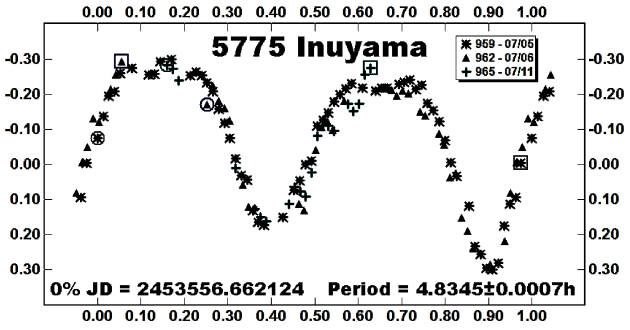

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References

Behrend, R. (2004). Observatoire de Geneve web site, http://obswww.unige.ch/~behrend/page_cou.html

Collaborative Asteroid Lightcurve Link (CALL) (2004). http://www.minorplanetobserver.com/DATA/submissions_results.htm

Harris, A. W., Young, J. W., Bowell, E., Martin, L. J., Millis, R. L., Poutanen, M., Scaltriti, F., Zappala, V., Schober, H. J., Debehogne, H., and Zeigler, K. W., (1989). "Photoelectric Observations of Asteroids 3, 24, 60, 261, and 863." Icarus **77**, 171-186.

Harris, Alan W. (2005). "Minor Planet Lightcurve Parameters". On Minor Planet Center web site: http://cfa-www.harvard.edu/iau/lists/LightcurveDat.html

Tedesco, E.F.: 1979, PhD Dissertation, New. Mex. State Univ. 280pp.

Warner, B. D. (2003). "Lightcurve Analysis for (Several) Asteroids", *Minor Planet Bulletin* **30**, 21-24.

Wisniewski, W. Z., Michalowski, T. M., Harris, A. W., McMillan, R. S. (1997). Icarus **126**, 395-449; 1995, Lunar & Planetary Science XXVI, 1511-1512.

THE MINOR PLANET OBSERVER: A BUSY SUMMER

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It happens every year: I go to the Society for Astronomical Science's (SAS) annual symposium in Big Bear, CA, and end up wanting to do even more things despite the fact I don't have enough time to do half of what I'm trying to do. The meeting this past May was particularly filled with temptations this year. I felt like the little kid peering into the candy shop window.

One of the highlights of the meeting was the presentation by Valerie Desnoux and Christian Buil. Christian, of course, is one of the experts on CCD imaging in the world, having written a classic book on the topic. He and Valerie are part of the Astronomical Ring for Access to Spectroscopy (ARAS). You can find the web site at http://astrosurf.com/aras/index1.htm. The group is dedicated to promoting spectroscopy by those with modest equipment. The work that is being done is nothing less than spectacular. Valerie and Christian's paper concerned Be Stars, bright hot stars with emission spectra.

Their talk was preceded by a mini-workshop by David Bradstreet, author of Binary Maker 3, which is a modeling tool that converts lightcurves of binary stars in to models. It never ceases to amaze me that so much can be learned from merely analyzing the change of light from an object over time. I know these are not related to asteroids but every once in awhile it's refreshing to look to other areas were smaller observatories can and are making strong contributions to science.

Of course, asteroids were not overlooked at the meeting. Petr Pravec traveled from the Czech Republic to present a paper on a study he and a group of others (OK, I'll say it – some are "amateurs") have been doing on binary asteroids, in particular those among the Near Earth Asteroid (NEA) population. Some very interesting findings have been made as a result of the study. A large paper is being prepared for publication in *Icarus* and some of the findings were presented at the Asteroids, Comets, and Meteors (ACM2005) meeting in Brazil in August. The initial study was expanded to cover inner main belt asteroids as well, i.e., Hungarias, Floras, and "Vestoids". Including these, especially the binary members found in recent years, yielded even more information for those studying the dynamics and evolution of asteroids.

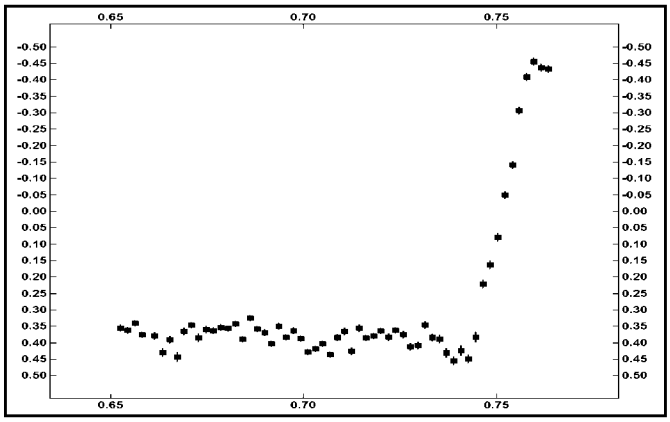
There were also updates from Lance Benner from the Jet Propulsion Laboratory regarding radar imaging of asteroids. Support from the lightcurve and astrometry communities is critical to the success of the radar efforts. High-precision astrometry is need to confirm the predicted positions for pointing the Goldstone and Arecibo telescopes while lightcurve work can often confirm findings, e.g., binary asteroids, or determine that the asteroid is spinning too slowly to get good measurements. In the latter case, another target might be selected in order to maximize the results from limited observing time.

If you'd like to read the papers from the SAS meeting, you can go on-line at http://www.SocAstroSci.org. The proceedings are available as a large PDF. What you'll find in those is just some of many possibilities for contributing to science with even humble equipment. I know I've harped on this topic before but after attending meetings such as the SAS symposium, it's hard to imagine not wanting to do research with all the wonderful equipment that's available these days. The meeting refreshes my resolve to keep up my work, which has been concentrating on the Hungaria family (or group) at the urging of Alan Harris for the past couple of years.

Among the first of the Hungarias I measured was 70030 Margaretmiller, which I happened to discover and is named after my wife. How many of us get the opportunity to both find and name an asteroid for a spouse or close friend and then measure its

rotation rate? The first part does wonders for building up what I call "Spousal Permission Units" – good will credits saved for a future time when one needs to ask for a particularly big favor or have a transgression overlooked. I like to say that my wife, a professional violist, is now also a "rock star." That gets a few more SPUs.

In July, there was the spectacular fireworks show on Comet Temple$_1$ after the Deep Impact probe hit it. Unfortunately, the comet was too low in the sky for me to turn my scopes on it and so I had to rely on accounts from friends around the world. Jerry Foote in Kanab, UT, sent me an amazing image showing the plume of material coming from the nucleus. Bob Koff of Bennett, CO, sent me a lightcurve he generated from his observations.



Lightcurve of Comet Temple1 at impact. Bob Koff, Antelope Hills Observatory, Bennett, CO.

That's good work for something less than 20° above the horizon. Many of those observing visually reported they didn't notice much of a difference. The CCD camera does not lie! Data are still pouring in and no doubt there will be plenty to fuel theories and papers for years to come. This brought back memories of the Shoemaker-Levy 9 collision with Jupiter. That I *did* get to see, or at least the aftermath: a large "black-eye" in the Jovian clouds. It is one of the astronomical events my wife remembers most, along with comets Hale-Bopp and Hyakutake.

So, just when things seem a little routine and there's seemingly nothing new going on, along comes a good meeting of the minds and another spectacular space probe event to keep things interesting. Of course, there's always trying to keep up with Spirit and Opportunity on Mars, Cassini around Saturn, and data mining on-line databases – among just a few other things. Almost all of this didn't require collecting a single photon of my own. It's a good thing, too. A very uncooperative Mother Nature brought my observing to a near standstill this summer. That candy store had a very thick window keeping me from the real treats.

Clear (and interesting) Skies!

A SIMPLIFIED METHOD FOR STANDARD STAR CALIBRATION

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Calibration of asteroid lightcurves to the standard magnitude system is often lacking due to the perceived difficulty. However, reasonably good calibration can be achieved through a simple method if standard star choices and measurements are made strategically. Using standard stars matching asteroid colors and performing calibration measurements at similar airmass values reduces the effects of most correction terms, allowing much simplification in the reductions.

[Preamble: The method described here has been long utilized by experienced practitioners. As the method is self-apparent, it is seldom described. The description offered here is hoped to be useful to new observers.]

CCD imaging provides a powerful technique for measuring asteroid lightcurves through differential photometry between the asteroid and comparison stars in the same image. One of the advantages of this simultaneous recording of the asteroid and the comparison stars is that lightcurve measurements can be obtained on nights that are less than perfect. Even if good conditions are present, there is a perceived difficulty in obtaining absolute photometric calibration on the standard magnitude system. The apparent difficulty in calibration often arises because no filter is used within the system, where either none is supplied with the CCD or the object being measured is near the limit of detection and the maximum photon counts are necessary for the best possible lightcurve precision. In other instances, absolute photometric calibration is not obtained because of the perceived time and effort required to determine extinction coefficients and color correction terms for the CCD and its filter combinations.

The purpose of this article is to describe a simplified method for quickly obtaining a reasonable photometric calibration of CCD lightcurves with respect to the standard magnitude system. Indeed, precise absolute calibration to 0.01 magnitude or better is an art form requiring the dedication of a substantial amount of observing time and painstaking reductions so that one derives first and second order extinction terms for the night(s) of observations as well as the color correction terms for their CCD system and filters. However, with some careful planning of the standard star measurements all of these effects can be minimized to the point of being "ignorable" if absolute calibration to within several percent (0.05 magnitude) is acceptable. For most asteroids, this level of precision is sufficient to substantially improve their catalogued magnitudes, where uncertainties of many tenths of a magnitude are pervasive.

There are three observational precepts for performing simplified calibrations of CCD lightcurves that require some advance planning and at least uniform sky conditions (if not 'photometric' conditions) over the time interval of the calibration measurements: **(1)** Determine the time(s) of night when you can measure the