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## **NEO Characterization**

### **THE NEOCC API AND VISUALISATION TOOLS: A COMPREHENSIVE RESOURCE FOR ACCESSING AND VISUALIZING ORBITAL DATA OF NEAR-EARTH OBJECTS**

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## **ABSTRACT**

The NEO Coordination Centre (NEOCC) is an important element of the Planetary Defence Office of ESA's Space Safety Programme. One of its transversal elements is the so-called Information Provision, which deals with the distribution and visualisation of orbital data of near-Earth objects (NEOs) through both the web portal and a dedicated application programming interface (API) service.

The NEOCC API system (described here: <https://neo.ssa.esa.int/computer-access>) provides a long list of data that can be used by independent organisations and third parties. It allows developers to easily access and use the data produced by NEOCC's "Aegis" asteroid orbit determination and impact monitoring system.

The data include either lists of objects such as: the list of all NEOs, the orbital element catalogue (in Keplerian or equinoctial orbital elements), or the 30-day ephemerides of all NEOs. Furthermore, the APIs also provide both the list of asteroids with a probability greater than zero of impacting the Earth (the so-called risk list) and the list of all the recent and future close approaches of NEOs with our planet.

In addition, the service also allows queries to data for a specific object. The API system can be used to request orbital information about a particular asteroid (in a Keplerian or equinoctial orbital elements, at present time or mid-observational arc), or information about its physical properties, or even to retrieve the records of all their observations, its close approaches with Earth, and its possible impacting solutions. The user can also ask the service to generate asteroid ephemerides from a particular observatory at a specific period, with a specific time-step.

Much of this information can be directly displayed by the NEO Toolkit (<https://neo.ssa.esa.int/neo-toolkit>), a new set of astronomical tools released last year by NEOCC. It consists of four complementary tools, each focused on a specific objective. With these tools, users can visualise high-precision ephemerides of several objects or asteroid families simultaneously and simulate the effects of several factors, such as gravitational forces, especially after a close approach to a planet. In addition, it also allows the user to accurately locate asteroids in the sky or in the Solar System, to simulate the approach to Earth and plan optical observations.

Overall, the API system and the orbit visualisation tools are powerful tools that can be used in a variety of applications, from web development and education to research and space exploration. By enabling different systems to communicate and exchange data and functionality, these tools can enhance the capabilities of software applications and make it easier for developers to create new and innovative applications.

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**Comments:**

*Since this contribution includes a general introduction to ESA's PDO "Information Provision" element, along with an overview of the NEOCC API and a quick introduction of its new NEO toolkit service, an oral presentation is preferred.*