ExploreNEOs: The Warm Spitzer Near Earth Object Characterization Survey

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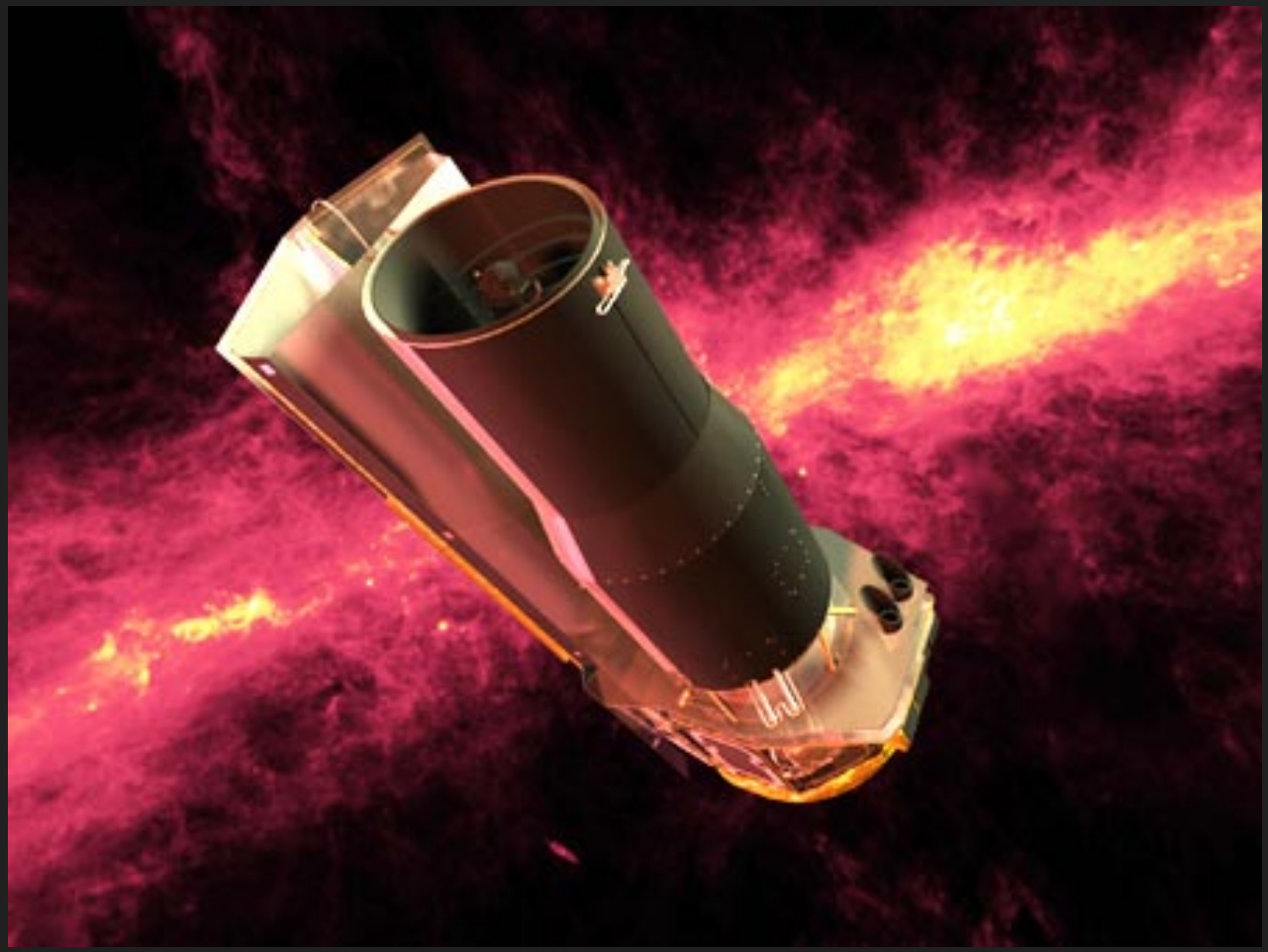
16 Apr 2013

Why do we care about NEOs?

- Short lifetime: Flux of material from elsewhere in the Solar System toward the Earth
- Dynamical state of the inner Solar System
- Compositional state of the inner Solar System
- Asteroids hit the Earth!

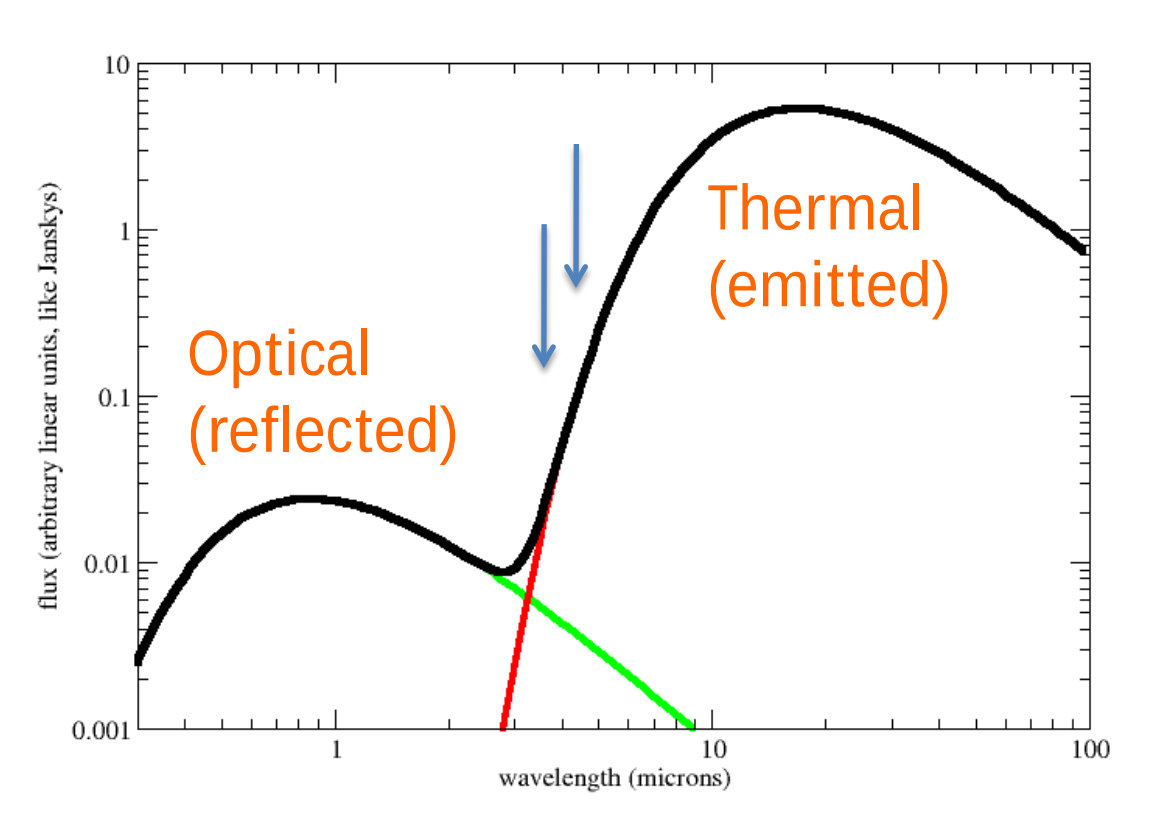
Spitzer: The NEO machine



Introducing ExploreNEOs

- Spitzer: 500 hours (Cy 6+7); PI: Trilling
- Observe ~600 known NEOs (10% of all known)
- Observations at 3.6 and 4.5 microns
- Thermal model: Derive albedo and diameter
- Study ensemble properties of NEOs

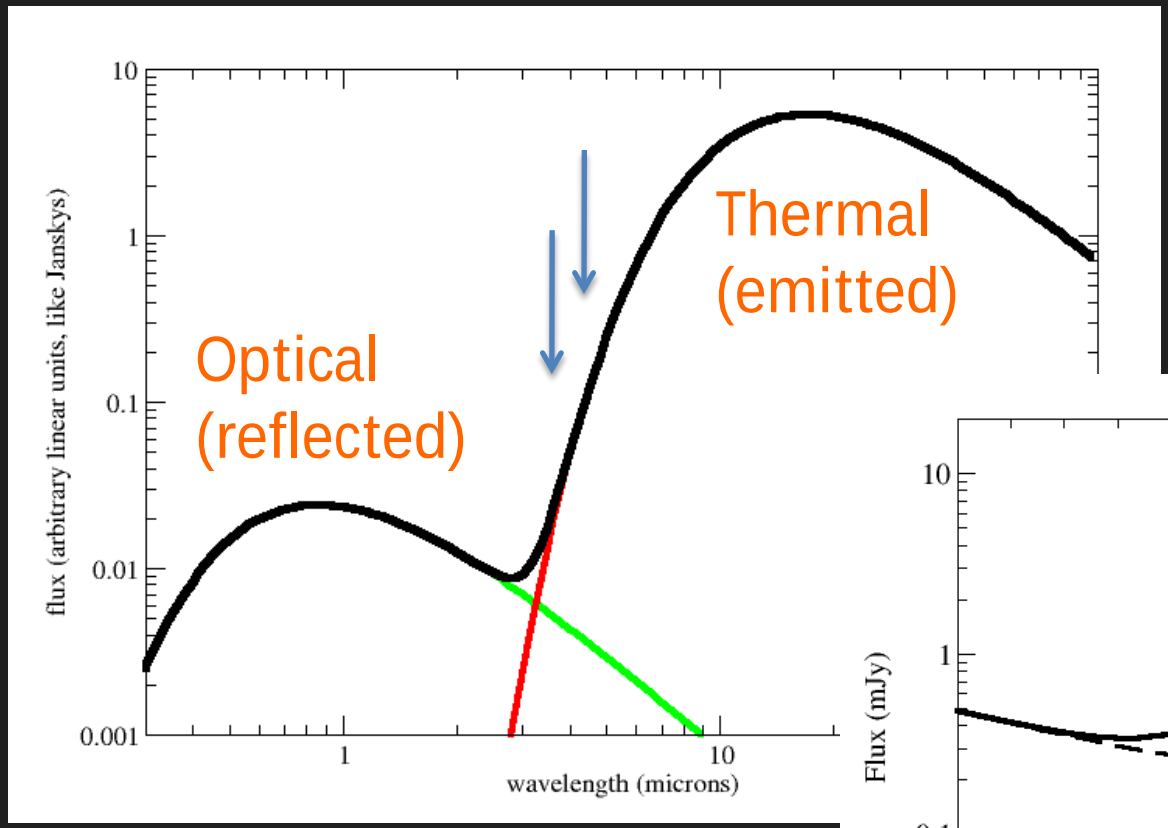
ExploreNEOs: Thermal modeling



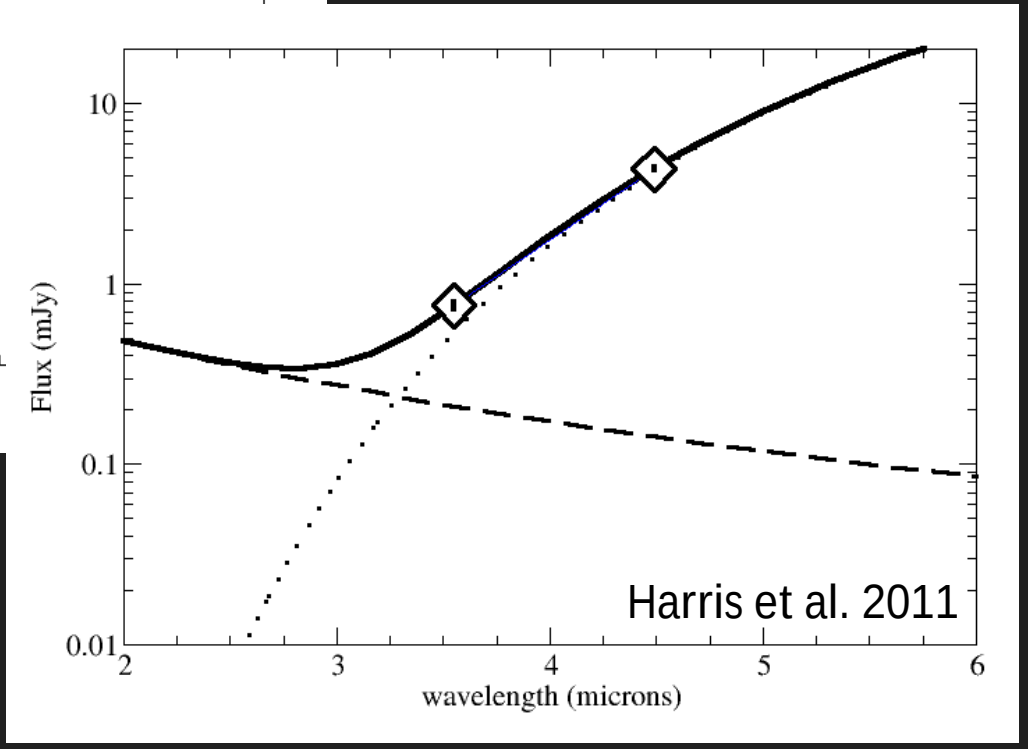
--With just optical, object could be big+dark or small+bright.

--With Spitzer, two measurements (optical, thermal) and two unknowns (albedo, diameter)

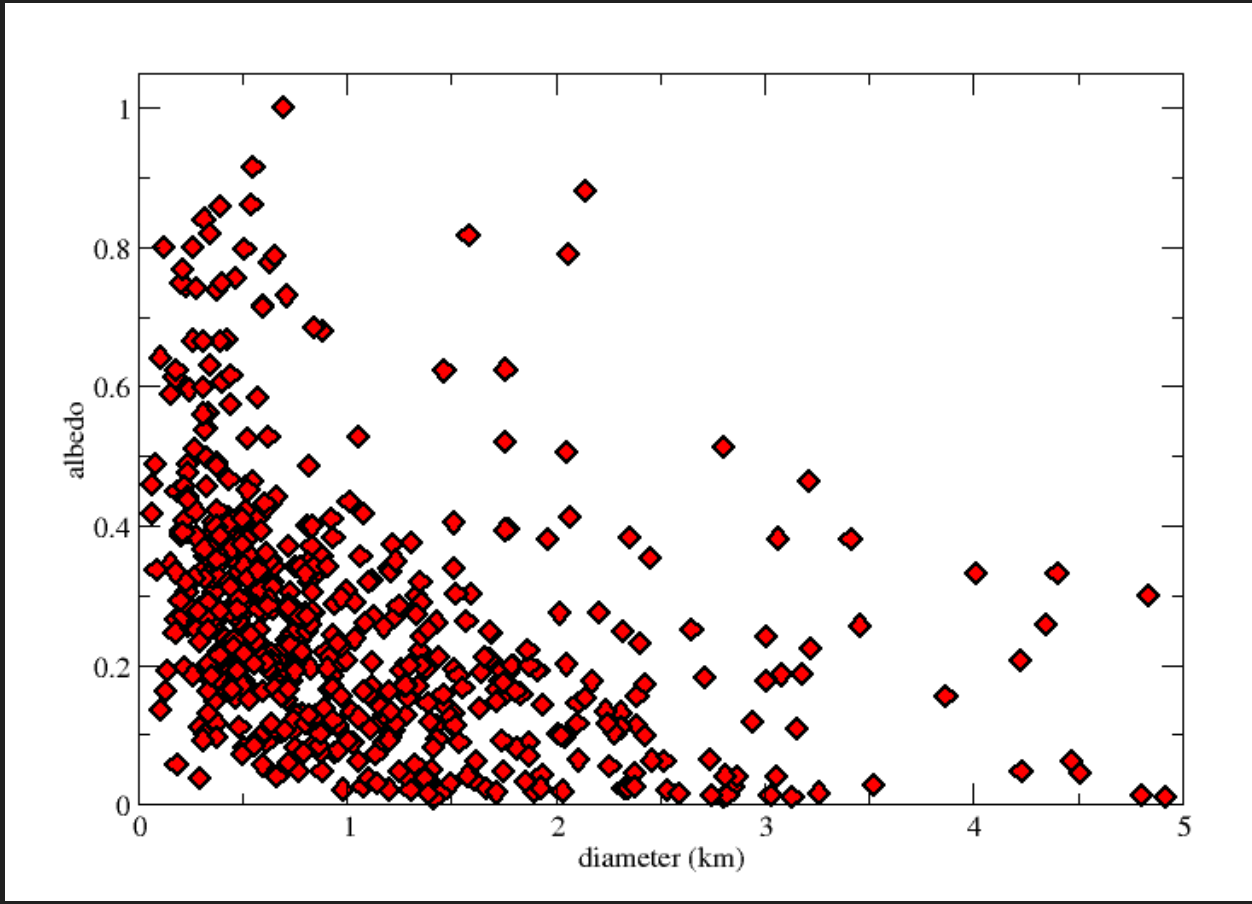
ExploreNEOs: Thermal modeling



(2100) Ra-Shalom



ExploreNEOs: Results (1)



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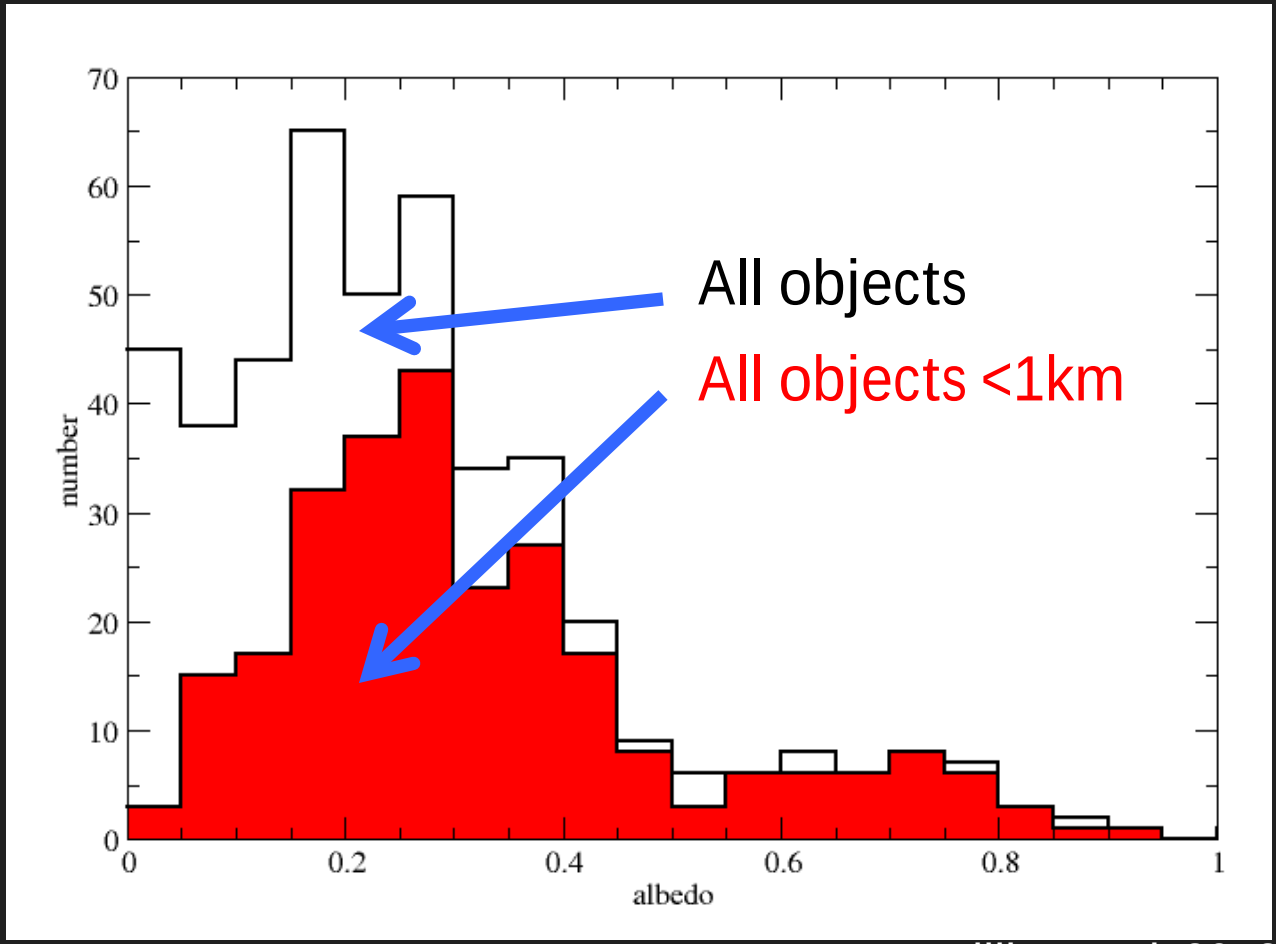
ExploreNEOs: Results (2)



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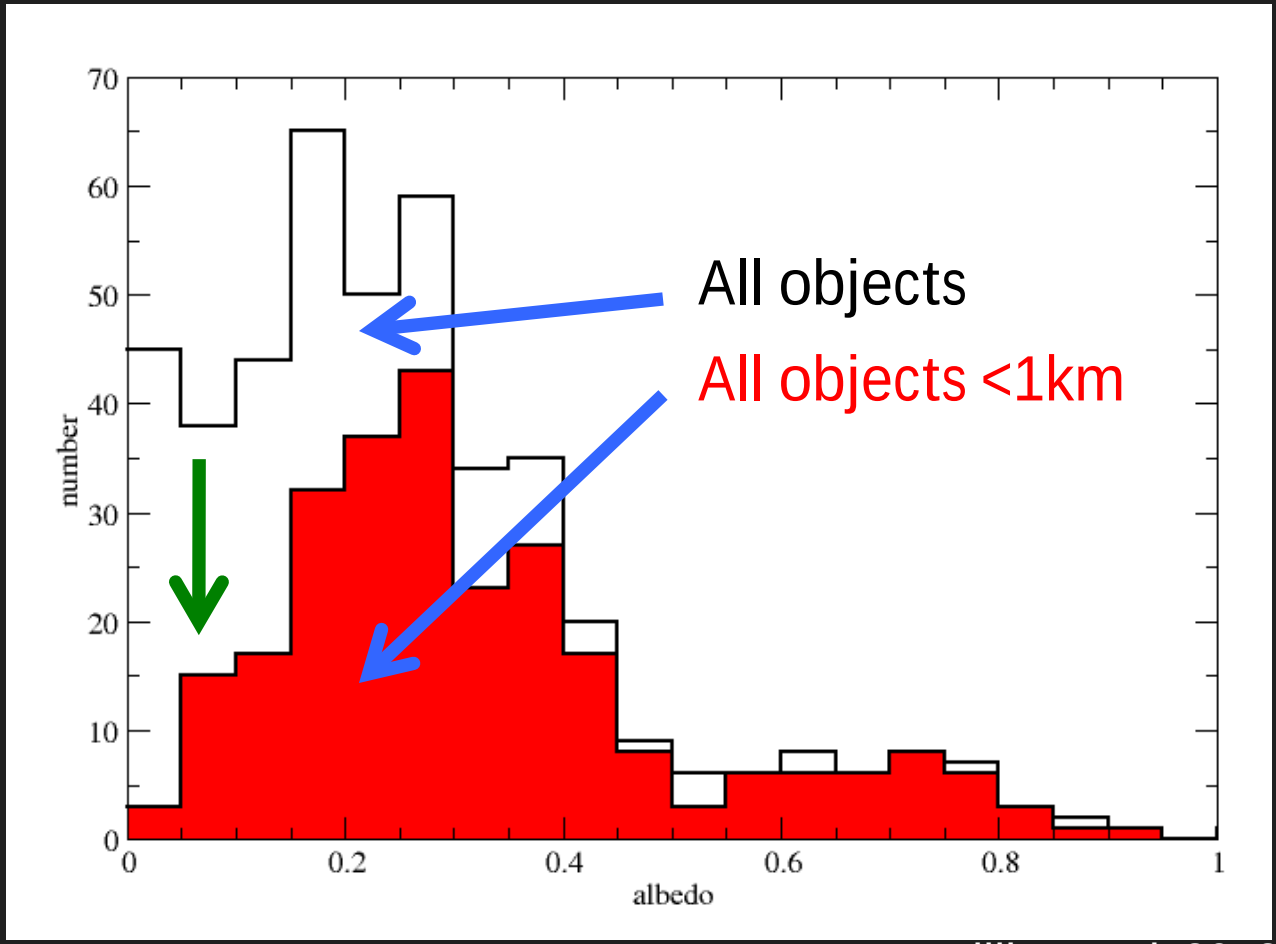
ExploreNEOs: Results (2)

Known bias



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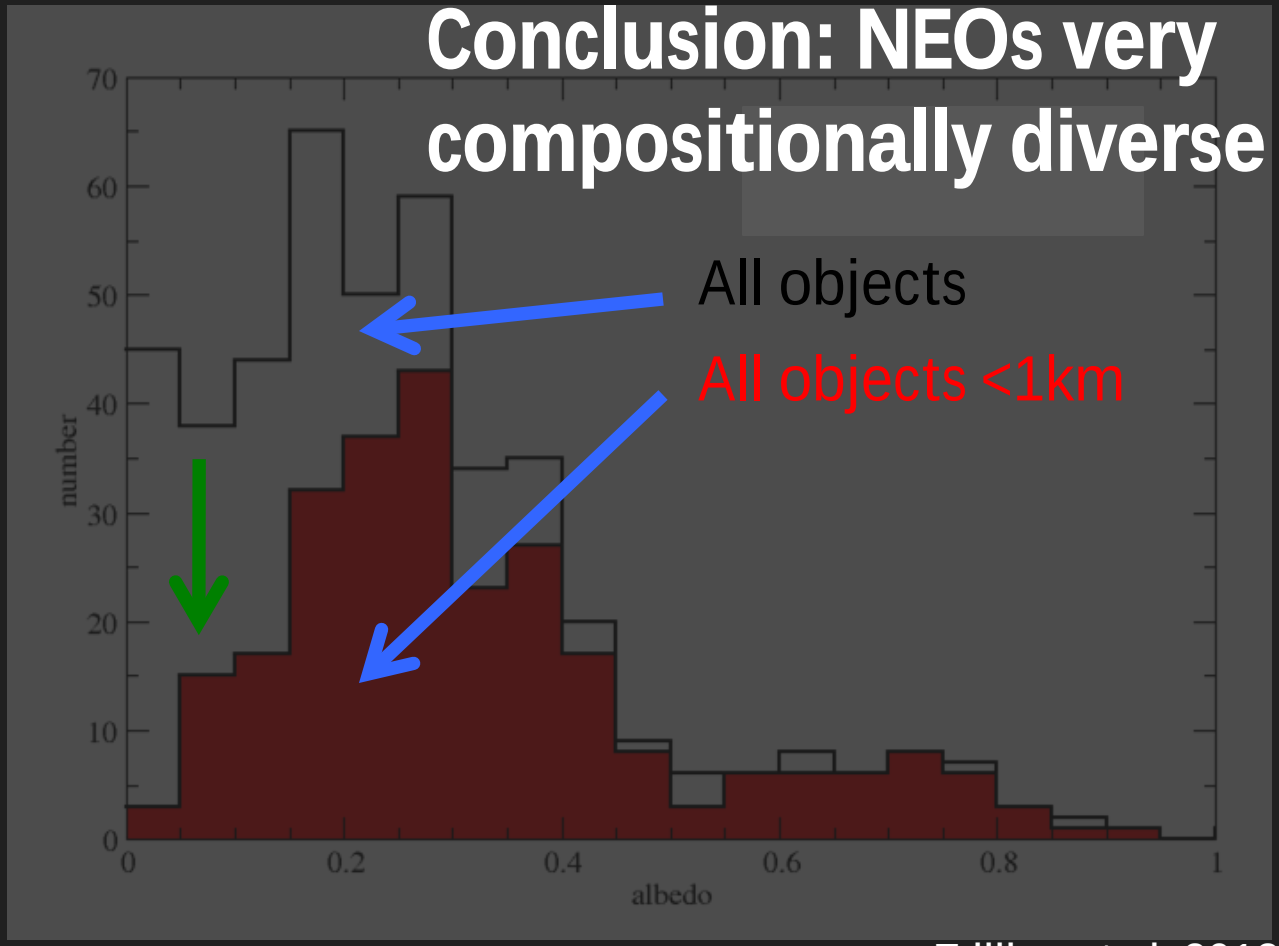

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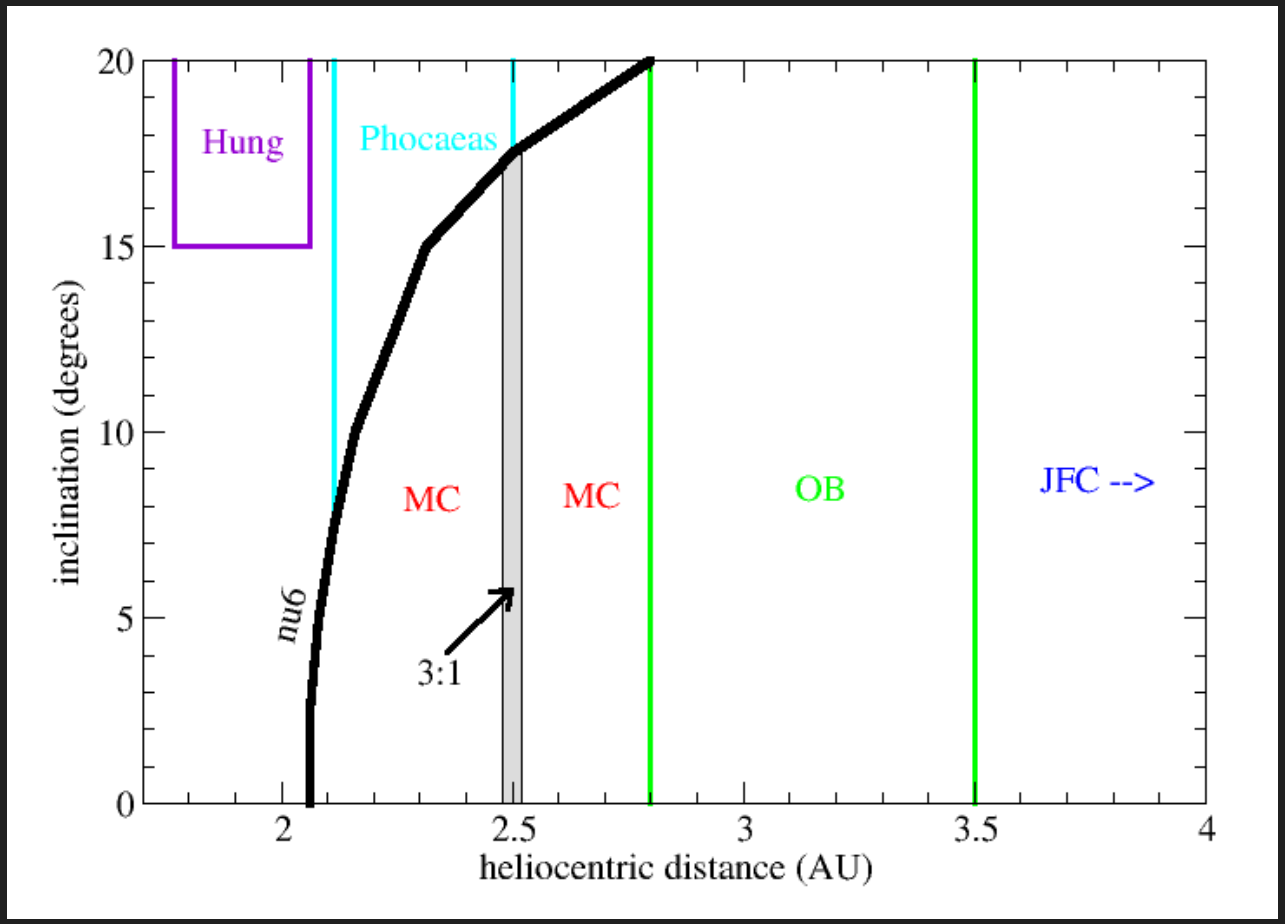
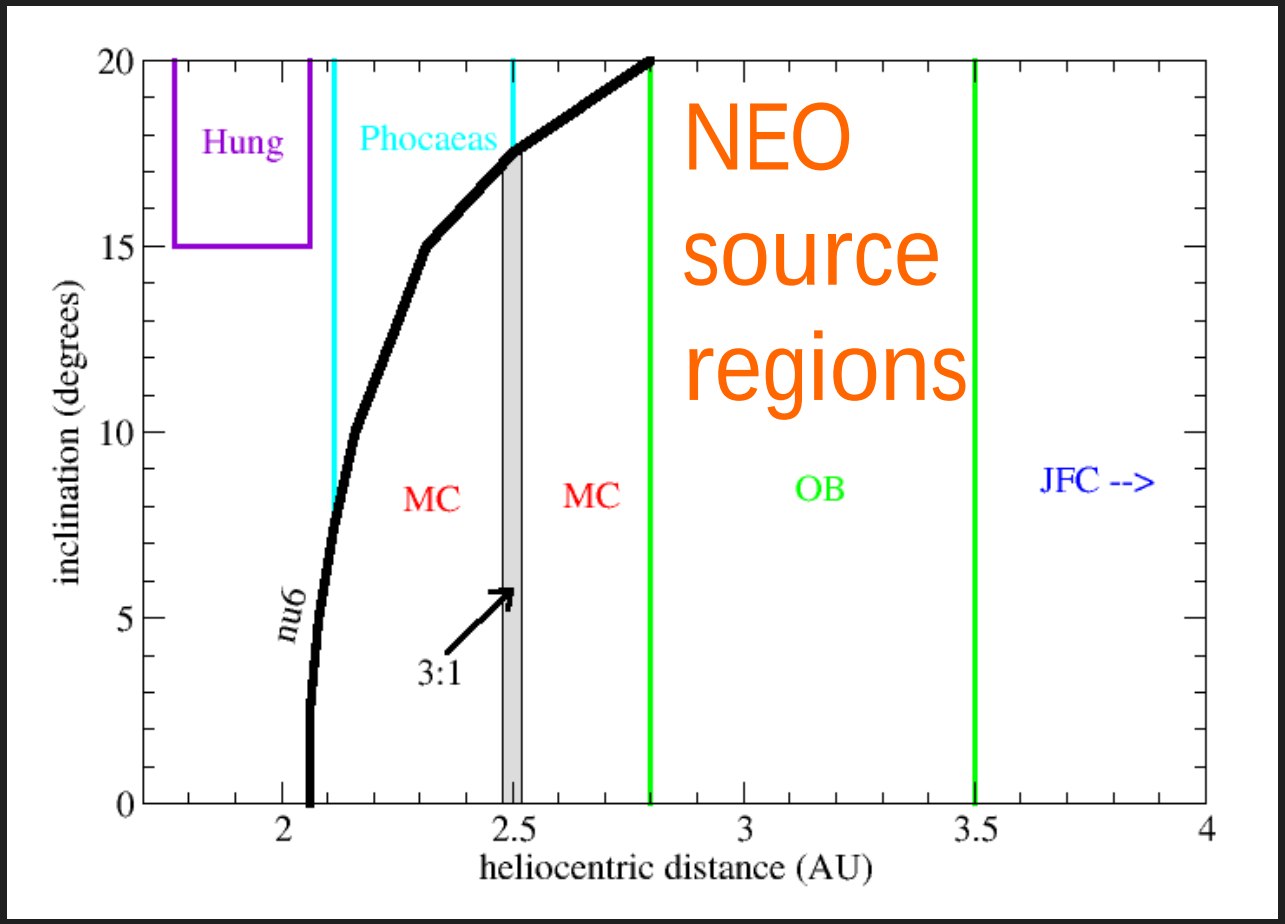
ExploreNEOs: Results (3)



Simplistic map of the main asteroid belt

ExploreNEOs: Results (3)



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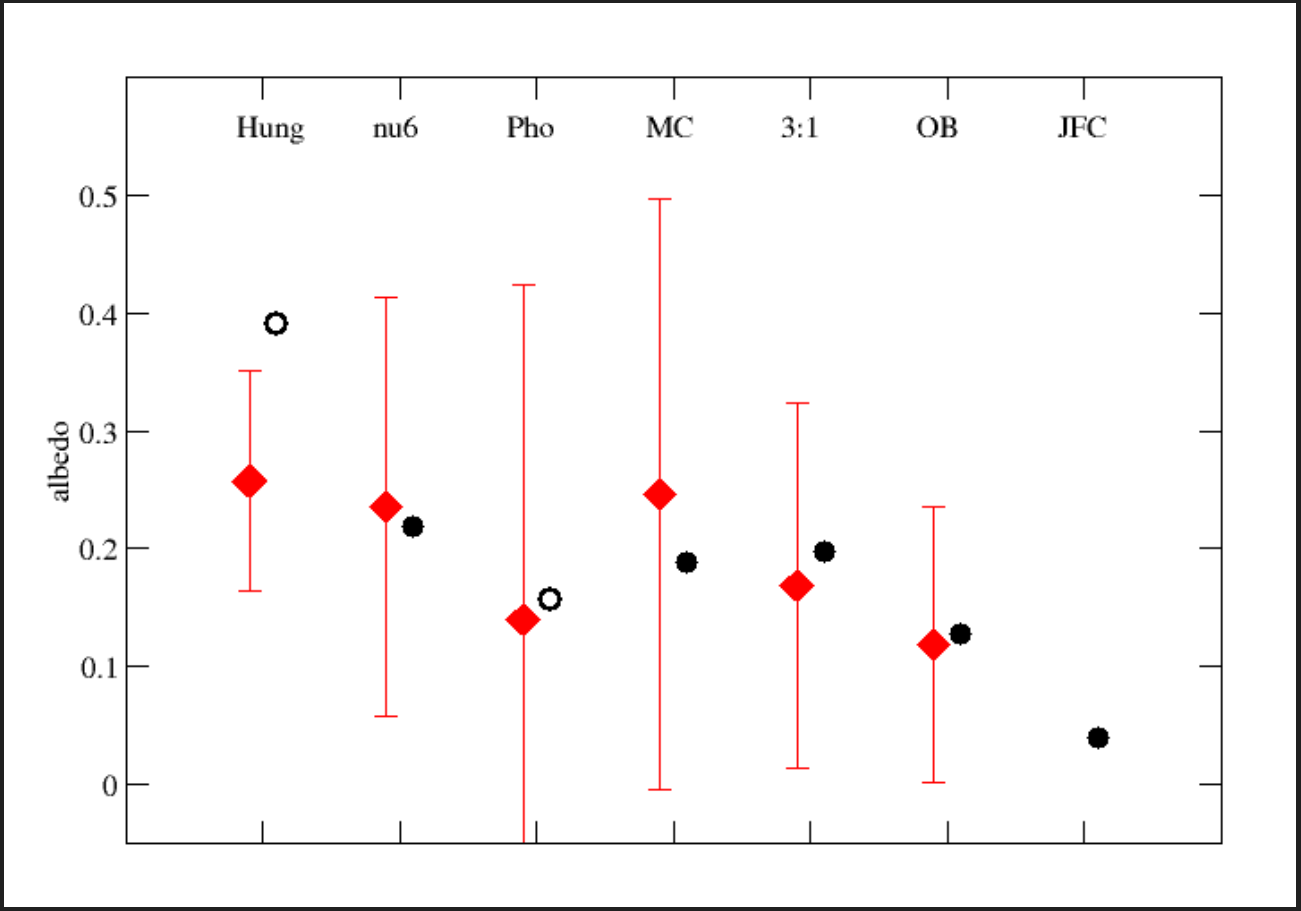

Delbo et al. 2013

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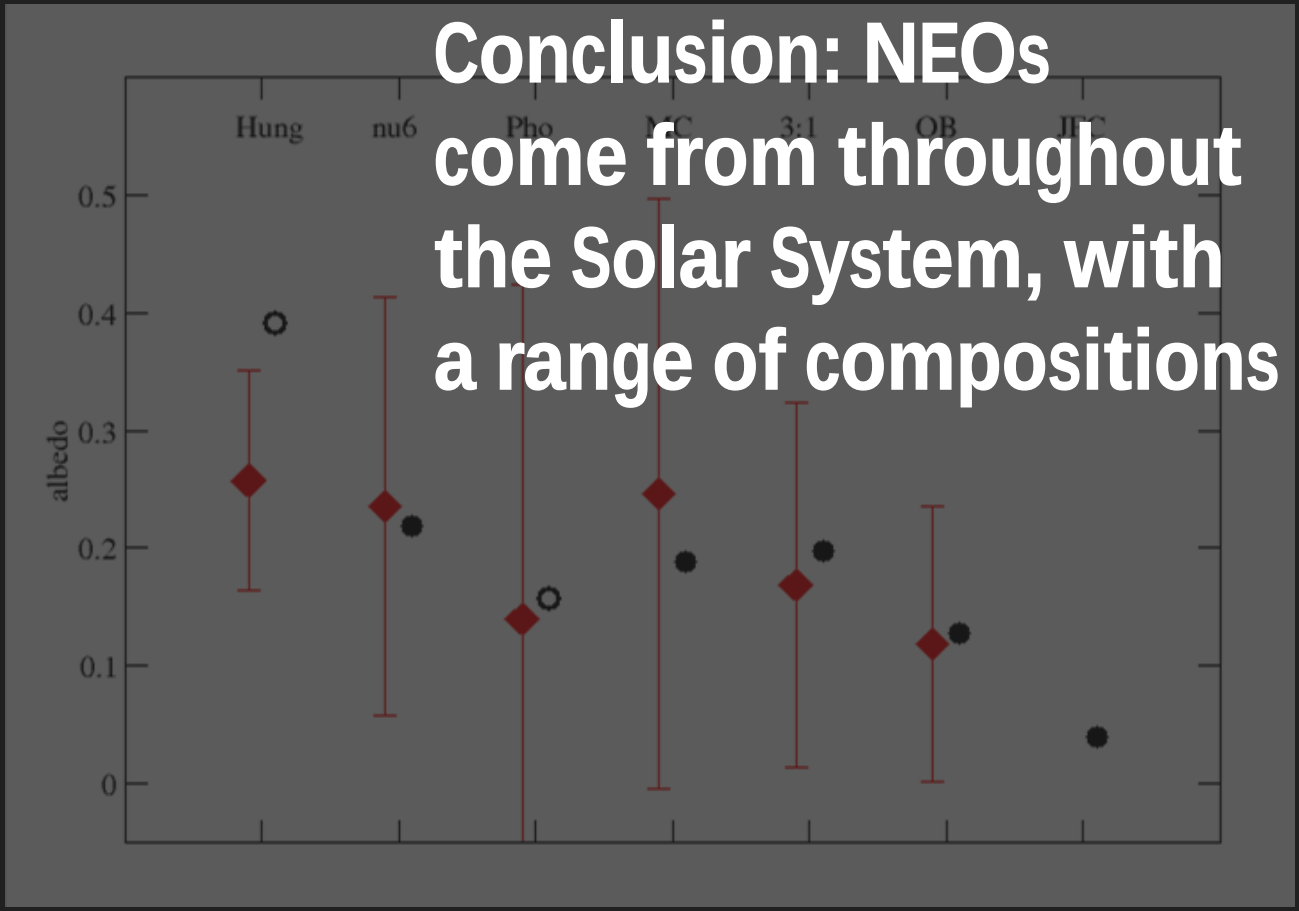
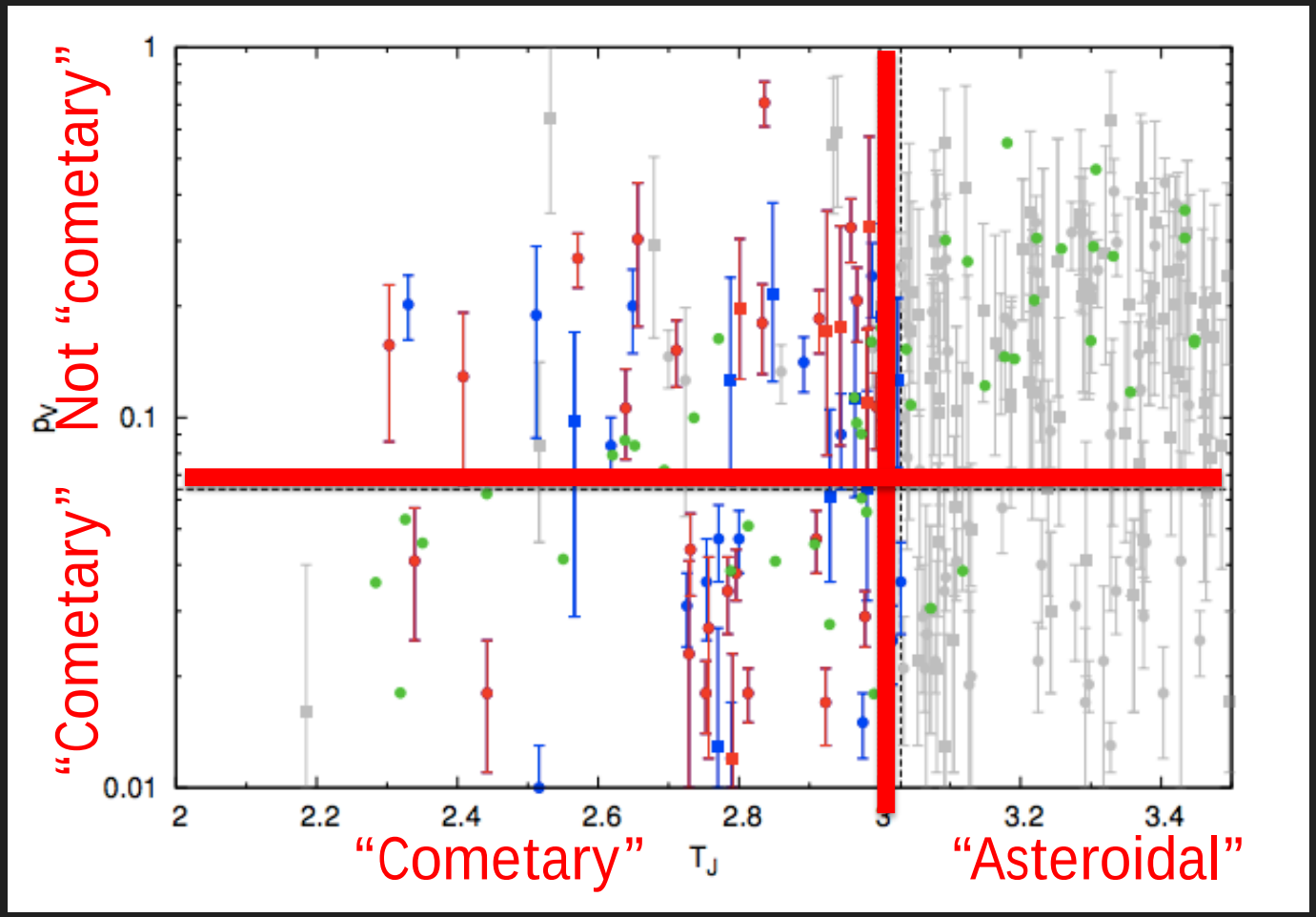


Conclusion: NEOs come from throughout the Solar System, with a range of compositions

Delbo et al. 2013

ExploreNEOs: Results (4)

albedo

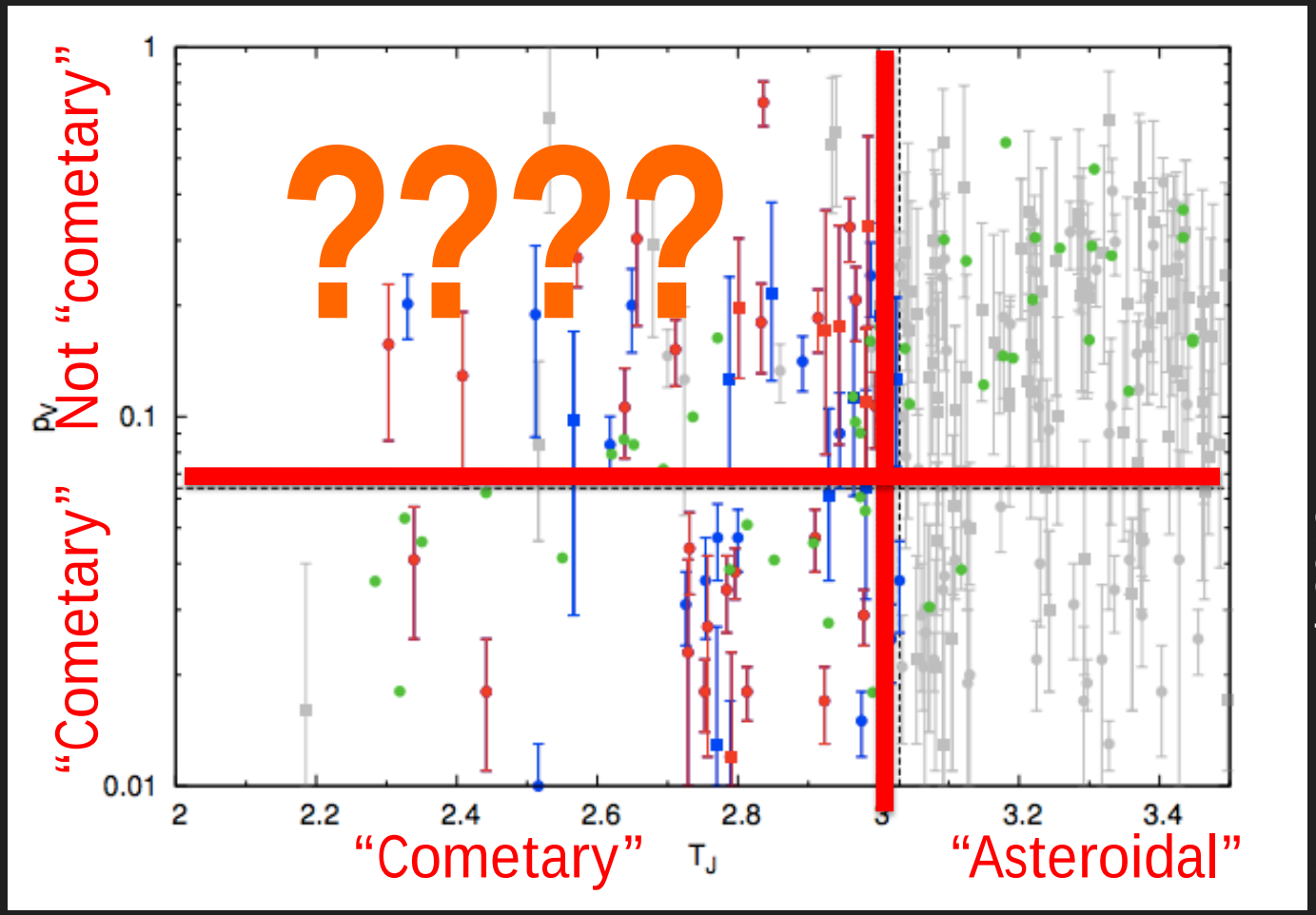


Mommert et al. 2013a

Dynamical measurement (Tisserand parameter)

ExploreNEOs: Results (4)

albedo



Mommert et al. 2013a

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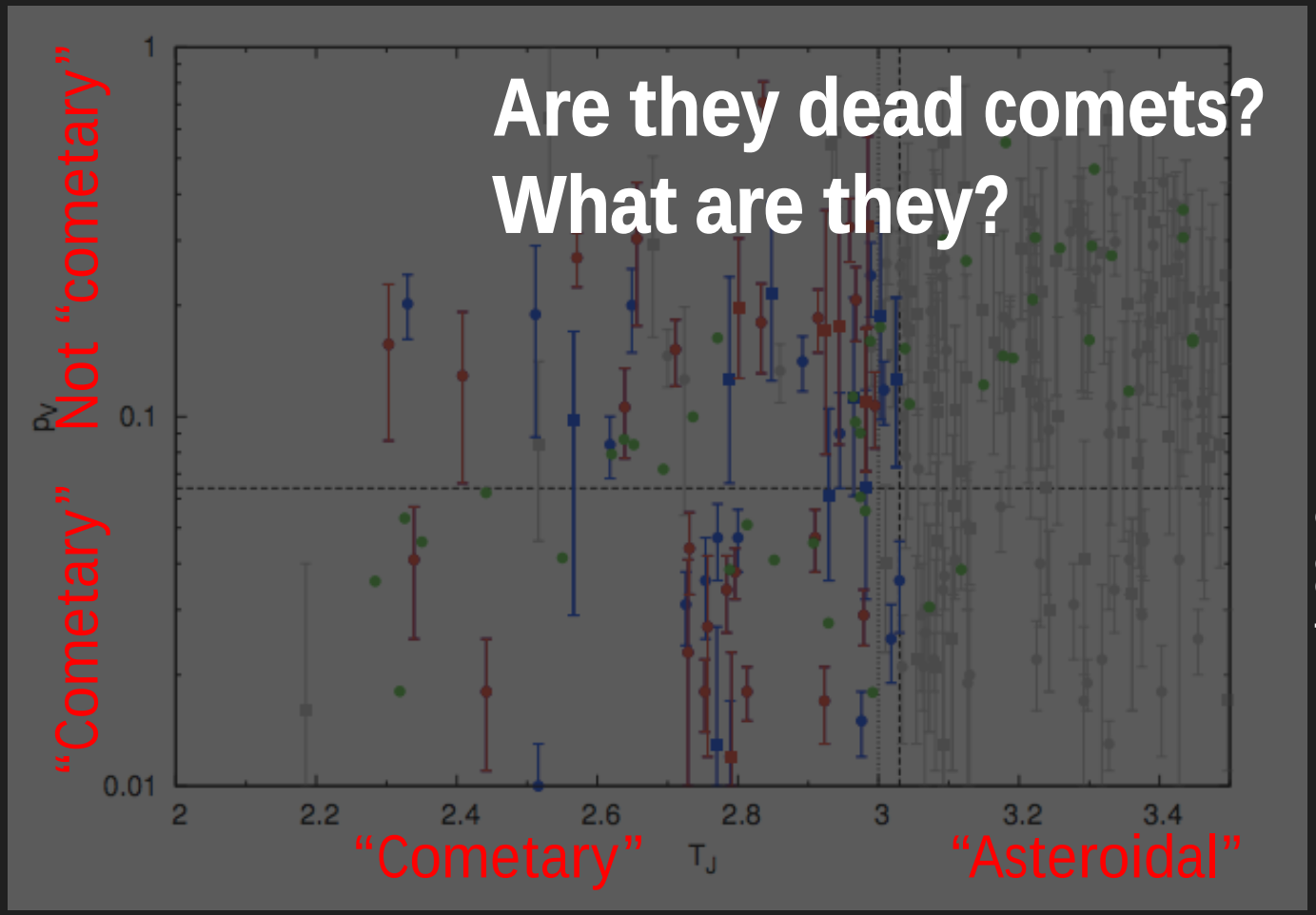

albedo

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Mommert et al. 2013a

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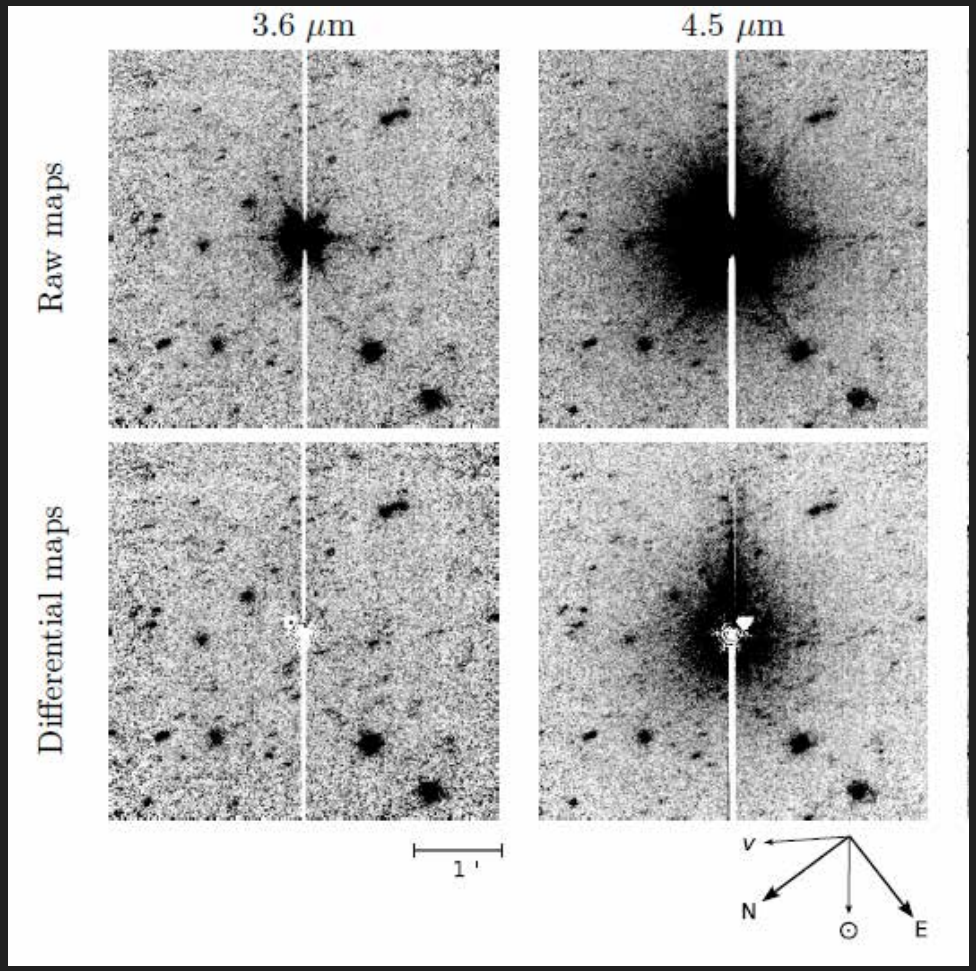
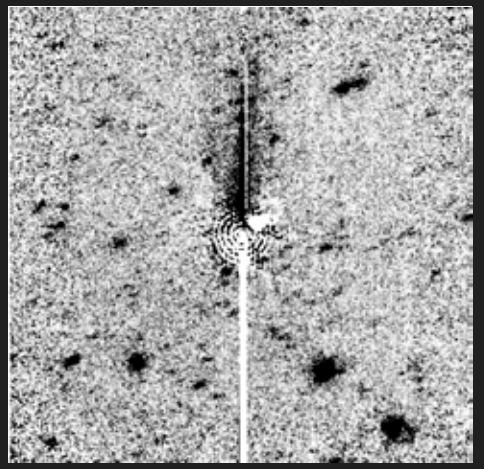
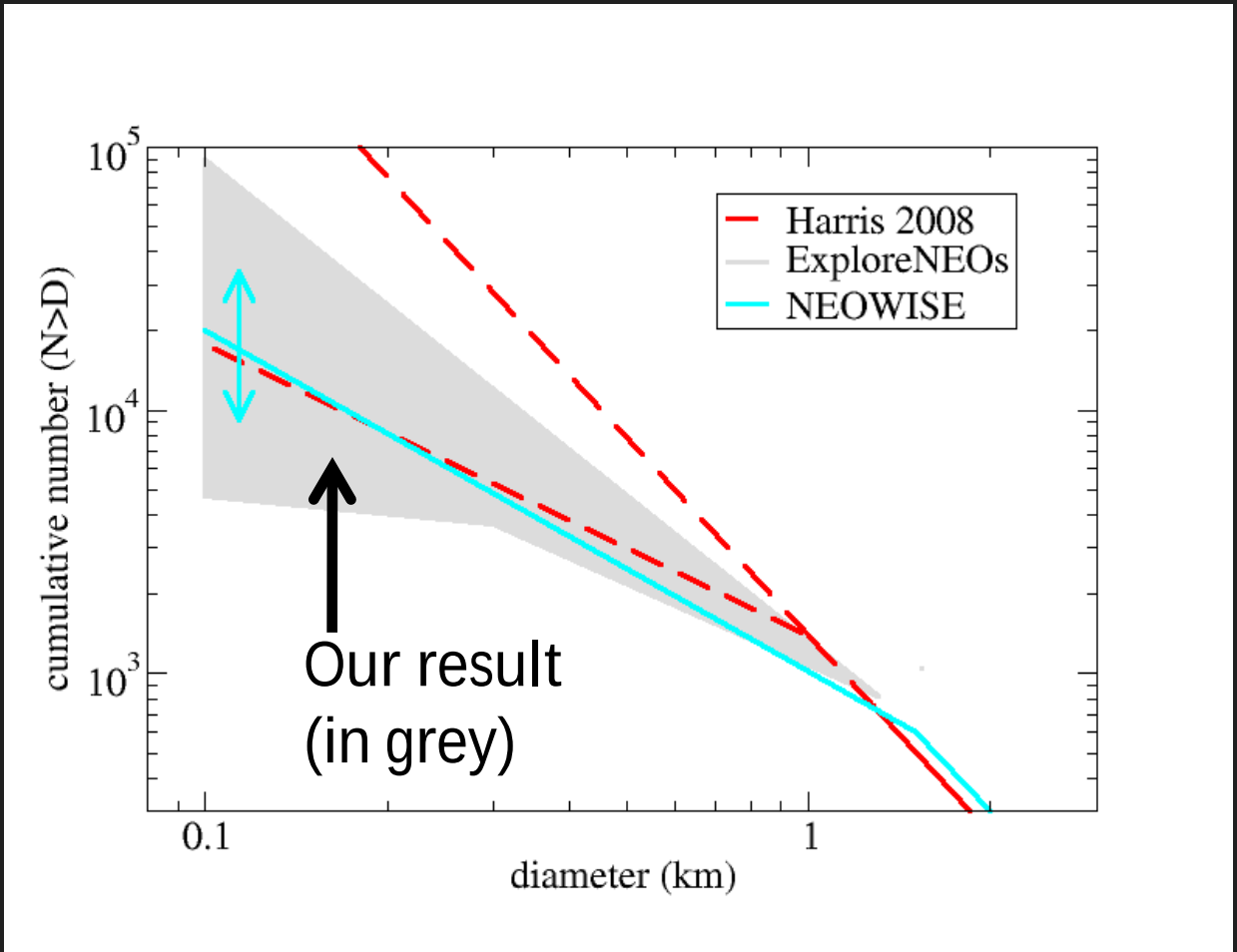


A dead comet grew a tail and came back to life!



Mommert et al. 2013b

ExploreNEOs: Results (5)



Trilling et al. 2013

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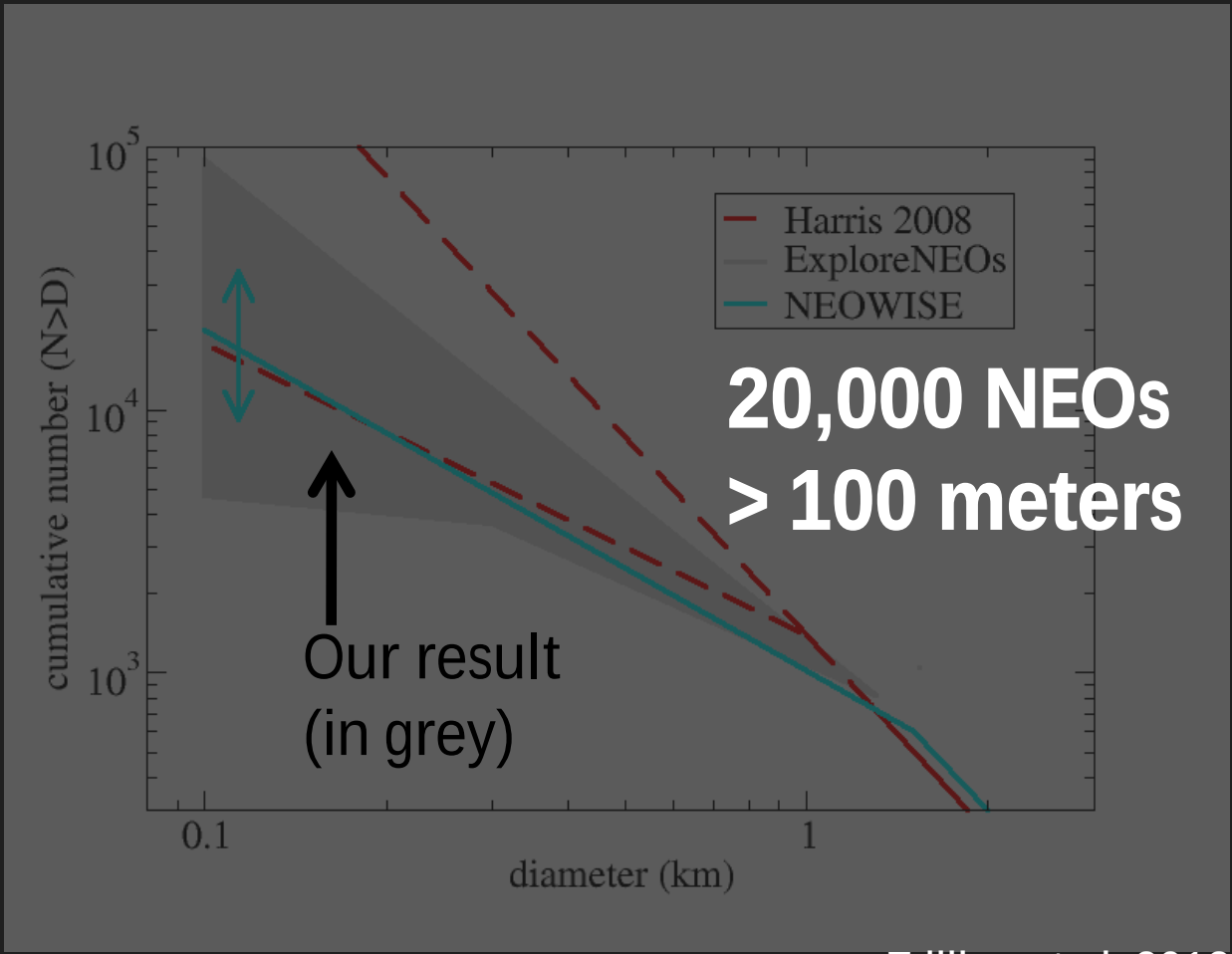

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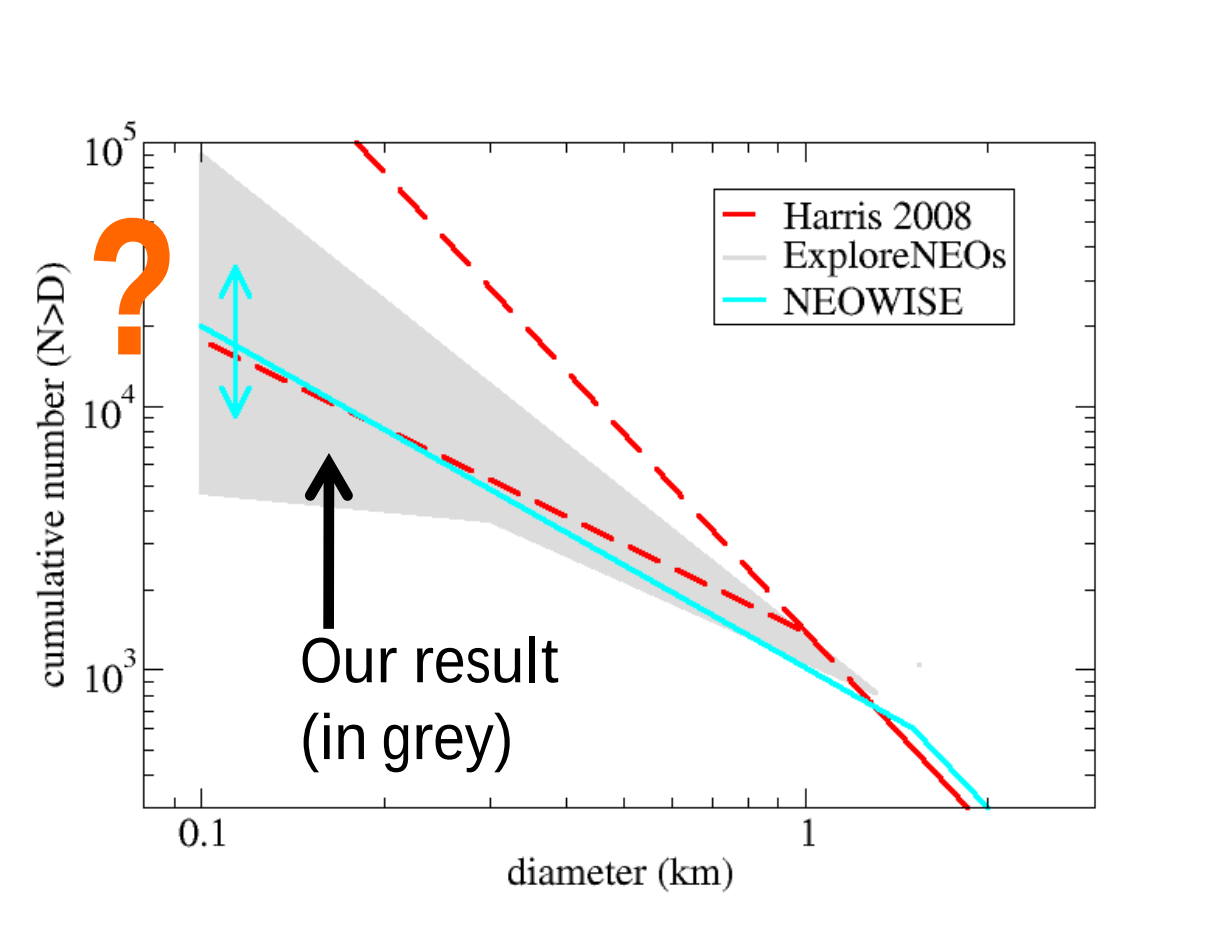

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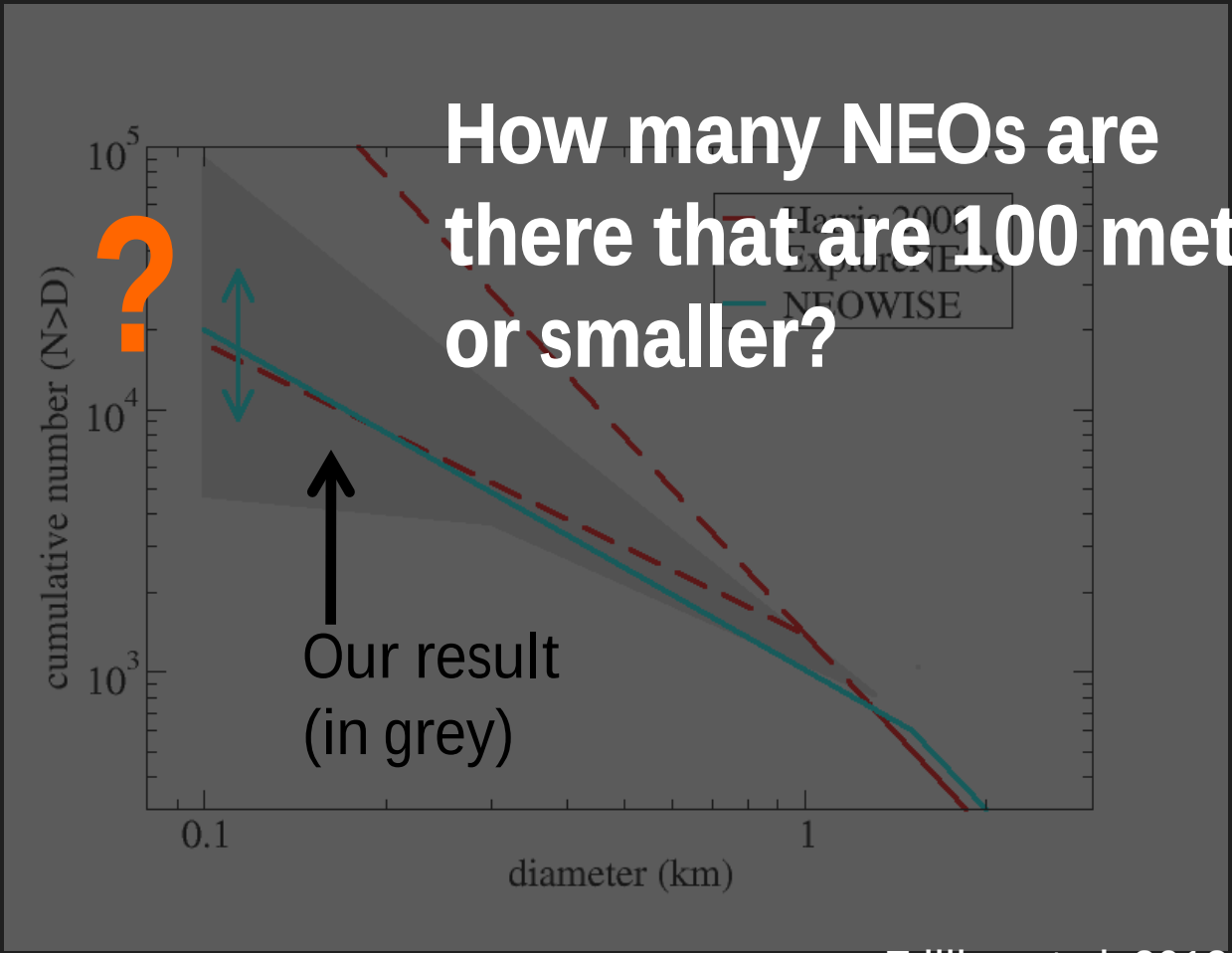

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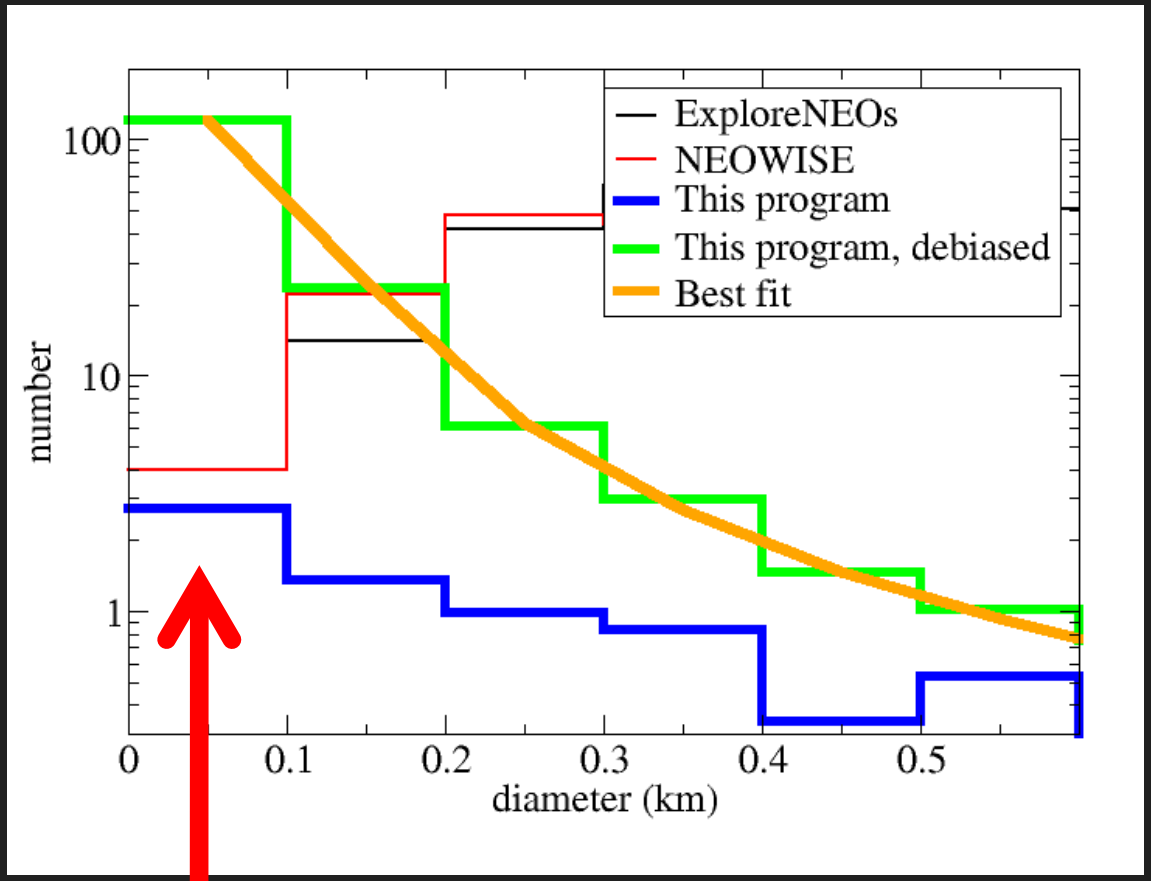
Introducing: DiscoverNEOs

90 hours Spitzer time for pilot program. Observations carried out last week. Full survey will be ~30 times bigger.



Conclusions

- ExploreNEOs has observed 600 NEOs and measured albedo and diameter
- Wide range of albedos observed
- 20,000 NEOs larger than 100 meters
- New Spitzer program to search for even smaller NEOs