Observing Proposal

Due **in class** Monday 13 October, 2008

Instructions for the Observing Proposal:

You may propose to make any observations which form a single coherent scientific project that you find interesting. The telescopes/instruments available for your project are the Palomar 60-inch (1.5m: "P60") telescope, which has a queue-scheduled CCD camera with several color filters: http://www.astro.caltech.edu/~derekfox/P60/ and http://www.astro.caltech.edu/~derekfox/P60/status.html **Your proposal should not require more than a total time of 4 hours, including all exposures, CCD readout and repointings of the telescopes**. On the P60, the exposures may be spread over up to a month (mid Oct to mid November), but to avoid wasting time, exposures should not be shorter than 1 minute (i.e. you can't look at bright objects), and you may suggest important dates/times. The queue scheduler does not guarantee these, however, so having multiple choices of objects or date/times will enhance the likelihood of success.

Examples for the P60 might include making repeated observations of the brightness of an eclipsing binary star, variable star, or a cataclysmic variable (accreting white dwarf) in suitable filters, to determine orbit/rotation/outburst, and/or to determine the speed of light. Since many are discovered each month, you could measure the light curve of a nova, supernova, or X-ray transient [accreting neutron star or black hole], or study variability in an active galactic nucleus (accreting supermassive black hole). Make multiple observations of an asteroid or Kuiper belt object to measure its orbit and/or rotation period. Do photometry in multiple colors of one or more galaxies to study structure and star formation. Image a star cluster in multiple colors to construct a Hertzprung-Russell diagram. Image galaxies in Hα and a nearby off-band to determine star formation rates and redshift limits.

Some helpful sources of coordinates, magnitudes and citations are CDS: http://cdsweb.u-strasbg.fr/ (good especially for stars), NED: http://nedwww.ipac.caltech.edu/ (good especially for galaxies), WEBDA http://www.univie.ac.at/webda/ (for open star clusters), GGCD http://www.mporzio.astro.it/~marco/gc/ (for globular star clusters), AAVSO http://www.aavso.org/publications/alerts/ IAU Circulars http://cfa-www.harvard.edu/iau/services/IAUC.html and ATels http://www.astronomerstelegram.org/ (variable stars, transients, supernovae).

Selection: About two proposals (the precise number depending on the total time requests, shorter programs obviously having a somewhat enhanced chance fitting in) will be selected by a time allocation committee (TAC) which will most likely include proto-Profs Morton, Newman and Kasliwal, Caltech Prof Phinney, and (if proposing for the Table Mountain telescope) Pomona Profs Penprase and Choi.

Grading: The proposal will count for 5% of your grade (i.e. same as a homework set). A perfect score will be awarded for a feasible program with all positions and exposures correctly calculated. Cleverness and creativity in the choice of objects and scientific program will be rewarded not by grade, but by the honor of yours being (one of the $\sim$ two) proposals actually executed and worked on by the class), and the right to record this on your *curriculum vitae* when applying to grad school.

Your proposal should have the following components:

1. **Page 1, Discussion:** A 1-page description (in no less than 12-point type) of the project,

explaining the scientific goals and methodology, and justifying the time and equipment requested. Give full citations to your sources of coordinates, magnitudes, variability, ephemerides [your professor and TA will need to check them to ensure that the telescope is not pointed in the wrong direction or in the right direction at the wrong time, and will get grumpy and lower your grade if they can't find the source of your information.]

2. **Page 2, Observing list:** Provide a list of targets to be observed, including names, coordinates (RA, dec in J2000), magnitudes. Specify the filter band to be used, your estimate of an appropriate exposure time.

   Include an explanation of the calculations you did to determine the exposure time (and the accuracy you require of your photometry -i.e. if you expect 100 photons, you will get at best 10% accuracy, not 1%.) If your object is extended, make sure the parts you care about fit in the CCD field, or that you specify observations that mosaic the area you are interested in. If your project requires repeated observations of the source, or it is important to observe at a particular date/time (e.g. to see an eclipse or outburst) specify the desired intervals between observations or special dates (there should be multiple choices for time/date in Oct-Nov 2007, since weather or other programs may interfere with your first choice. If there is only once choice, your program is not suitable).

3. **Page 3: Citations [and optional figures and extra calculations]** Use this page to list your citations in proper form -e.g.

   Einstein, A. 1916 "Die Grundlage der allgemeinen Relativitätstheorie" Annalen der Physik, Vol 354, pp 769–822.

   It may also include figures such as lightcurves, or supporting calculations demonstrating the feasibility of your program. Proposals filling more than 3 pages will be returned unevaluated (just like the real world!).

If you are particularly interested in other instrumentation, please see Prof. Phinney ASAP, as we may be able to obtain time on the 40-inch (1m: "T40") JPL/Pomona telescope on Table Mountain http://www.astronomy.pomona.edu/tmo/index.html and http://www.astronomy.pomona.edu/tmo/Instruments.html which also has a 4096x4096 pixel CCD camera with a 13' field, but with the capability of **polarimetry** [a fixed double-calcite Savart plate, which makes simultaneous displaced images of each source in the two orthogonal polarizations, and a rotatable 1/2 wave plate, which allows one to rotate the planes of polarization at will with respect to the fixed Savart plate axes. For discussion of the operation of a similar instrument on a different telescope, see http://www.journals.uchicago.edu/cgi-bin/resolve?id=doi:10.1086/504958] and **Near Infrared imaging** and **low-resolution grism spectroscopy** [the dispersion is 6Å per 0.19" camera pixel; don't forget typical 1.5arcsec seeing in your resolution calculations; you will be limited to brighter objects than for imaging since the light from the source will be spread over a much wider area.]

With the T40, you may do imaging similar to that on the P60 (though not for time series extending for more than a single night, which the P60 allows), but most interesting are its additional capabilities: polarimetry (interesting notably for magnetic cataclysmic binaries, aka "polars", the Crab nebula and similar "plerion" supernova remnants, stars behind dark clouds whose light is absorbed by aligned dust grains, and a few active galaxies), and grism spectroscopy. The T40 time should not require time series (it will all be done one one night, whose date you may not specify). You may propose to use both the T40 and the P60 as long as the combined observations form part of a coherent program (e.g. photometry and polarimetry or photometry and grism spectroscopy of a single object or set of objects).