

Impactor Physical Properties:

2024 PDC25 Hypothetical Asteroid Impact Exercise

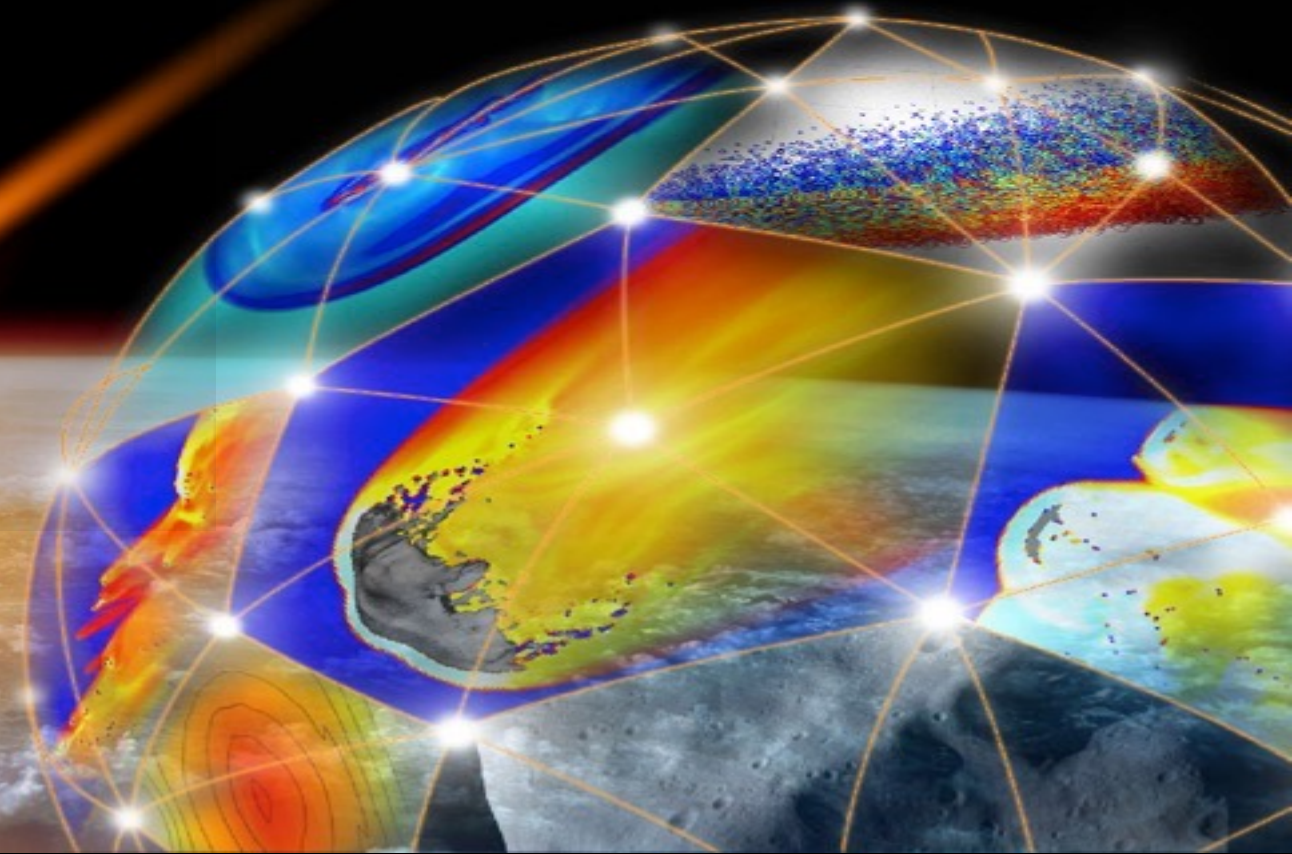
Epoch 2 – Post Flyby Reconnaissance

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9th IAA Planetary Defense Conference
May 2025



Available Asteroid Characterization Information

Physical property distributions were determined by combining our knowledge about the properties of the NEO population with constraints derived from the flyby mission. This assessment produced a set of virtual impactors for which cumulative properties reflect the resulting distributions, and individual combinations of parameters are physically plausible.

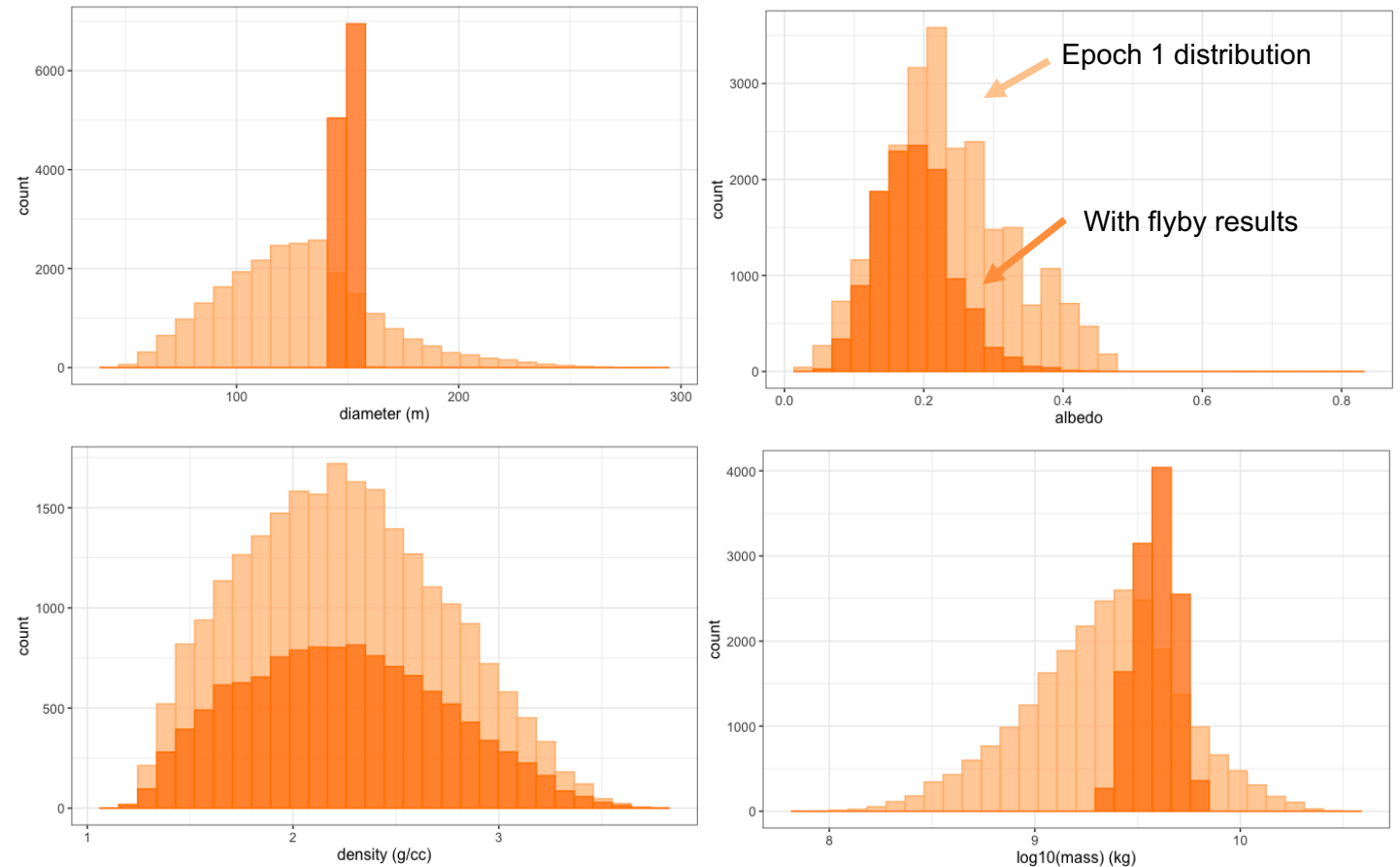
Observational data as of 28 April 2028:

- Flyby mission results:
 - Elongated shape with 2:1:1 axis ratio
 - Effective spherical diameter of $150\text{m} \pm 2.5\text{m}$
 - S-type taxonomy
 - Rotation period 3 hours
 - Thermal Inertia 200 ± 20 (SI units)
 - Spin axis RA, Dec = $(253, 74)$ degrees ± 3 degrees

Observational data enabled estimate of Yarkovsky drift from thermophysical modeling:

- Yarkovsky semimajor axis drift of 586 ± 195 m/yr

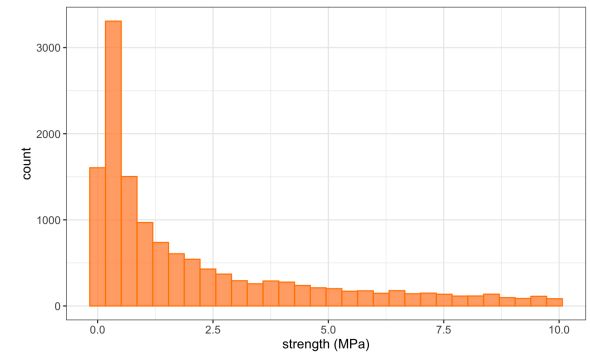
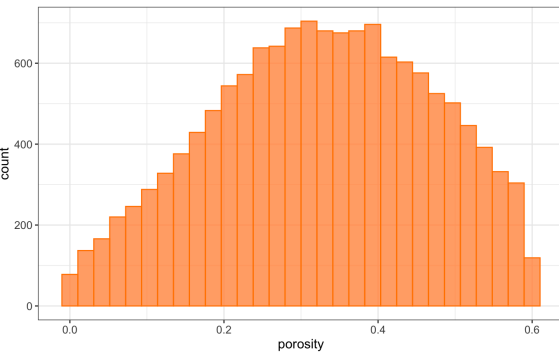
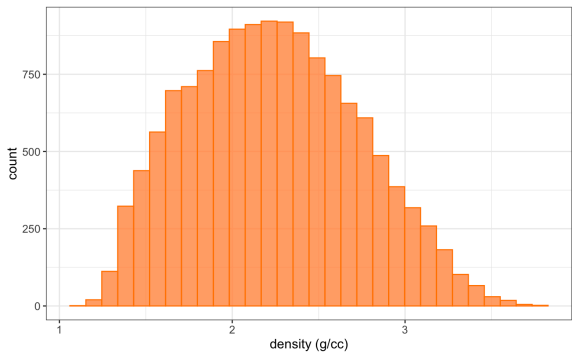
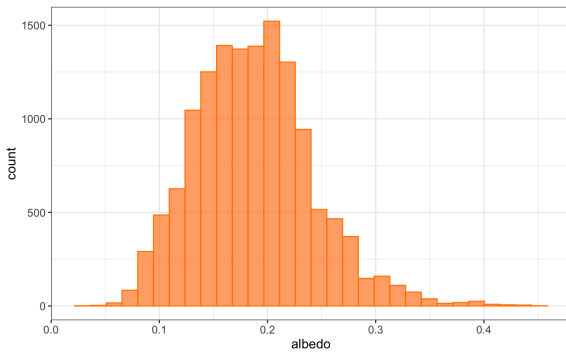
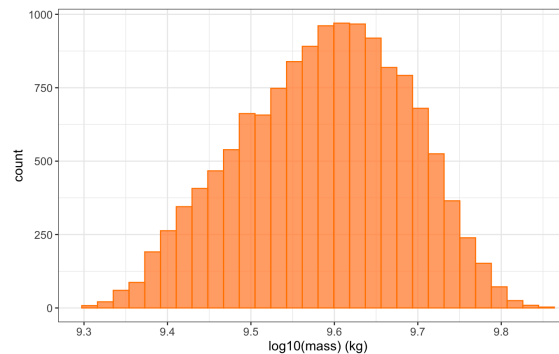
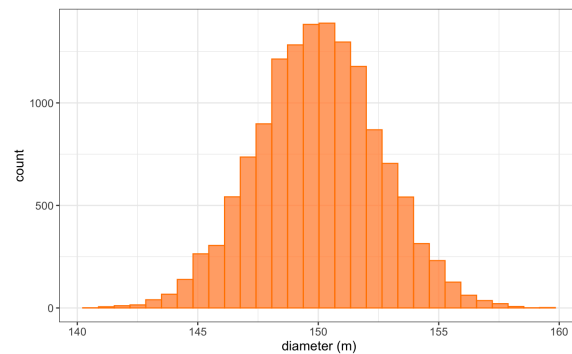
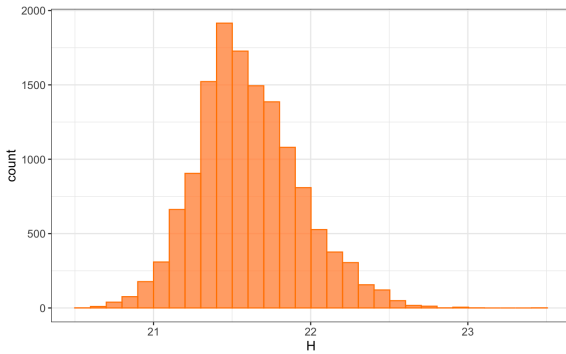
Asteroid property refinements from flyby mission



Asteroid Property Details

Statistical percentiles and highest-probability interval ranges for asteroid property distribution samples modeled*

	Mean	5th%	25th%	Median (50th%)	75th%	95th%	Most Likely Range (68%)	Full Range Modeled
Diameter (m)	150	146	148	150	152	154	148 - 153	140 - 160
Mass (kg)	3.97E+09	2.60E+09	3.30E+09	3.92E+09	4.58E+09	5.50E+09	2.82E+09 - 4.67E+09	2.0E+09 - 7.0E+09
Energy (Mt)	89	59	74	88	103	124	63 - 105	45 - 158
H Magnitude	21.61	21.12	21.38	21.57	21.81	22.21	21.27 - 21.88	20.6 - 23.5
Albedo	0.187	0.103	0.148	0.186	0.219	0.279	0.135 - 0.236	0.03 - 0.45
Density (kg/m3)	2244	1485	1862	2229	2589	3087	1613 - 2646	1130 - 3700
Porosity (%)	32.6%	7.7%	22.3%	32.9%	43.6%	55.2%	19.1% - 49.8%	0 - 60%
Strength (MPa)	2.1	0.1	0.3	1.0	3.1	7.9	0.1 - 2.2	0.1 - 10



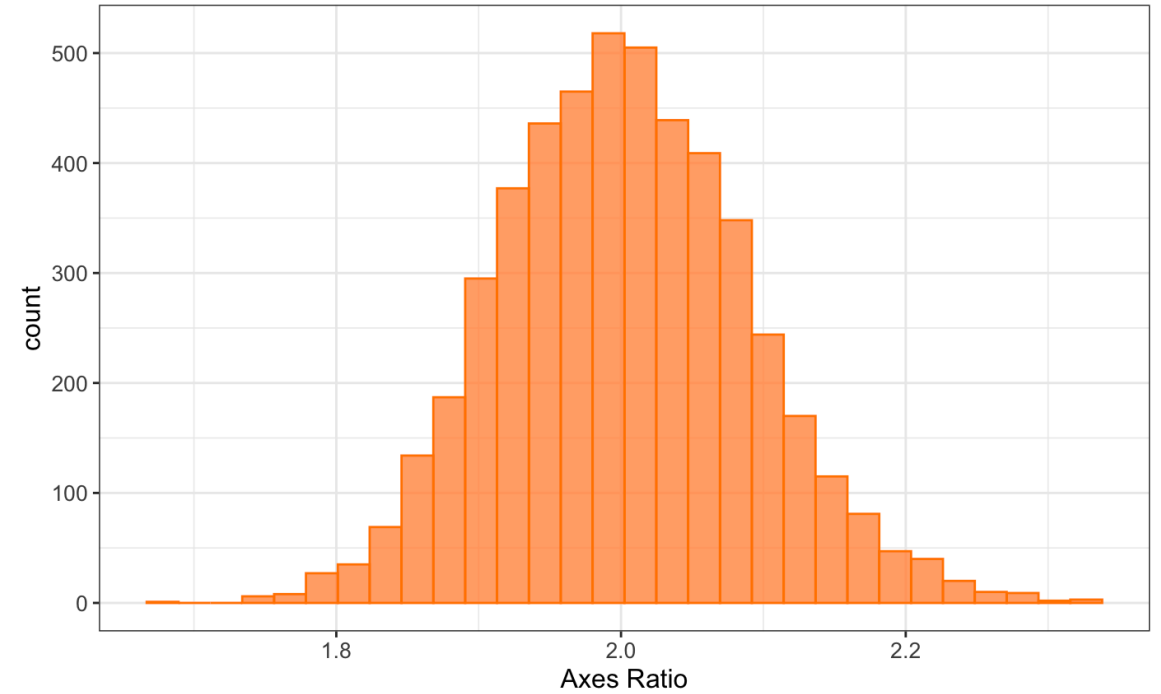
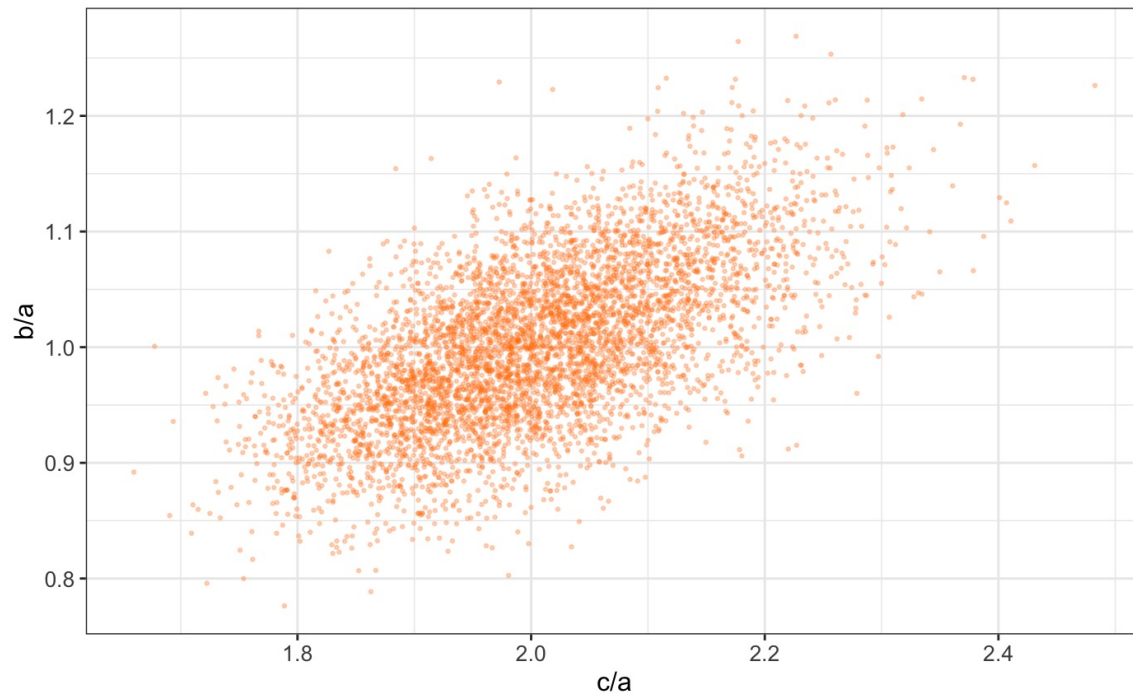
* Property stats are each computed *independently*. Multiple values from a given percentile cannot necessarily be combined to represent a single physically-plausible asteroid.

[Property model:
J. Dotson et al., 2024]

Shape Details

The flyby space mission determined the asteroid is elongated with ~ a 2:1:1 axes ratio.

	Mean	5th%	25th%	Median (50th%)	75th%	95th%	Most Likely Range (68%)	Full Range Modeled
Axes Ratio	2.00	1.86	1.94	2.00	2.06	2.15	1.91 - 2.08	1.7 - 2.3



Specific Property Sets

To facilitate high fidelity modeling across the range of physical properties, below are point cases which were chosen such that the mass is near the percentile listed in the Pointcase column and the other properties are internally consistent. The cases labeled lowest and highest reflect the lowest mass and highest mass objects modeled. (These values are sensitive to the details of the specific model run, so are not a robust statistical min/max – rather they should be considered as representative of the extreme ends of the distribution.)

Pointcase	Mass (kg)	Diameter (m)	H Magnitude	Albedo	Density (kg/m ³)	Porosity (%)	Strength (MPa)	a (m)	b (m)	c (m)
lowest	2.00E+09	147	21.42	0.221	1211	59.5%	0.2	115	118	235
5th	2.60E+09	149	22.16	0.109	1514	57.0%	0.3	123	116	230
25th	3.31E+09	149	21.24	0.253	1902	40.2%	0.8	120	115	241
50th	3.93E+09	150	21.60	0.179	2207	31.3%	1.0	119	117	244
75th	4.59E+09	151	21.59	0.179	2540	24.4%	1.2	119	120	242
95th	5.49E+09	152	21.58	0.178	2968	9.3%	4.2	121	124	236
highest	7.03E+09	155	22.28	0.090	3598	3.9%	5.5	126	126	234

a, b, and c represent the dimensions of the ellipsoid that is similar to the shape of the asteroid.