ASTR 8060
Homework 1

Learning goals: become familiar with astronomical coordinate systems; Practice positional conversions in sexigesimal format; practice figuring out what is observable when; become familiar with common telescope facilities. Equip yourself as an observational astronomer with common calibration papers that will come in handy at an observatory.

1. Compute starting from their RA and Dec. the angular distance in arcseconds between Alcor and Mizar starting from their Right Ascension and Declination. Also compute their position angle, usually defined east of north (make the assumption of plane geometry, given that their separation is small, so no need to do spherical trigonometry).

2. Derive the law of cosines (Chromey equation 3.1) and then rewrite it in terms of RA and declination. Use this to determine the separations for which the assumption of plane geometry is valid. To do this, make a plot comparing separations calculated with the law of cosines and the plane geometry assumption and see where they diverge from one-to-one.

3. Using a tool such as the NASA/IPAC Extragalactic Database (NED) Coordinate Calculator, find the RA and DEC of:

   - Galactic Center
   - Galactic anti-center
   - Galactic North Pole
   - Galactic South Pole
   - The location(s) where the ecliptic crosses the Galactic Plane

   Commit these, roughly, to memory.

4. You're going observing on September 1, 2023 at Kitt Peak to follow up several binary supermassive black hole candidates from Charisi et al. (2016).

   Without resorting to any software, estimate approximately when, local time, the following objects will rise and set to within a couple hours. Use what you know about the Sun's track across the sky, and how its declination varies with seasons. Give the minimum airmass achieved by each object during that 24-hour period.

   - UM 269
   - PDS 898
   - PKS 2203-215

5. When you have completed the previous problem, check your answers using appropriate software. I recommend `pyskycalc` from ThorSky[1] or this website. In either case, you should create a coordinate list including all the bold (i.e. significantly periodic) objects in Table 2 of Charisi et al. (2016). Then set the site, date, and time in the software and generate airmass (or altitude) plots for each target. Use these to check your answers for the objects in the previous problem.

[1] https://github.com/jrthorstensen/thorsky

6. Write a table of vital stats for the following telescopes: Nu-STAR, Chandra, HST, Gemini, SOAR, LCO, Spitzer, JWST, ALMA, NOEMA, VLBA, VLA

   Break up the assignment so that each student does a handful of telescopes then merge your answers. Include at least the following:

   - full name (i.e. not the acronym)
   - location
   - aperture size
   - operational wavelength range or photometric bands (this will be instrument dependent, so list the instrument)
   - website link

7. Create an "observational notebook". This should include a directory on your computer where you can store useful references to access them at the telescope[2] and an electronic format for saving your notes (e.g., with software like Evernote or Google Docs). For each resource below, write up a 2–3 sentence summary of the usefulness and contents of each paper. Are there other papers you'd recommend be in this list?

   - The Kitt Peak Direct Imaging Manual
   - Photometric Standards: Landolt, 1992, AJ, 104, 340
   - A User's Guide to Stellar CCD Photometry with IRAF: Massey & Davis, 1992
   - A User's Guide to CCD Reductions with IRA: Massey, 1997

[2] Never assume that you'll have working internet at a telescope!