PHY517 / AST443: Observational Techniques

Homework 2

1. Orion culminates at 1am in September; at what time does it culminate 3 months later? Describe how you arrived at your answer.

2. Look up the focal length of our telescope, and the size of the STL-1001E CCD. You can find both in the manuals linked from the *Observing Equipment* tab on the class wiki. What is the field-of-view of the camera when attached to the telescope?

3. Looking up references and compiling LaTeX:

   - Download the `example.tex` file, and read and compile it.
   - Look up 3 references for your "birthday object", and read their abstracts.
   - Write a short paragraph about this object, briefly summarizing the conclusions from these 3 papers.
   - Include the references via BibTex.
   - Also include your finding charts and StarAlt chart in the document.
   - Submit the compiled pdf and the source code.

Work together with your lab partners for the following:

3. Request your exoplanet transit observing dates! These instructions can also be found on the wiki.

   - You can find the current catalog of known exoplanets at `http://exoplanet.eu/catalog/all_fields/`. Filter the catalog to include only exoplanets detected as "primary transits" and download it. You can use topcat to view the contents of the catalog.
   - Use the R.A. and Dec. coordinates to select stars that are observable from Stony Brook in the next two months.
   - The catalog does not tell you the transit depth, but you can calculate it from the data given in the table. Figure out how, and make a new column with transit depths.
   - Use topcat to plot the transit depth vs. the brightness of the host star. Which are your best targets?
   - The catalog also does not tell you the duration of the transit, but again, you can calculate it. To do so, derive an estimate of the transit duration under the assumption that the planet crosses directly across the center of the star. Explain why this is an upper limit to the real duration, but should not be too far off. Select stars with transit durations $\lesssim 3\,\mathrm{h}$.

- Figure out how to calculate the expected mid-points of transits, given the data in the table. For the stars that you have selected, calculate the transit times in the next two months. You will have to write a small program (in the language of your choice) for this step.
- Select transits that occur at night-time, and when the star is well observable ($> 40°$) for the entire duration of the transit. You can use the script `rdj2aau.py` on the wiki to convert (R.A., Dec., MJD) to (azimuth, altitude, UTC). To use the script, prepare a text file with all your candidate events (each row should be one event, i.e. one set of RA, Dec, JD, separated by a whitespace). Run it as `python rdj2aau.py in.txt out.txt`.
- Choose 4 transits, staggering them out in the timeframe discussed in class. The latter two dates are your back-up dates in case the observations on the first night fail due to weather or technical problems. Note that the transits can be for different stars / planets. Also note that you need to avoid days ± 3 days around Full Moon. If the Moon is bright, make sure your target is $> 40°$ away from it (StarAlt will tell you the distance in degrees). Refer to the Mt. Stony Brook observing calendar for scheduling constraints and available dates.
- Send me your choice of dates - first come, first serve. Include the results of your calculation for the mid-transit time, the transit duration, and the magnitude dip, as well as the StarAlt plot for each transit. When should you arrive at the telescope?