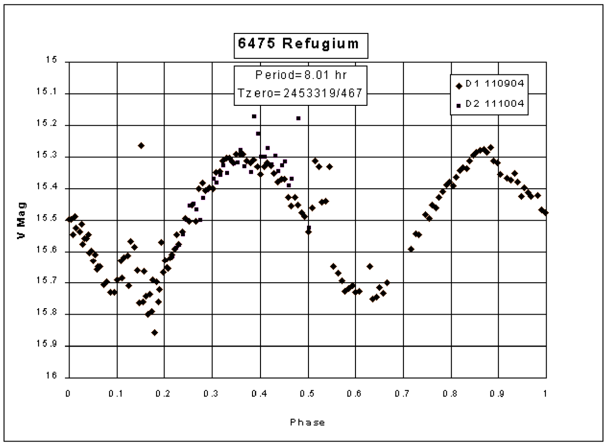

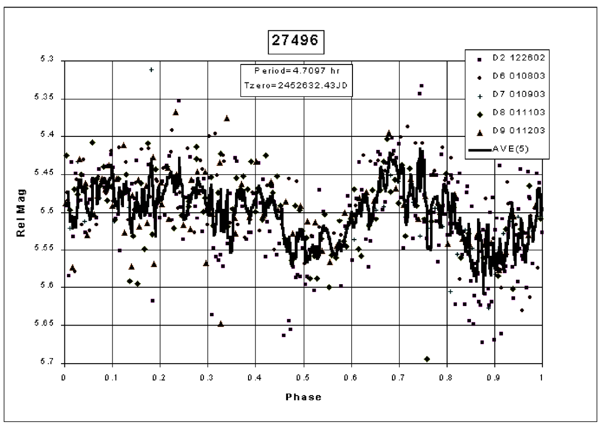

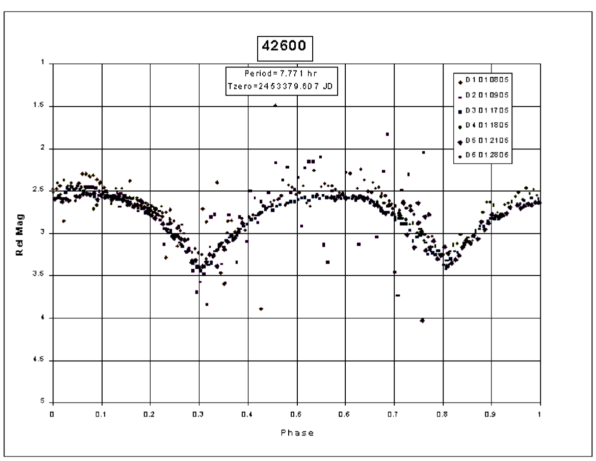

PROBABLE BINARY 3220 MURAYAMA

Akira Tsuchikawa
Sakuradanchi 1-1 Yanagida Noto
Housu Ishikawa, Japan
tsuchy@s5.dion.ne.jp

Seidai Miyasaka
Matsugaya 52-5-208
Hachioji, Tokyo, Japan

Hiromi Hamanowa
Hikarigaoka 4-43, Nukazawa
Shirasawa, Adachi, Fukushima, Japan

(Received: 26 May Revised: 23 August)

Lightcurve observations made from three stations during 2004 Nov.7 to Dec.17 have revealed that 3220 Murayama is a probable binary asteroid. Primary's rotation period: 4.8595±0.0011 hr, amplitude: 0.13-0.15 mag. Secondary-to-primary mean diameter ratio: 0.4 The orbital period is unclear.

Yanagida Astronomical Observatory, MPC Code 417, is in the Noto peninsula, which is located in central Japan facing the Sea of Japan. The observatory utilizes a 0.6m, f/6 Ritchy-Chretien telescope with a Mutoh CCD camera. Co-observatories are Miyasaka Observatory, MPC Code 366, which utilizes a 0.36m f/8 Ritchy-Chretien telescope with a SBIG STL-1001E CCD, and Hamanowa Astronomical Observatory, MPC Code D91, which utilizes a 0.4m f/4.5 Newton telescope with a SBIG ST-8 CCD. All images were taken using an R-band filter. The images were measured with IRAF. The period analysis was done with cyclocode, developed by B. Dermawan (2003).

The lightcurve of 3220 Murayama was previously reported by Stephens (2005). He observed Murayama during Oct.15 to Oct.18 2004. He reported that its rotational period was 4.87 ± 0.01 hour and amplitude was 0.16 magnitude. Its lightcurve did not seem to be a binary system. However our lightcurve observations during 2004 Nov.7 to Dec.17 have revealed this minor planet is a probable binary asteroid.

Figure 1 is the lightcurve of Murayama. It includes all data, and the period is set to 4.8595 hr. Figures 2 and 3 are the short-period components. They are the primary's rotational lightcurve, derived from the original data by rejecting the deep extinction. The long-period lightcurve components are caused by occultation/eclipse events in the binary system. They are derived from the original data by subtracting the short-period component of each month. The data of Nov. 29 are included in both the November and the December analysis. Figure 4 shows that the only observed occultation event was in November. Figure 5 shows there were both occultation and eclipse observed events in December. All data are corrected for light-time. Zero phase is equal to 2453318.88332 JD. Because the orbital period is unclear, it is not possible to be certain of the long-period lightcurve components. We need more lightcurve observations to determine the orbital period. The next opposition of Murayama occurs in April 2006.

Acknowledgments

Thanks are given to Miyasaka, S. and Hamanowa H., for their support observation, to members of lightcurve mailing list for their advice and suggestions. Also many thanks to Dr. Petr Pravec, who helped me with the analysis and interpretation of this probable binary asteroid.

References

Dermawan, B. (2003). “CYCLOCODE Period Searching & Lightcurve Fitting Program; Ver. 3.6” http://www.toybox.gr.jp /mp366/lightcurve/cyclocode/cyclocode_doc_eng.pdf

Stephens, R. D. (2005). “Rotational Periods of 745 Eugenisis, 995 Sternberga, 1185 Nikko, 2892 Filipenko, 3144 Brosche, and 3220 Murayama.” *Minor Plan. Bull.* **32**, 27.

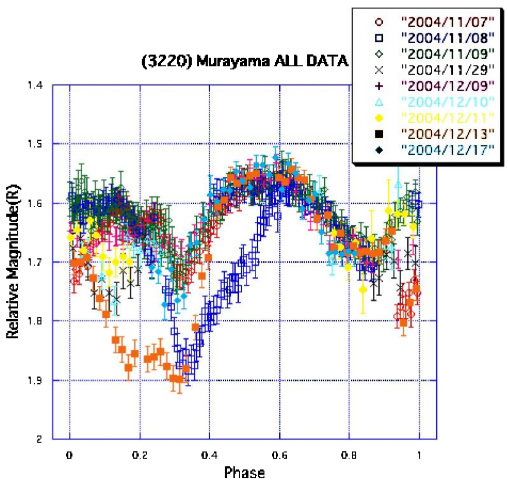

Figure 1. Lightcurve for 3220 Murayama containing all the data. The period used is 4.8595 hr.

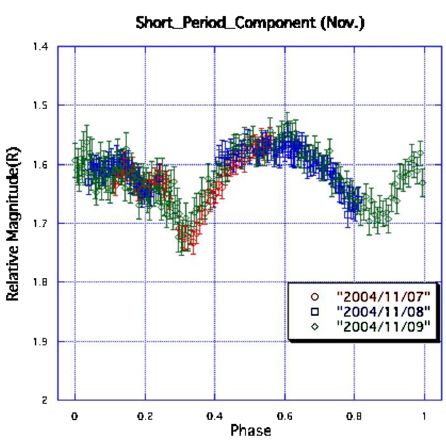

Figure 2. The 4.8595 hr short-period component in November.

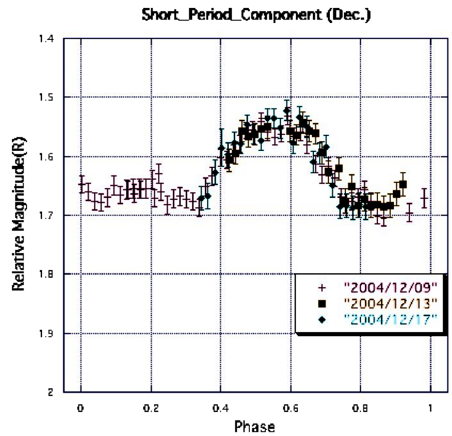

Figure 3. The 4.8595 hr short-period component in December.

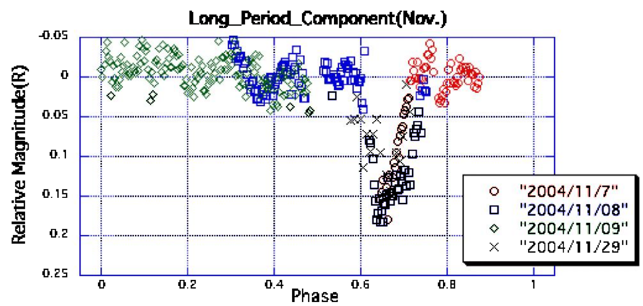

Figure 4. The long-period component derived from the original data by subtracting the short-period component in November. The period used for this figure is 13.135 hr.

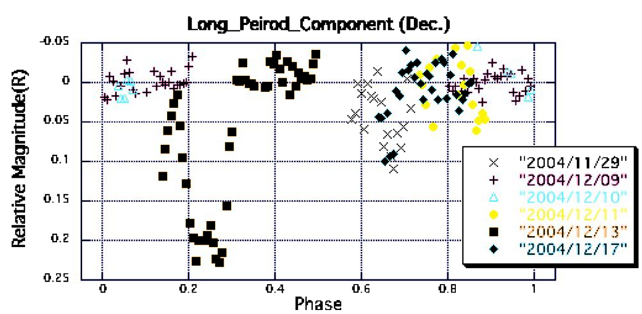

Figure 5. The 13.135 hr long-period component derived from the original data by subtracting the short-period component in December. The period used for this figure is 13.135 hr.