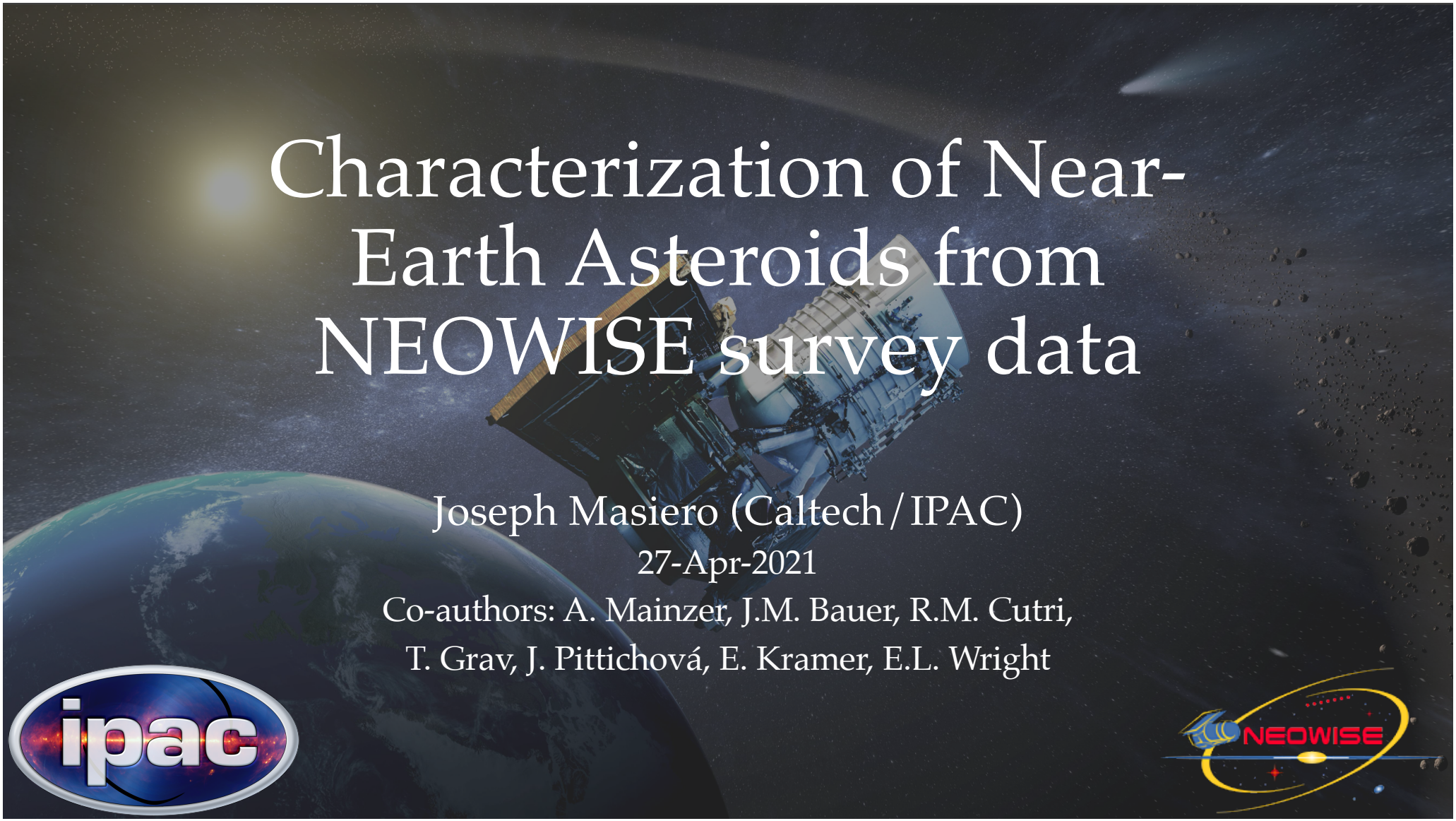

Characterization of Near-Earth Asteroids from NEOWISE survey data

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27-Apr-2021

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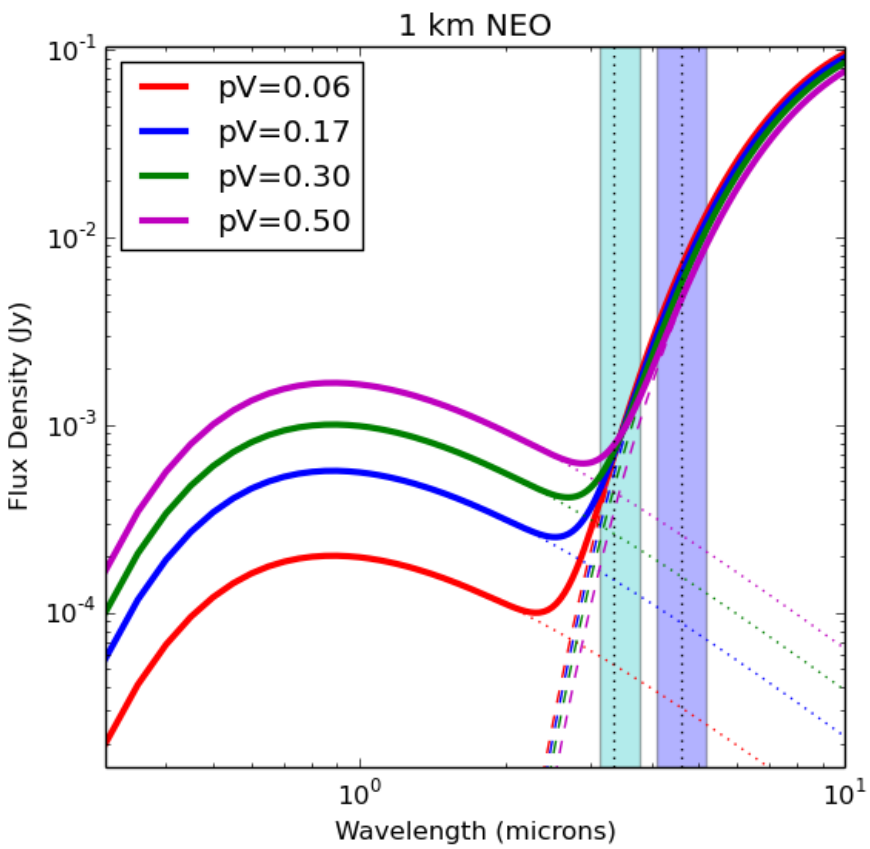
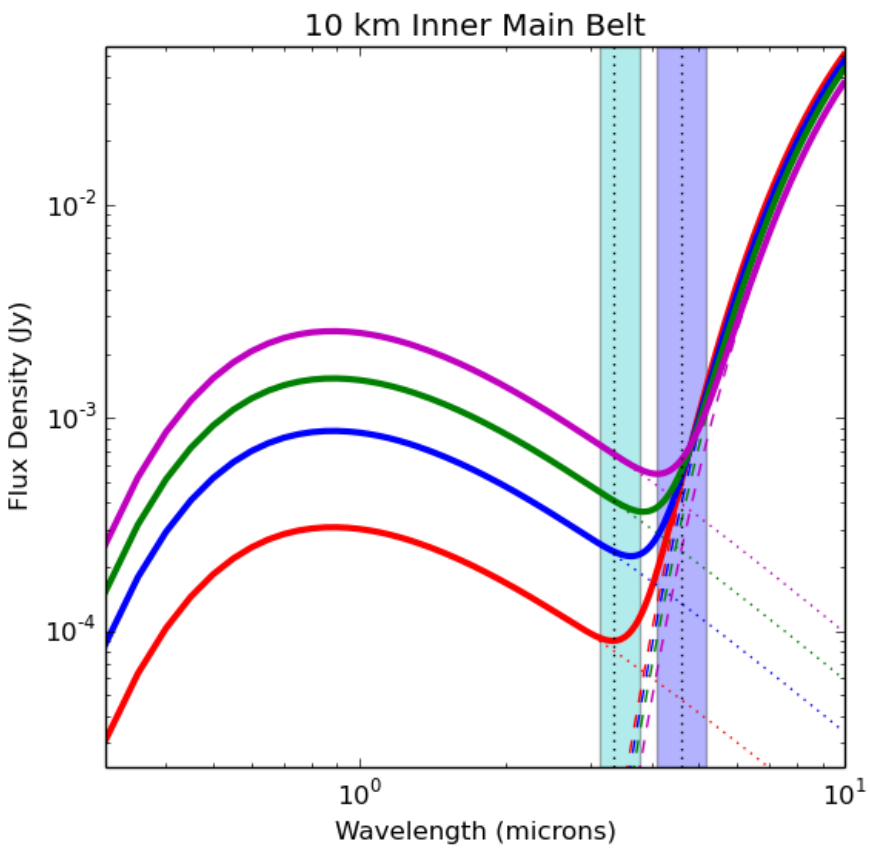
NEOWISE mission overview

- PI-led (PI: Amy Mainzer, U Arizona) under NASA PDCO Program (Lindley Johnson, Planetary Defense Officer)
- Utilizes WISE spacecraft brought out of hibernation in October 2013, following same survey pattern
- 3.4 and 4.6 μm bands (W1 and W2) at ~77K
- Terminator-following pole-to-pole orbit
- Surveys entire sky roughly every 6 months
- Mission goals:
  - Expand survey of NEOs at mid-infrared wavelengths using W1 and W2 channels
  - Obtain physical characterization (including diameters and albedos) of NEOs detected by NEOWISE
  - NEOWISE observations a key component to future mission planning (both human and robotic) as well as planetary defense preparation

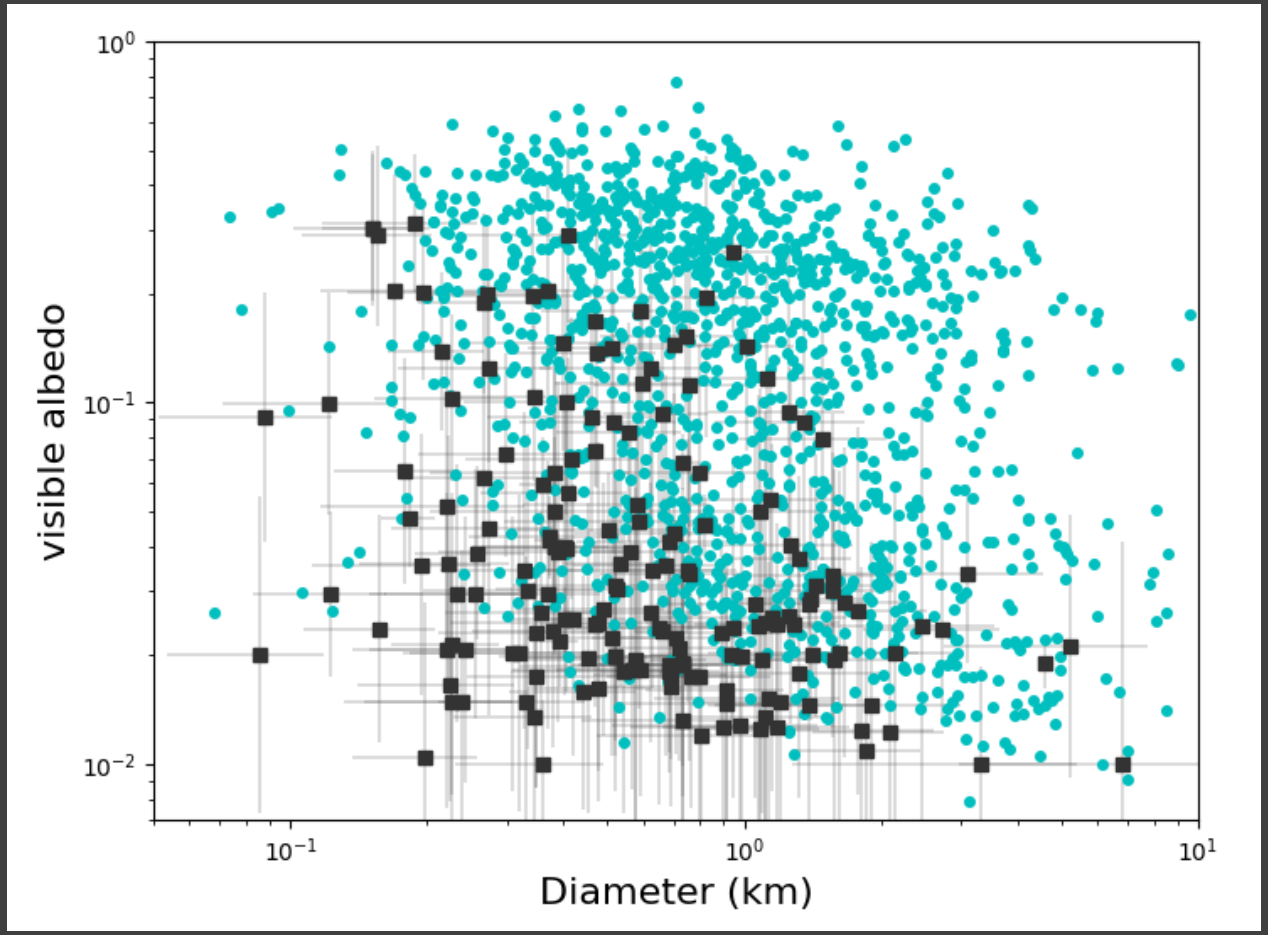
NASA JPL/Caltech

Sizes from Thermal Infrared





Seven years of NEOWISE survey



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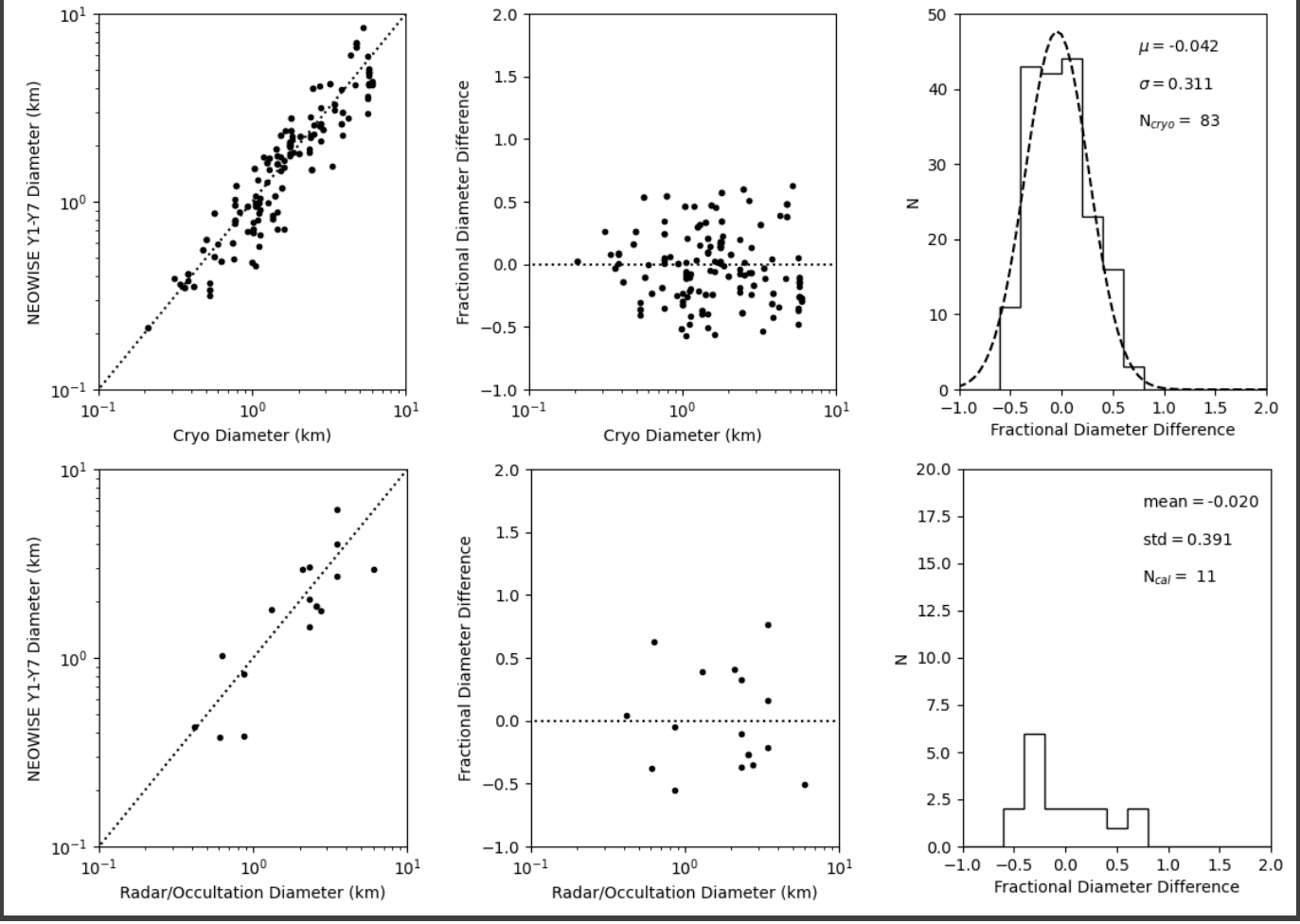
NEO size accuracy

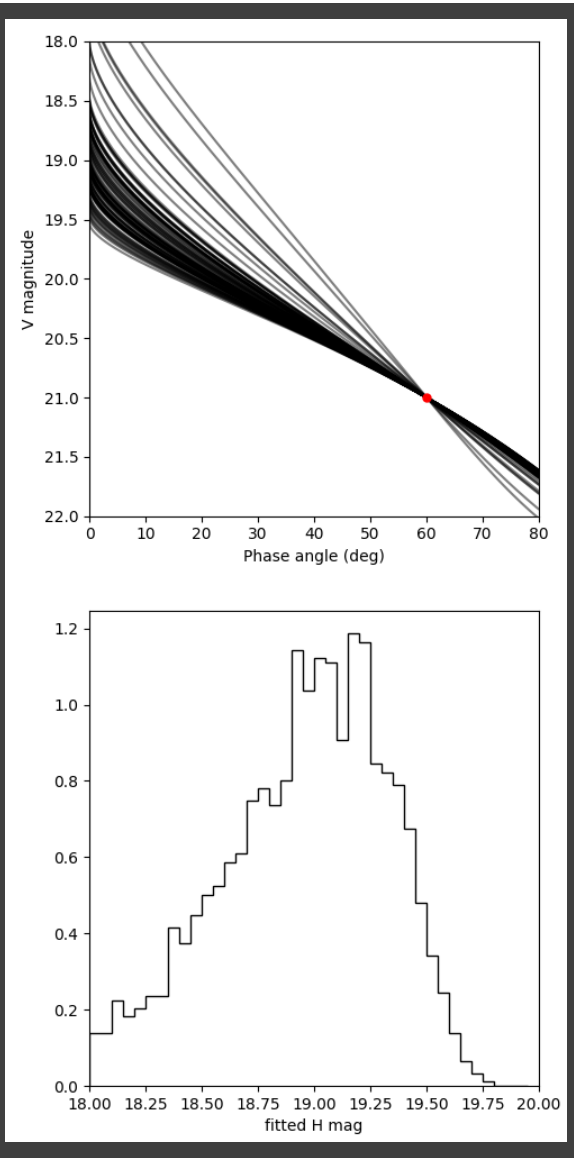


- Sizes from NEATM are spherical equivalent diameters
- Using only 3.4 and 4.6 microns, NEO diameter accuracy is ~30-40%
- This is due to uncertainty in the beaming parameter for NEOs
- When thermal peak is observed and beaming can be fit (e.g. cryogenic WISE mission) diameter accuracy improves to ~10-15%

Masiero et al. in prep

Albedo Uncertainty

- Albedos derived by combining thermal IR diameters with optical measurements
- Uncertainties from both components drive final albedo uncertainty
- For NEOs, observations made at high phases result in large H mag uncertainties unless G slope parameter is constrained
- This drives the uncertainty on albedo
- For the Main Belt, optical observations are at low phase angles, so uncertainty on H much smaller, and not comparable to NEOs
- Caution needed when relating albedo to physical properties
- See Masiero et al. 2021, PSJ, 2, 32 for discussion



Masiero et al 2021

Observations of Exercise Object 2021 PDC

- NEOWISE would not detect 2021 PDC in regular survey operations
- However, a survey replan would allow NEOWISE to follow it for ~3 weeks in June 2021
- This would allow for 300 exposures of 2021 PDC, which could be coadded to increase sensitivity
- Trade off would be increased heat load on the telescope potentially reducing sensitivity by the end of the observing campaign
- Data would be sufficient for a 3σ detection of a 100m size object

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Size constraints on 2021 PDC

- Using an assumed 3σ detection, NEATM thermal model fit gives a diameter of 2021 PDC of 160 ± 80 m
- Large uncertainty a result of unknown beaming parameter
- Based on this, NEOWISE would be able to provide a 3σ upper limit of D < 240 m to mitigation planners by early July 2021
- As data came in over June, upper limit could be calculated and would steadily decrease, with largest sizes being rejected in mid June

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Conclusions

- NASA has requested that the NEOWISE team plan to continue survey through June 2023
- Orbital evolution will be monitored as sun comes out of Solar minimum
- NEOWISE continues to perform well
- No significant degradation in sensitivity anticipated during this time, rate of NEO characterization expected to continue at current level
- NEOWISE offers a unique capability to provide thermal IR observations of a large number of NEOs in support of hazard assessment and planetary defense