SMPAG – 24/03/2021 (UN-COPUOS)

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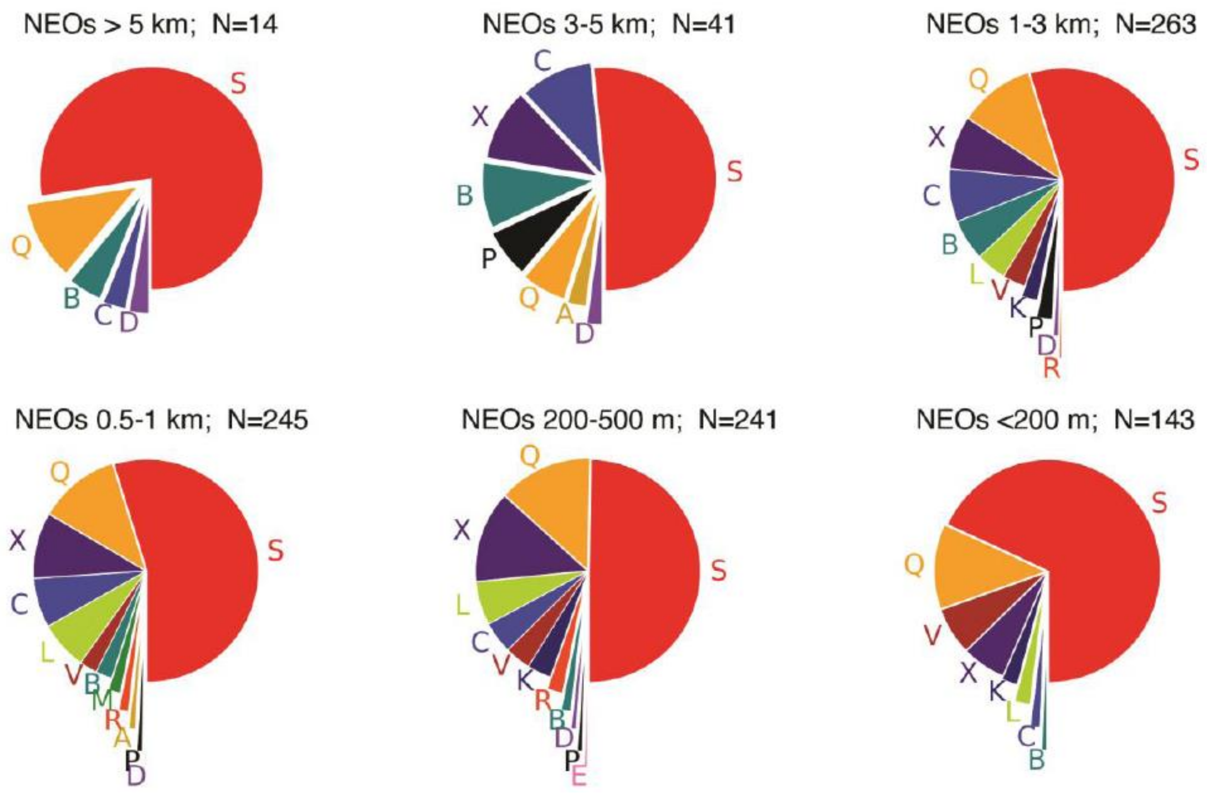
WP 5.9

(Romanian Space Agency)

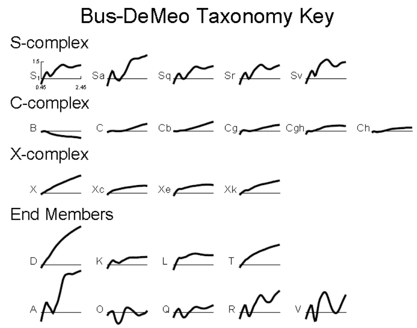
NEO/PHA density

- Density of objects
  - Function of internal structure (monolithic or rubble pile)
  - Function of mineralogy (ices/volatiles rich, silicate rich, metal rich)
  - Function of thermal properties (low albedo NEOs imply large diameters at the same magnitude)

NEO/PHA dominated by silicates

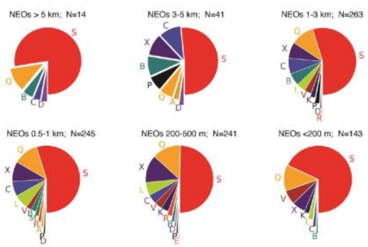


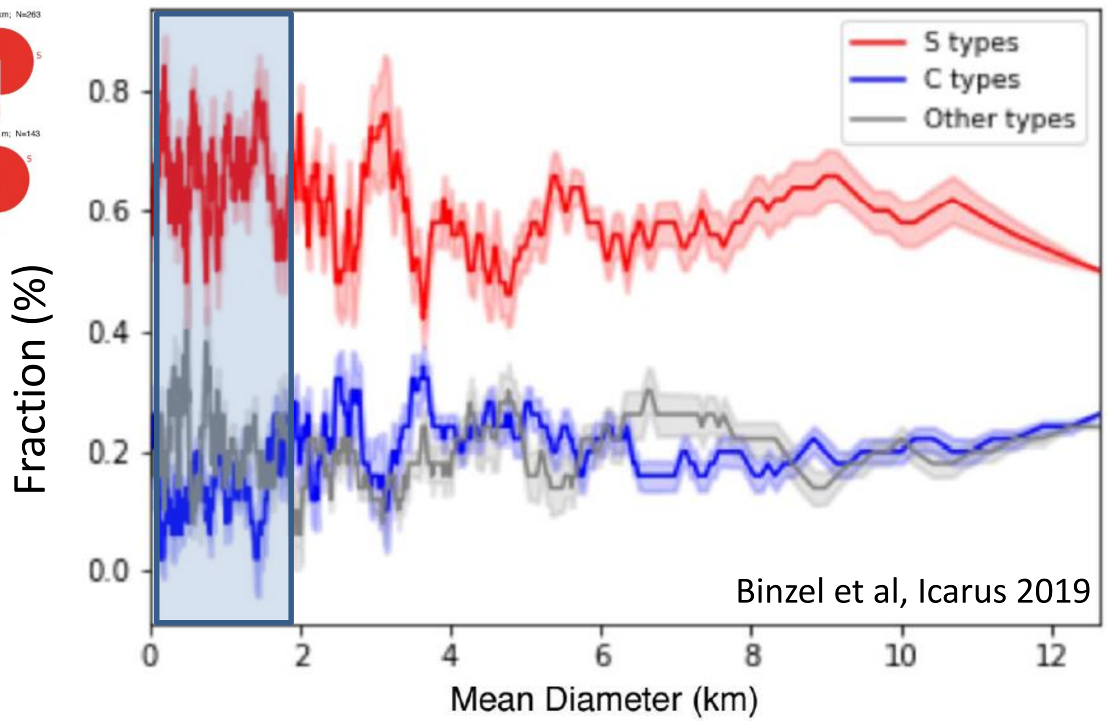
60% S complex
20% C complex
20% other



Binzel et al, Icarus 2019

NEO/PHA dominated by silicates





60% S complex
20% C complex
20% other

1,100 objects

- Constant distribution over two orders of magnitude in diameter
- Constant distribution over eight orders of magnitude in volume
- C-type dropping < 10% for D<1.5km could be an observational bias

Density

Meteorite		ρ	N_s	N_m	Refs.
Ord. chondrites	H	3.42 ± 0.18	265	157	2,3
Ord. chondrites	L	3.36 ± 0.16	277	160	2,3
Ord. chondrites	LL	3.22 ± 0.22	149	39	2,3
Carb. Chondrites	CI	1.60 ± 0.03	14	4	2,3
Carb. Chondrites	CM	2.25 ± 0.08	33	18	2,3
Carb. Chondrites	CR	3.10	7	3	2
Carb. Chondrites	CO	3.03 ± 0.19	22	8	2,3
Carb. Chondrites	CV	2.79 ± 0.06	51	10	2,3
Carb. Chondrites	CK	2.85 ± 0.08	3	3	3
Enstatites	EH	3.47 ± 0.21	16	9	4
Enstatites	EL	3.46 ± 0.32	25	14	4
Achondrites	HED	3.25 ± 0.26	96	56	5
Stony-Iron	Pal	4.76 ± 0.10	10	5	2
Stony-Iron	Mes	4.35 ± 0.02	8	3	2
Stony-Iron	Ste	4.18 ± 0.10	2	1	2
Iron	Ata	4.01 ± 0.04	1	1	1
Iron	Hex	7.37 ± 0.14	2	2	1
Iron	Oct	7.14 ± 0.13	5	5	1

Silicates (S-taxon)

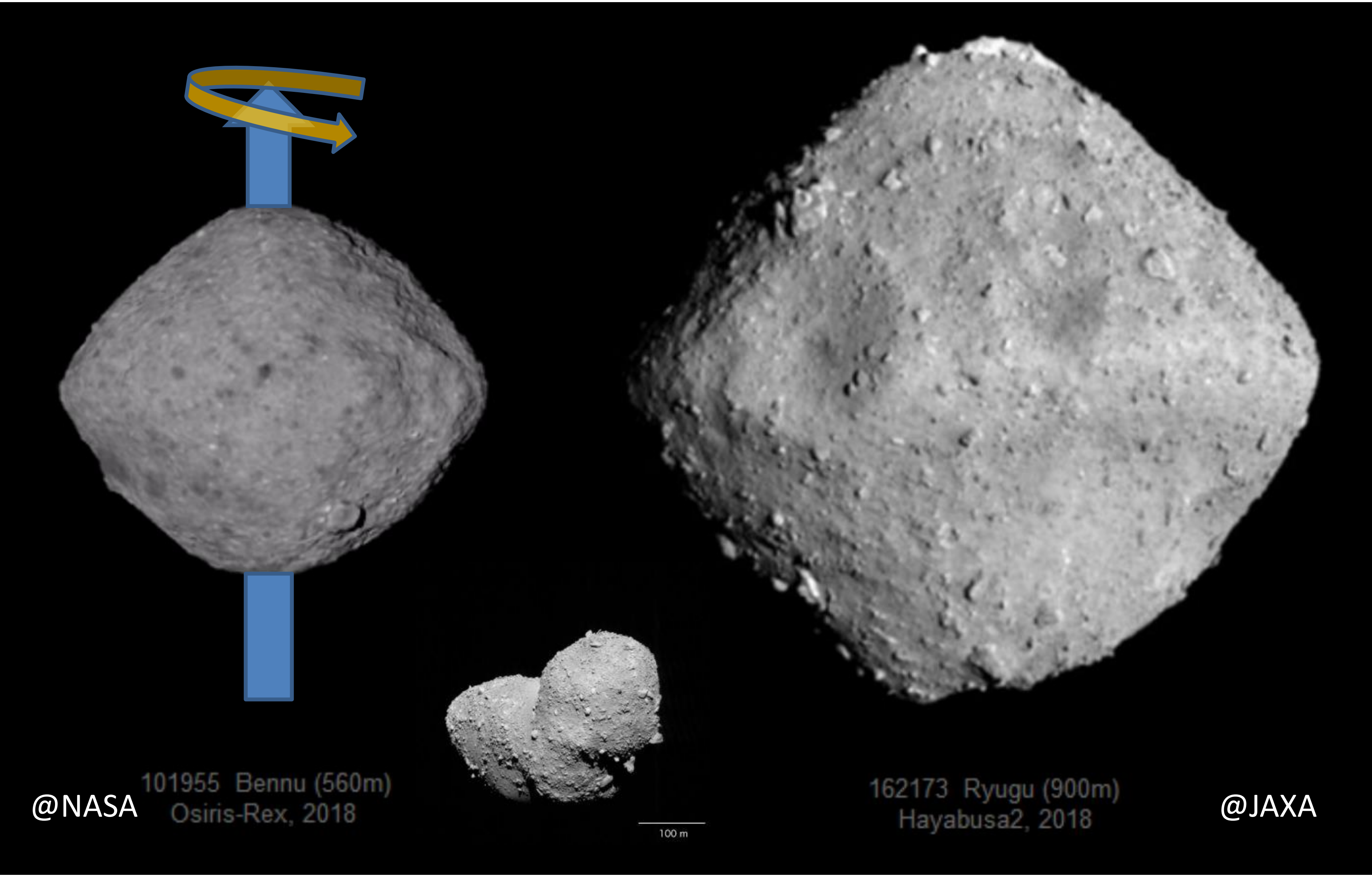
Carbonaceus (C-taxon)

E-taxon

X-taxon

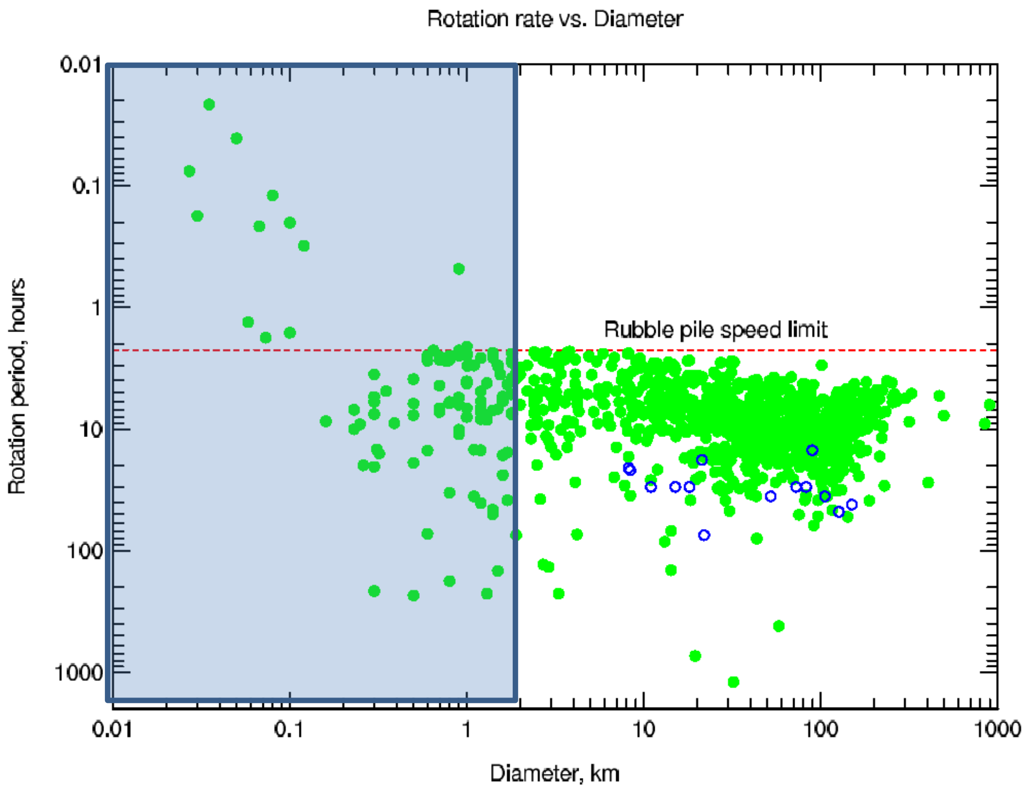
Carry, B. PSS 2012

Rubble pile asteroids and the equatorial ridge



Monolithic versus rubble-pile

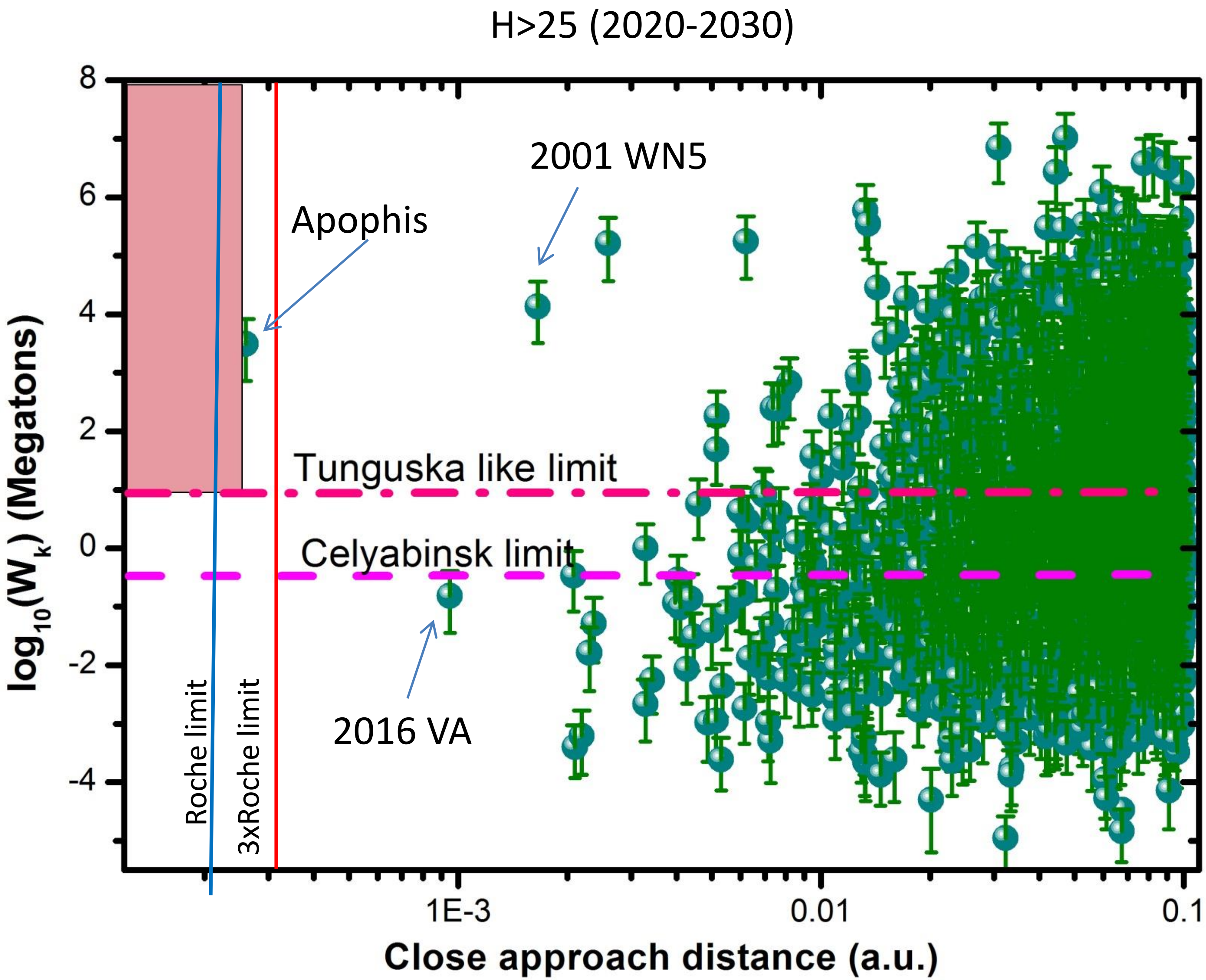
- Rubble pile asteroids seem to represent better NEA population (Pysn > spin barrier)
- Reconsideration of asteroid densities toward lower values



Correlation between graze and energy

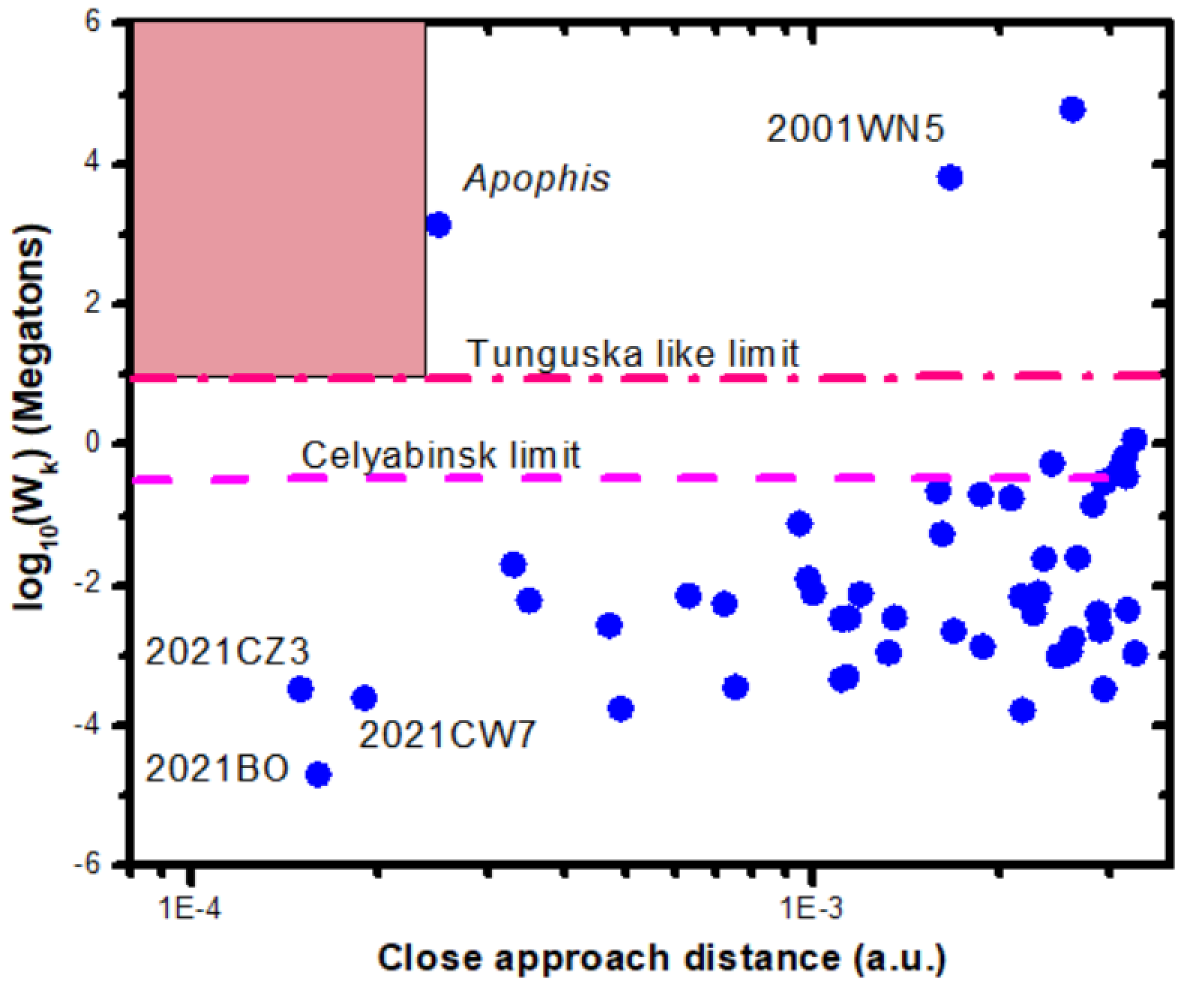
- Compute the Minimal Orbital Intersection Distance for all NEAs 2021 – 2031
- Estimate the energy interval using a density interval
- Consider the energy of 10 MT (Tunguska like or Meteor Crater like events) as threshold

Evergy vs MOID



Top 50 MOIDs 2021-2031

- Osculating elements (epoch March 2021)
- Large Part objects discovered in 2021
- Proficiency of NEA surveys



Summary

- 3xRoche limit in hydrodynamic model, as threshold
- 60,000 km of altitude (4×10^{-4} a.u.) as closest approach to be included into the list of threats
- Objects releasing energy greater than Tunguska event to be included on the list of threats
- Timeframe threshold for intervention – work in progress