Physical Properties of Near-Earth Asteroids

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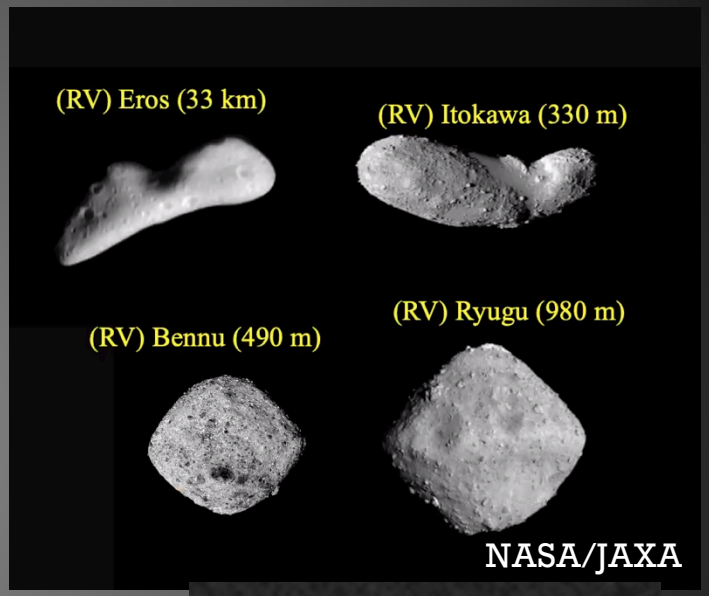
Near-Earth Asteroids (NEAs)

Motivation

- NEAs are crossing the orbits of terrestrial planets (perihelion <1.3 AU)
- Sizes from a few meters to 40 km
- Known NEAs: 27189 (November 2021)
- Potential danger to the Earth – impact hazard: we need composition and orbital properties
- Similar to main-belt asteroids, but easier to study in the similar size range
- Large diversity – rocky, icy, metallic, rubble piles or monoliths
- Spin axis orientations and shape models are known only for about 30 NEAs => poor knowledge
- Currently in the middle of interest – space missions OSIRIS-Rex, Hayabusa 1+2, DART, Hera, DESTINY+



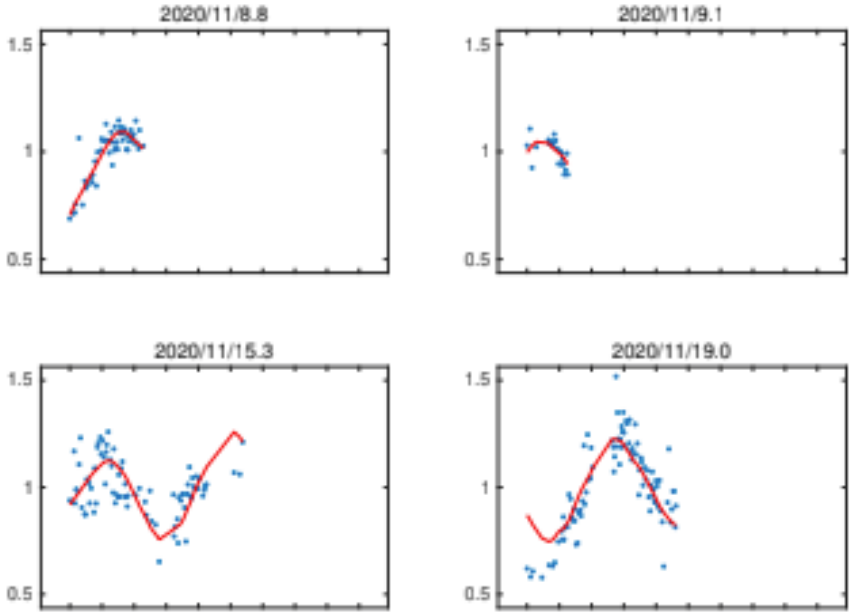
Physical properties of NEAs

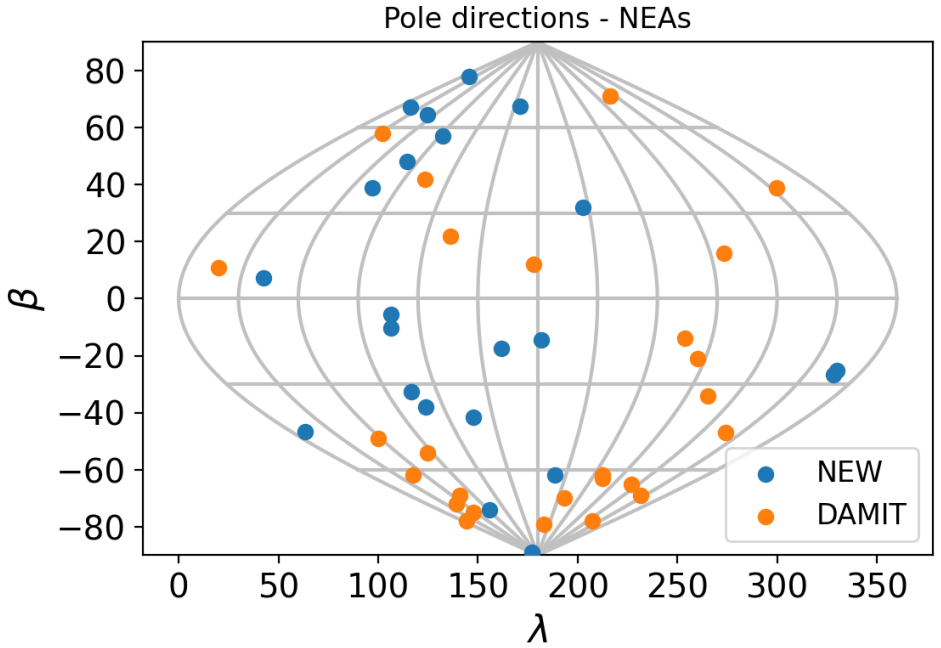
Photometry contains information about rotation properties (rotation period, spin axis) and shapes

We compile lightcurve data and apply the convex inversion

=> Rotation states (rotation period and spin axis direction) and shapes for 22 NEAs (almost factor of 2 improvement)

17 prograde and 32 retrograde NEAs, which is consistent with theoretical predictions (delivery zones from the main-belt)





Conclusions and future work

- We maintain and update a large database of shape solutions (DAMIT) and optical data (DAFEED) at Institute of Astronomy, Charles University, Prague
- New data through our own telescopes and via collaborations, including the Unistellar's citizen science campaigns with eVscope network
- We improve the knowledge about the physical properties of these bodies, which is necessary for assessing the impact hazard, or constraining their origin and dynamical models
- Rotation state properties and shape models can be used as inputs for further studies - determination of physical properties such as albedo, surface composition, bulk density (e.g., via thermophysical modeling, orbital modeling)
- Support for space missions – observations and modeling of mission targets

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