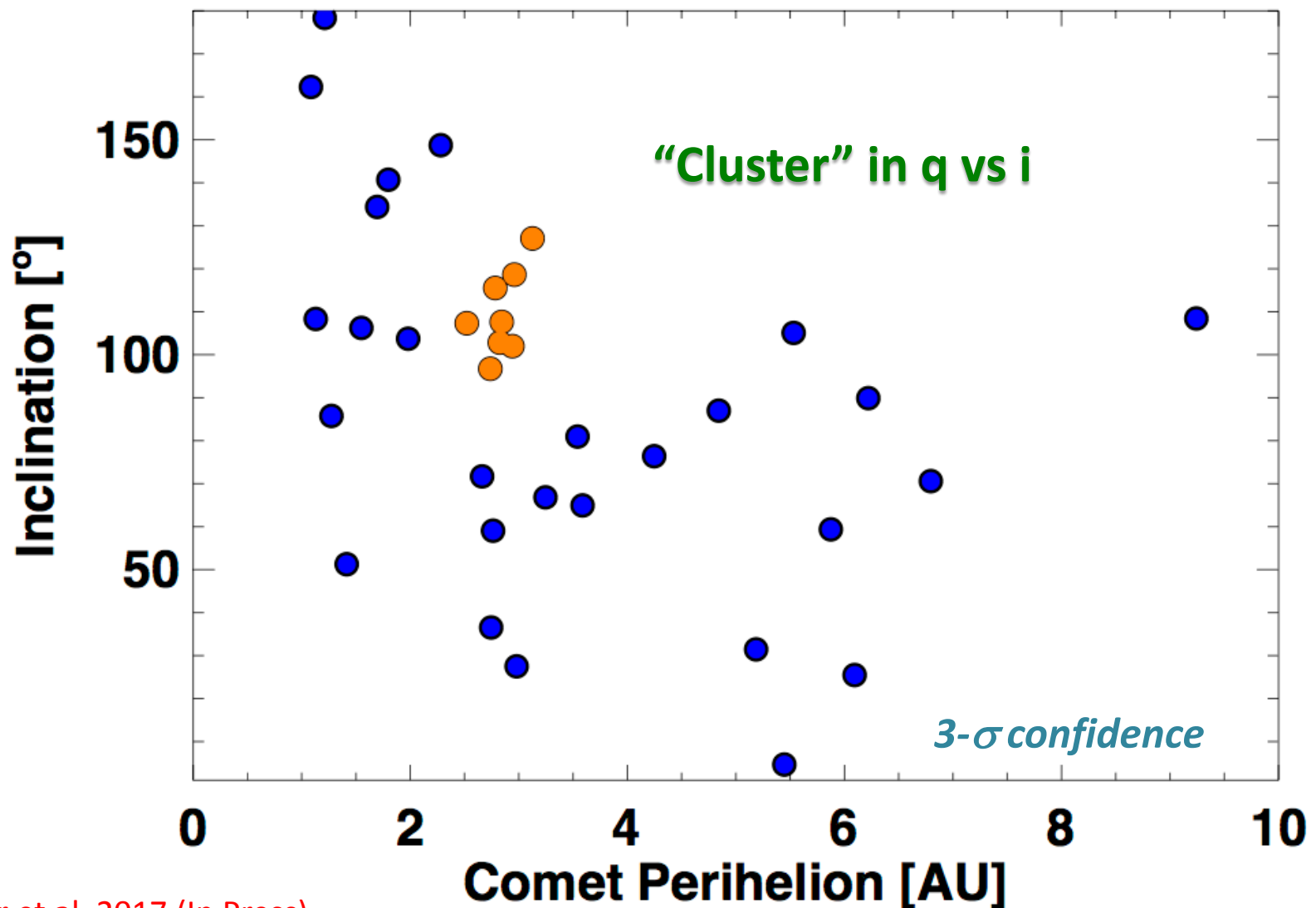
- Flow chart of tail fitting process which selects best-fit model for cometary dust tail particle sizes and ages

Application of Analysis Technique to WISE prime mission data set

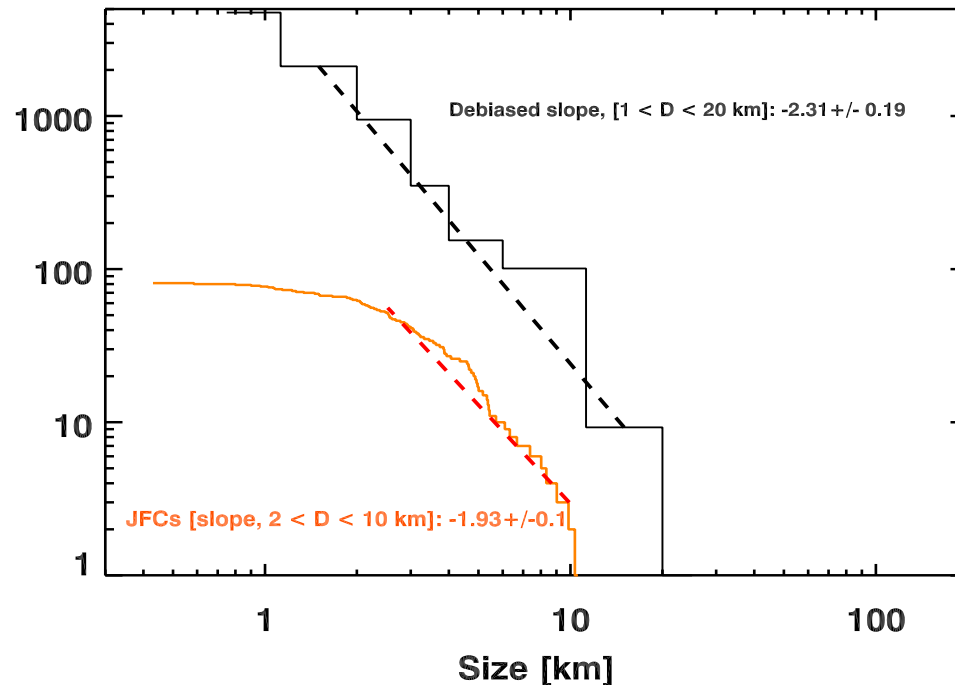
- Apply technique in uniform manner to get more consistent results than by manually fitting the models
- In preparation for submission; expected to be submitted in summer 2017 (Kramer et al. 2017, in prep)



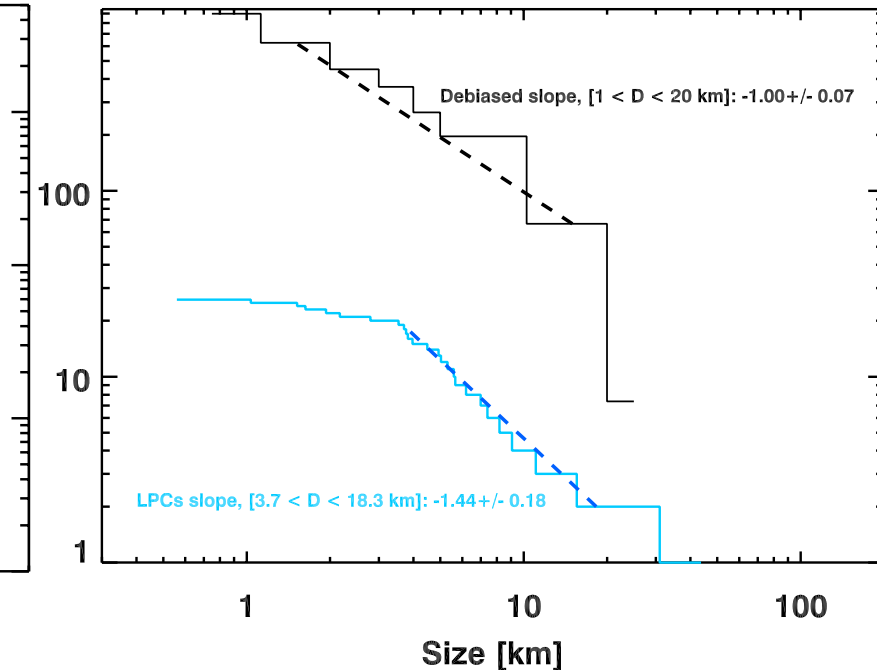
Pipeline-Detected LP Comets



NEOWISE JFC CSD



NEOWISE LPC CSD



- Extracted diameters for 94% of the 164 comets in our sample. When compared to other diameters, they are within $\pm 25\%$.
- **Debiased: LPCs $\beta = -1.0 \pm 0.1$, JFCs $\beta = -2.3 \pm 0.2$.**
- Mean LPC nuclei are $\sim 1.6 - 2\times$ larger than JFCs
- **RAW JFC size distribution slope matches Fernandez et al. 2013**
- **DEBIASED JFC CSD is steeper**
- **~ 2100 JFCs, ~ 7 LPCs/year**
- **$N_{\text{JFC}} \sim 2000$ for $D \gtrsim 1 \text{ km}$**

Bauer et al. 2017 (In Press)

NEOWISE 2017 Data Release Adds Year 3 Data to the Public Archive:

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

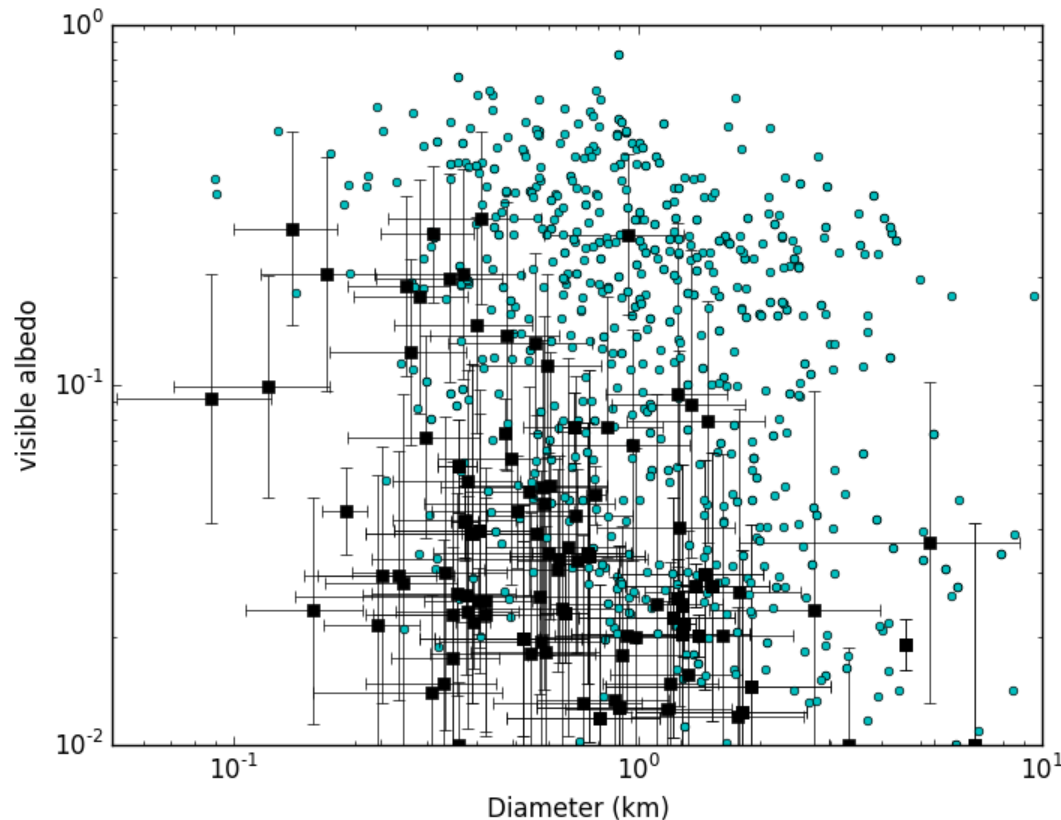


Data Product	Year 3	Total
Single-exposure Images (image sets)	2,599,344	7,718,110
Single-exposure Source Database (detections)	19,631,135,692	57,790,941,849
Moving Object Tracklets (detections/objects)	155,615 11,881	454,986 23,867
Known Solar System Object Possible Assoc. List (entries/objects)	16,465,465 648,632	46,474,077 709,077

Time-domain resource to obtain positions and thermal infrared fluxes to characterize solar system small bodies, as well as variability and motion studies of galactic and extragalactic sources

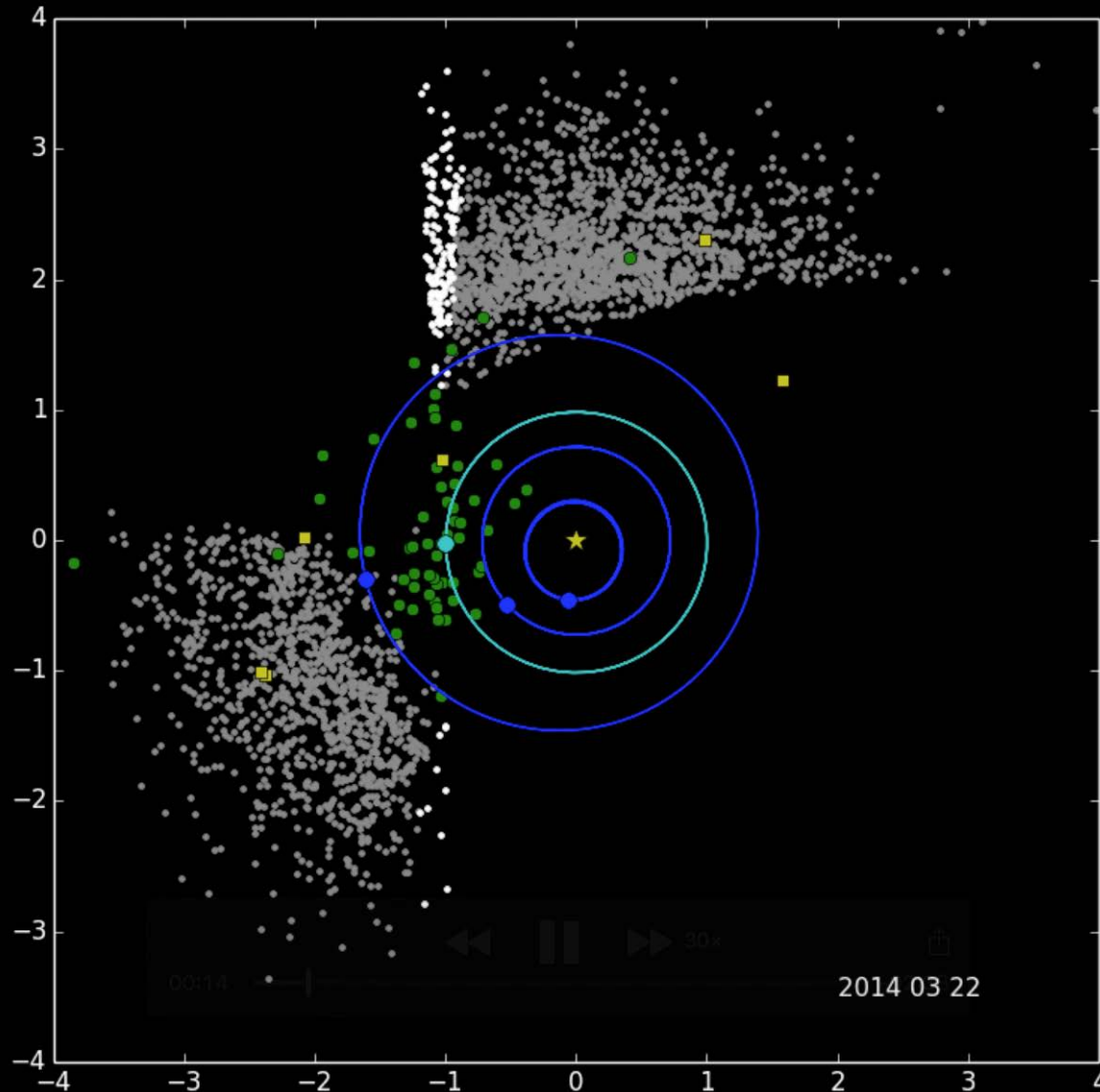
Data access via IRSA and Minor Planet Center

Diameters and Albedos Computed for 541 NEOs and 17,847 MBAs



Masiero et al. 2017 (in prep): Computed albedos and diameters of NEOs detected during first 3 survey years. Cyan points are previously known NEOs. Black points are discoveries attributed to NEOWISE.

454,986 Thermal Measurements of 23,867 Small Bodies In First Three Years



NEOWISE asteroid and comet detections

- Cyan – Earth
- Blue – Mercury, Venus and Mars
- Grey – MBAs
- Green – NEOs
- Yellow - Comets

Courtesy T. Grav, PSI