Occultation predictions of KBOs and other unusual objects

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Kuiper Belt Objects (KBOs)[1] are of special interest for our understanding of the solar system and his formation. We do not know many of these objects nor do we know very much about them (therefore a KBO flyby of the Pluto Express space mission is planned if suitable candidates could be found). The observation of stellar occultations by KBOs could provide us with valuable physical data like their diameter. Candidates of such events are presented.

[1] *also known as Transneptunian Objects (TNOs)*

Introduction

In our current general understanding of the solar system, the region beyond Neptune is populated with ~10^5 Kuiper Belt Objects (KBOs) with diameter D > 100 km (Jewitt, Luu, Trujillio 1998). This region was first postulated by Edgeworth and Kuiper in 1949 and 1951, respectively. In 1992, the first KBO (1992 QB1) was discovered (Jewitt and Luu, 1993). At present only a fractional part of these KBOs and of other "unusual" objects like Centaurs are known.

With exception of Chiron, Pluto and Charon no occultation by KBOs or Centaurs has ever been observed. Physical data, in particular the diameter, can only estimated by formulas where the geometric albedo has to be assumed (in general 4%) or was provided independently by combining thermal and visual measurements. But because we deal with faint objects (m_R ~ 22-23), this is a difficult task and big telescopes are needed. Only for a few objects like the Centaur (10199) Chariklo and the KBO (20000) Varuna direct measurements of the albedo were performed. The observations of star occultations by such objects could give us valuable information about their diameter (with highest accuracy), shape, albedo (can simply be calculated if the diameter is known) and perhaps the presence of companying moons or even an atmosphere. As known, the present atmosphere of Pluto was discovered during an occultation.

Results and discussion

The author searched for occultations by KBOs and other unusual objects like Centaurs for the years 2002 & 2003. These predictions were carried out by an own program, which is also used for the annual prediction of occultations by minor planets, distributed by IOTA/ES. In a first step, all objects were selected from the list of TNOs and Centaurs published on the webpage of the Minor Planet Center (MPC 2002) for which at least 3 oppositions were observed. For these candidates full perturbed (M-v) apparent ephemeris were computed. Then a search for occultations of Tycho catalog stars was performed by a second program. During this calculation, an estimate of the diameter (assuming an albedo of 4%) according to the formula given by Trujillo et al. (2001) was used for the calculation of the expected occultation duration. From all events found by the program, those were selected for which the observation conditions will be reasonable, i.e. magnitude drop at least 0.5mag and elongation from the Sun > 30 deg. The results will be published on the web (Kretlow 2002) and in the proceedings of this meeting.

Conclusions

The observation of occultations of KBOs/Centaurs could provide us with important information about their main physical parameters. Possible candidates were presented. It should be mentioned, that the accuracy of the prediction will increase significantly, if last-minute (or better last-days) astrometry of high accuracy will be available to the calculators. On the other hand, the width of the ground track is expected to have a width of several hundred km, so hopefully an occultation by a KBO could be timed in the near future.

References

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