ASTC02 - Practical Astronomy
Lab Report 1
Asteroid and Planet Orbits

Professor Hanno Rein

Deadline: Thursday November 9th 2017, noon

The goal of this practical is to determine the orbits of Pluto, Kleopatra, and Phocaea from multiple observations. You write up should be about two pages plus any tables and images.

Problem 1.1   10 Points

(a) Collect all observations that you took as well as the archival data from this summer. You can find all files at `rein003.utsc.utoronto.ca`. The archival images are in the `asteroids` folder.

(b) Make a list of all observations that you are planing to use. State:

- who took the images
- the date and time
- the telescope and instrument used
- the observing conditions
- any unusual occurrences.

(c) Determine (using stellarium) if your object of interest is in the frame. Include one screenshot of stellarium for each object.

(d) Determine the location of the object on the sky using the `astrometry.net` service. List the right-ascension and declination for each observation.

Problem 1.2   10 Points

Determine the orbit of the three objects using Gauß' method. The code to do this is available on the github repository for the course and on the rein010.utsc.utoronto.ca machine (use this if you have trouble running it on your own computer). Quote all orbital elements and compare them to the literature values.

Problem 1.3   10 Points

Do an error analysis, i.e. determine how good your orbit fits are. You can do this in a brute-force way:

(a) Estimate how accurate you determined the location in the images, δ. Justify your choice of δ.

(b) Vary the location of each observation by $\delta \cdot \mathcal{N}$ in both directions, where $\mathcal{N}$ is a normally distributed random number with variance 1.

(c) Run Gauß' method with these perturbed locations. Do this many times.

(d) Calculate the mean and the spread (error bars) of the orbital parameters you get.