Small Near-Earth Objects

Here, we will talk about The Small Near-Earth Objects. Small objects include all natural bodies that are not planets or natural satellites. This usually means all asteroids and comets, but can also include dwarf planets (e. g. , Ceres) as small objects or "Small Solar System Bodies" as a different term from the International Astronomical Union.

A **near-Earth object** (**NEO**) is any small Solar System body orbiting the Sun whose closest approach to the Sun (perihelion) is less than 1.3 times the Earth–Sun distance (astronomical unit, AU). This definition

applies to the object's orbit around the Sun, rather than its current position, thus an object with such an orbit is considered an NEO even at times when it is far from making a close approach of Earth. If an NEO's orbit crosses the Earth's orbit, and the object is larger than 140 meters (460 ft) across, it is considered a potentially hazardous object (PHO). Most known PHOs and NEOs are asteroids, but about 0.35% are comets.

There are over 34,000 known near-Earth asteroids (NEAs) and over 120 known short-period near-Earth comets (NECs). A number of solar-orbiting meteoroids were large enough to be tracked in space before striking Earth. It is now widely accepted

that collisions in the past have had a significant role in shaping the geological and biological history of Earth. Asteroids as small as 20 metres (66 ft) in diameter can cause significant damage to the local environment and human populations. Larger asteroids penetrate the atmosphere to the surface of the Earth, producing craters if they impact a continent or tsunamis if they impact the sea. Interest in NEOs has increased since the 1980s because of greater awareness of this risk. Asteroid impact avoidance by deflection is possible in principle, and methods of mitigation are being researched.

Whereas asteroids are rich in the mineral raw materials required to build structures

in space, the comets also are rich resources for the water and carbon-based molecules necessary to sustain life. In addition, an abundant supply of cometary water ice could provide copious quantities of liquid hydrogen and oxygen, the two primary ingredients in rocket fuel. It seems likely that in the next century when we begin to colonize the inner solar system, the metals and minerals found on asteroids will provide the raw materials for space structures and comets will become the watering holes and gas stations for interplanetary spacecraft.

Thus, the importance of monitoring these objects for various reasons, whether beneficial or harmful to us, becomes clear. That is why we came up with creating a

web application that serves to monitor The Small Near-Earth Objects in an interactive and easy-to-use way according to these source steps:

Ephemerides:

Use the Horizons web-interface to generate ephemerides for any small body available in our SBDB.

The SBDB (Small-Body Data-Base) API provides a method of requesting machine-readable data for a specified small body within JPL's SSD/CNEOS Small-Body Data-Base (SBDB). The SBDB contains object identification and naming information, orbital data, and selected physical data for all known asteroids and comets within the solar system. A rich set of ancillary data, such as close approach and virtual impactor information, are also available through this API.

Database Lookup:

This tool provides access to data related to the user-specified asteroid or comet. Specifically,

- orbital elements

- orbit diagrams
- physical parameters
- close approach details
- radar astrometry
- discovery circumstances
- alternate designations

Small-Body Mission-Design Tool:

The Small-Body Mission Design tool provides three services:

- **Accessible Small Bodies:** presents the list of small bodies that can be reached given a set of mission-design constraints. In addition, users can set multiple constraints on the physical and orbital properties of the target small bodies.
- **Extended Missions:** given a user-defined heliocentric orbit, this tool returns the

list of small bodies that come closest to that particular orbit during a certain period of time. This list can be considered a proxy for the list of objects that may be easiest to reach from the reference orbit. This feature is particularly useful for identifying potential candidates to explore during an extended mission phase.

- **Interactive Design Tool:** provides an interactive interface to explore mission opportunities to a user-specified small body. Both ballistic and low-thrust gravity-assist missions are supported.

Small-Body Identification Tool:

This tool provides a list of **small-bodies only** (asteroids and/or comets) which are

likely contained in the specified field on the specified date/time.

- The API service provides programmatic access to the tool.

Meteor Streams:

This list of meteor streams is based on data from the IAU Meteor Data Center and the references therein. Peak activity times were verified using the database from the American Meteor Society.

Small-Body Satellites:

This website lists known and suspected natural satellites of small bodies. Suspected satellites are marked as [unconfirmed] in the “Satellite Notes” column. Publicly

available orbital and physical properties of the satellites can be displayed in the table below by selecting the appropriate checkbox. Additional information might be available in the object page that can be reached by clicking on the object name.
HTTPS://SSD.JPL.NASA.GOV/SB/SATS.HTML

Small-Body Radar Astrometry:

Going to visit JPL'S Asteroid Radar Research site for information the use of radar to determine the physical characteristics of small bodies such as shape, surface roughness, and rotational state.

Inner Solar System:

These inner solar system diagrams show the positions of all numbered asteroids and

all numbered comets on 2018 January 1. The orbits and positions of the planets Mercury, Venus, Earth, Mars, and Jupiter are also shown. Asteroids are yellow dots and comets are symbolized by sunward-pointing wedges. The vernal equinox is to the right along the horizontal axis (+X direction).

Gravity Fields:

The gravity field of a body is a mathematical description and estimate of the complex gravity potential of that body. Depending on the accuracy with which the gravity was measured, there could be thousands of terms to the model, which is typically described in terms of spherical harmonic coefficients. Orbiter missions are typically necessary to "map" the gravity

field of a body, and the SSD group is involved in developing many of the gravity fields of bodies beyond Earth (the Earth's gravity field is well determined by the data from the GRACE and GRACE-Follow On missions, and their results).

In conclusion,

Due to the danger of Small Near-Earth Objects and their importance in several things for human life from their resources, monitoring them is a factor of strength for us, in addition to the signifiacant of spreading awareness about this. Therefore, our project will represent the factor of monitoring and awareness together and focus on making it easy to access and use. Besides, interactive in a fun and enjoyable way.

References:

NEO Basics (Centre Of Near-Earth Objects Studies)
https://cneos.jpl.nasa.gov/about/basics.html

Near-Earth object (Wikipedia)
https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://en.wikipedia.org/wiki/Near-Earth_object&ved=2ahUKEwiq6rGUzPSIAxWDT0EAHRYHNwoQFnoECCAQAQ&sqi=2&usg=AOvVaw1yy0hCJYhlmF28GApPC83e

Small Objects (Jet Propulsion Laboratory)
https://ssd.jpl.nasa.gov/sb/