

## LIGHT CURVE ANALYSIS OF 1495 HELSINKI

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This is a collective effort from observers of different longitudes to derive an accurate synodic period of  $5.33116h \pm 0.00003h$  with amplitude of 0.83 and  $0.61 \pm 0.03$  mag in May and June 2006, respectively, for the minor planet 1495 Helsinki.

Leura observatory is located about 100km west of Sydney Australia at an Altitude of 950m, Latitude of S 33.7936 and Longitude of E 150.3369. It houses a 0.35m Celestron Schmidt-Cassegrain Telescope operating at f11. Attached to it is an SBIG ST9XE CCD camera which has a Kodak KAF-0261 CCD giving 1.07 arc second/pixel at binning 1x1. No filters were used for all images. Dark frames and Flat Field frames were used for image calibration.

L 'Observatoire des Makes is located in La Reunion Island in the Indian Ocean. It houses a 0.35m Celestron Schmidt Cassegrain Telescope mounted on CDM mount with MCMT II. Attached to it is an ST7 SBIG CCD camera and a focal reducer operating at f3.3. A 80X900 refractor telescope is piggy backed on the main telescope along with an ST6 SBIG CCD which operates as an autoguider.

For data reduction, Oey used the Canopus V.9 software where differential photometry were employed whereas Teng et al. send all data to Behrend that were latter reduced and compiled in his web site (Behrend 2006). The composite light curve were then combined and reproduced for this publication.

### Observations

1495 Helsinki was discovered in 21<sup>st</sup> September 1938 by Yrjö Väisälä at Turku. Its original designation was 1938 SW. It is named after the largest city in Finland. This object was originally selected due to its little or no data published. It has a diameter of 18 km based on an H value of 11.6 mag.

The work was started from Leura Observatory on the 13<sup>th</sup> April 2006 which continued on for 6 sessions ended on the 21<sup>st</sup> May 2006. A month later, Behrend of Genève Observatory contacted Oey regarding the merging of data by one of his contributors with the recently obtained data from Leura. After the merge, the initial appearance of the curve was one that does not fit well into a clean bimodal curve. It was considered that the data may be caused by either a binary asteroid or a tumbling object.

Communications were initiated with Pravec of Ondrejov Observatory. He had the opportunity to analyse Oey's 6 sessions data earlier on separate occasion; the initial data showed a complex behavior, with some of them having a larger amplitude and others being shifted in phase. No good solution could be found from the initial data, however, and he suggested that other observers from different longitude should be recruited to help resolve the data further. At this stage 1495 Helsinki was mainly a Southern hemisphere target at declination of -42 deg.

The combined effort from J.P. Teng et al. gave no indication of the variability shown in Oey's earlier light curve. It was realized that an error may have occurred in Oey's light curve data. An analysis of the more complete dataset has shown that all but two sessions fitted entirely with a single periodicity; the two unfitting sessions were 2006-5-8.6 and 13.6, both of the initial dataset of six nights. While the 5-8.6 session showed a higher amplitude, the 5-13.6 session showed a shift in time. A revisit of the original images of the two sessions was obviously needed.

At this time, a new version of Canopus reduction software (Canopus V9.101) was released. It incorporated a new feature with the ability to subtract nearby faint stars allowing data contaminated with these faint stars useful. (Warner 2006). The data were then reduced once more and the revised data of 5-8.6 fitted entirely with the single periodicity; the higher amplitude of the first reduction of the night was caused by uneliminated background stars.

At that point, there remained the one unfitting session of 5-13.6, which showed a phase shift; when adding 0.010 day to all times of the session, it fitted well with all the other data. A re-reduction of the original images by Oey showed that there was a time error in the initial reduction; while a cause of the time error of the initial reduction was not revealed, the newly reduced data showed a perfect fit. So, the revisit has eliminated the serious reduction problems in the two sessions and it confirmed that there was only one periodicity present in the asteroid during the whole observational interval.

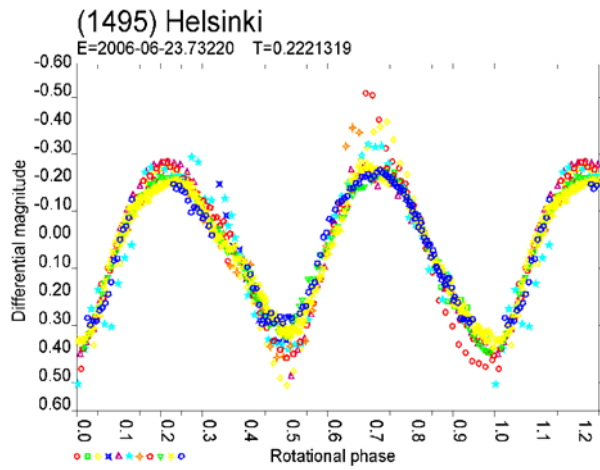
All data were merged by Behrend to obtain a light curve of period  $5.33116h \pm 0.00003h$  with amplitude of  $0.61 \pm 0.03$  mag.

The geometric parameters and light curve are shown in table 1 and graph 1 below.

### References

Warner, B. D. (2006). "StarBGone". On Minor Planet Observer website.  
<http://www.minorplanetobserver.com/MPOSoftware/StarBGone.htm>

Behrend, R. (2006), Observatoire de Genève web site.  
[http://obswww.unige.ch/~behrend/page\\_cou.html](http://obswww.unige.ch/~behrend/page_cou.html)



Graph 1 Light curve for minor planet 1495 Helsinki. The epoch of minimum brightness and origin of the graph is 2006-06-23.732