Near-Earth Objects – Threats and Treasures

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Near-Earth Objects (NEOs)

NEOs: asteroids or comets coming within 1.3 astronomical units (au) of the Sun, i.e. within 0.3 au of Earth’s orbit

To date, more than 34,000 NEOs have been discovered.
- Ca. 10,000 NEOs with a diameter of less than 30 m
- Ca. 12,000 NEOs with a diameter between 30 and 100 m
- Ca. 7,000 NEOs with a diameter between 100 and 300 m
- Ca. 5,000 NEOs with a diameter between 300 and 1,000 m
- 860 NEOs with a diameter larger than 1,000 m
Potentially Hazardous Objects (PHOs)

PHOs: NEOs with a minimum orbital intersection distance of less than 0.05 au (about 7.5 million km) from Earth’s orbit, measuring more than 140 meters across

To date, there are 2,324 PHOs.

(99942) Apophis (370 m across): PHO with the historically highest rating on the Torino Scale, will pass safely between the geostationary orbit and Earth on 13 April 2029
NEO Discovery Statistics

Near-Earth Asteroids Discovered
Most recent discovery: 2024-Jan-22

Cumulative Number Discovered

- Blue: All
- Orange: 140m+
- Red: 1km+

NEAs:
- 34149 all
- 10769 >140m
- 860 >1km

PHAs:
- 2396 all
- 153 >1km

NECs: 123

https://cneos.jpl.nasa.gov/stats/

Alan Chamberlin (JPL/Caltech)
NEO Discovery Statistics

Near-Earth Asteroid Discoveries by Survey

All NEAs (as of 2024-Jan-25)

https://cneos.jpl.nasa.gov/stats/

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Size and Average Time between Impacts

1 μm diameter  →  every 30 microseconds
1 mm diameter  →  every 30 seconds
1 m diameter    →  every year
100 m diameter  →  every 10,000 years
1 km diameter   →  every 100,000 years
10 km diameter  →  every 100,000,000 years
International Coordination

International Asteroid Warning Network (IAWN)

Space Mission Planning Advisory Group (SMPAG)
The Janus-faced Nature of NEOs

On the one side, NEOs are a threat, but they can be deflected (as NASA’s DART has shown).

On the other side, NEOs are a treasure. They can be turned into resources (as the future will show).
Chemical Composition of Asteroids

- **C-Type** (carbonaceous or chondrite): about 75 percent
- **S-Type** (stony or silicaceous): about 15 percent
- **M-Type** (metallic): about 10 percent
Benefits of Asteroid Mining

Abundant Resources

Reduced Environmental Impact

Economic Opportunities (and Technological Innovations)

Space Exploration Support (and Space Colonization)
"Asteroids have us in our sight. The dinosaurs didn't have a space program, so they're not here to talk about this problem. We are, and we have the power to do something about it. I don't want to be the embarrassment of the galaxy, to have had the power to deflect an asteroid, and then not, and end up going extinct. We'd be the laughing stock of the aliens of the cosmos if that were the case."

“The first trillionaire in the world will be the person who mines asteroids.”

Neil deGrasse Tyson
Thank you for your time and attention!

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