CONTROLLING THE OBSERVATIONAL DATA ON MINOR PLANETS WITH THE "CERES" SOFTWARE PACKAGE

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CERES is a powerful software package for calculating the ephemerides of the major planets, minor planets and comets and for executing related tasks.

At the present time the principal features of the package are as follows:

1. To store in its integrated database the elements and other characteristics of all the numbered minor planets, as well as to browse and to update the data.

2. To calculate ephemerides of various types for members of the solar system. It is possible to obtain spherical or rectangular coordinates (geometric positions) of any specified object referred to the center of the Sun, the Moon or a major planet. For the Earth the geocentric or topocentric astrometric coordinates are also available, as are the apparent coordinates with their first and second derivatives. The coordinates can be referred to the planes of equator, ecliptic or horizon. It is also possible to get a set of heliocentric osculating elements. The ephemerides can be calculated with different accuracy and be represented in various forms. One can obtain the coordinates of a minor planet, either from simple Keplerian motion or by numerically integrating the perturbed motion, taking into account the perturbations by any or all of the major planets, the Moon and the four most massive minor planets.

3. To model visually a dynamical picture of the motions of several selected minor planets, the Sun, the Earth, Mars and Jupiter simultaneously. The point from which the picture is to be viewed can be specified arbitrarily, and the scale and speed of action are also adjustable.

4. To store and to browse the coordinates of more than 500 stations (MPC list) for which topocentric positions of minor planets can be computed.

5. To visualize the tracks of several minor planets in a selected area of the sky and to show the motion of any minor planet against the stellar background. The package contains data on about 200 000 stars in the PPM catalog within a zone 80 degrees wide centered on the ecliptic. There are special utilities for the user to create his own star catalog.

6. To get information on different astronomical notions.

CERES runs on IBM PC compatibles under MS-DOS version 3.0 or later and requires 640 Kb of RAM, about 6.5 Mb of hard-disk storage and an EGA/VGA adapter. A math coprocessor is recommended. CERES (version 2.3) is distributed on five 3.5-inch 1.44-Mb or six 5.25-inch 1.2-Mb diskettes. These diskettes contain both executable files and data files, including the star catalog and a numerical ephemeris of the Sun, the Moon and the major planets for the years 1950–2020.

The actual and new options of the CERES software are now under developing. In addition to the augmented catalogs of numbered minor planets and observing stations the catalogs of selected unnumbered minor planets and periodic comets are introduced. It is now possible to integrate the motion of any object for an interval of at least of two centuries (1850–2049). Objects in planetocentric orbits and that have parabolic or hyperbolic orbits can also be processed by CERES. Perturbed orbital motion can be modelled on the screen. New options for processing the observations of minor planets are to be added, including comparison of available observations with computed positions and orbit determination. A search for all the objects observable within a selected area of the sky at a given moment is very useful for an observer, as is an image of the sky on the screen and/or printer. The problem of identifying objects (and therefore discovering new ones) at short notice is facilitated.

It is supposed that CERES will provide ephemeris support for observations of occultation phenomena associated with minor planets, namely, occultations of stars by objects and of objects by the Moon. The task can be carried out, both in terms of predicting the local circumstances for any observatory and of constructing charts of the Earth's surface showing the limits where the phenomena will be visible.

These new facilities are designed to help observers in planning their photographic, CCD or photoelectric occultation observations, in controlling the accuracy of observations before publishing them and in searching for new objects. In other words, by using CERES software one can test the quality of observations and perhaps obtain a list of unknown objects. This will make the CERES software package useful for monitoring all the members of the solar system, including the near-Earth asteroids.