EPSC Abstracts
Vol. 6, EPSC-DPS2011-1538, 2011
EPSC-DPS Joint Meeting 2011

Euraster an European Network for Asteroid Stellar Occultations

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Abstract

Except for in situ space missions, asteroid stellar occultations are the only way to measure asteroids at a sub kilometer level. To be scientifically relevant we need to get several positive chords in order to draw an accurate silhouette. These occultation data are the only way to fit the absolute size of 3D models obtained with light curves. At the end, it can be possible to get a good estimation of the volume and therefore if we know the mass, of the density. As we need a lot of observers, amateur contribution is crucial. We present here some statistics and results of the ten last years.

1. Introduction

Euraster is a web site (www.euraster.net) created and maintained by E. Frappa where all the European results are store in an ASCII format easy to use for any data base software. The aims of this site is to translate the observers reports in an simple form. This is an important effort to find errors in the reports, especially for datation which is critical for these observations. The site is complete since 1997.

2. Statistics

It is possible to see a drastic evolution of the number of positive observations from 10 per year in the nineties to more than 50 per year nowadays (Figure 1). This is mainly due to better prediction with the apparition of faint star catalogs like UCAC based on HIPPARCOS reference frame. The techniques also move from visual observation to video data with GPS time inserter. We can also see than most of the observations are made with low cost 20 cm telescope. (Figure 2). With this kind of instrument it is possible to reach magnitude 12 at video rate. It is also possible to detect double stars [2]

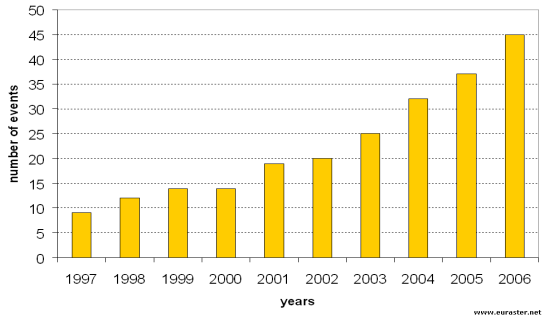

Figure 1 : evolution of positive observation

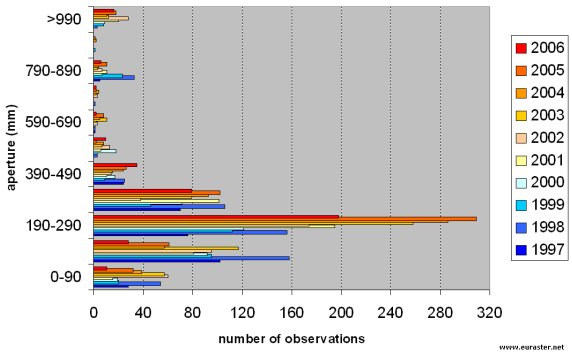

Figure 2 : size of the telescope used

3. Best events

To get a good event many parameters must be present. First good weather conditions which are not obvious for Europe! Second good prediction, so an accurate asteroid orbit and a good star position to deliver an observation probability of at least 50%. This is done for big asteroids (D > 80 km) and "bright" stars belonging to TYCHO catalog (m<10).

So at the end, only few “big” events are observed over Europe every year.

3.1 (345) Tercidina september 2002

Tercidina is a 100km diameter object, an occultation occurred over Europe on 17th september 2002. Figure 3 shows the observers map. Note the elongated shadow path.

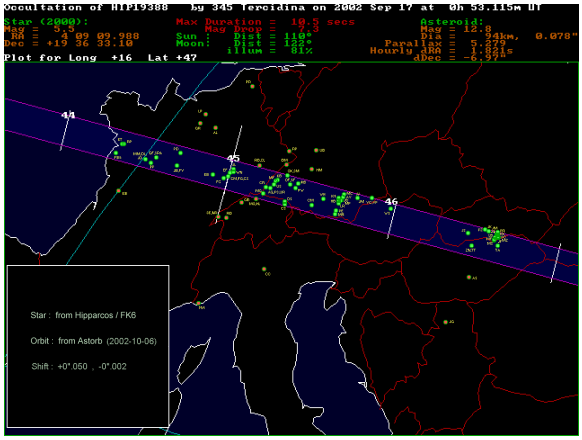

Figure 3 : observers map

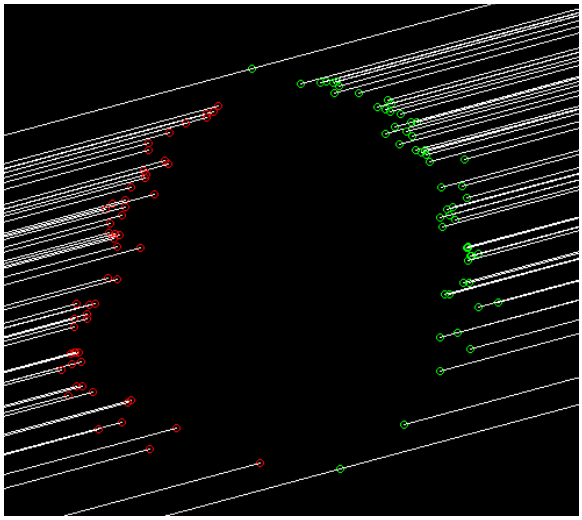
Figure 4 : silhouette of the asteroid

This observation shows clearly that Tercidina is not spherical. For each good event we look for light curve data to get 3D shape. Some results for other asteroids have been obtained by Durech et al [1] In this case there was not enough data so we started an observational campaign in collaboration with the CDR-CDL Geneva team . We are now close to a 3D model as we have several light curves. (http://obswww.unige.ch/~behrend/page1cou.html#000345)

4. Summary and Conclusions

Since 1997, more than 500 positive occultations were observed. In the old time observing a positive event was an adventure, now it becomes usual and we must think to the future and especially to the use of GAIA catalog starting on 2014. At that date the prediction accuracy will be good for every object bigger than 10 km. To not demobilize observers, we have to edit a short list of scientifically important asteroids and search for these specific occultations. It could be all the objects with a measured mass, like double asteroids. We also must start light curve observations of these objects as we need generally 10 years data to get a good 3D model as it was done for Pallas [3] . All these works can be done with amateur size telescope and for sure will not be done by professional telescopes! So we can reach the goal to measure more than 200 densities only with amateur data. These data could be a key to understand solar system formation and evolution.

Acknowledgements

We would like to acknowledge all the European observers, these results can't be the same without a dense observers network. In particular we want to acknowledge observers of negative observations, most of them don't give up during these ten last years. Hopefully predictions get more accurate and most of the observers have now positive results.

References

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