PH2900 (Astronomy)
Complex Problem 4
To be turned in by 5:00 p.m., Friday 16 December 2005

Your final 'Complex Problem' is computer based exercise which can be done in addition to or in place of one of the observatory practicals. This time we will use a software package on the Astrometry of Asteroids from the CLEA project, whose homepage you can visit at

`www.gettysburg.edu/academics/physics/clea/CLEAhome.html`

The student manual for the Astrometry of Asteroids project is available through the web site and paper copies will be distributed. Much of the material in it is well known to us (right ascension, declination, etc.) and can be skimmed quickly. You can use this manual as a workbook, but I would prefer that you write up your results as a separate lab report, i.e., don't simply turn in the workbook.

Your core assignment is to work through Sections 1 through 3 of the workbook. The very keen you can go a bit beyond this, and I leave it up to you to decide how to extend the project. Further extensions include doing a bit of research on asteroids and discussing how you would search for one using our telescope. You could also try to use the error propagation formula that we have seen to estimate the uncertainty in the distance to the asteroid that you find.

The software is installed on the computer centre PCs. Go to Programs $\rightarrow$ Academic Applications $\rightarrow$ Physics $\rightarrow$ Clea Asteroids. It is also easy to download the program from the CLEA website and install it, say, on your own laptop or PC.

There is an important typo in the workbook, which is then partially fixed by the instructions, but nevertheless creates some confusion. Suppose you measure the right ascension α and declination δ for an asteroid at two different times, and you find they change by $\Delta\alpha$ and $\Delta\delta$. The angle $\Delta\theta$ by which the asteroid has moved should be given by

$$\Delta\theta = \sqrt{(\cos\delta\Delta\alpha)^2 + (\Delta\delta)^2}\,,$$

where here δ can be taken as either of the two δ values (or their average), since the asteroid does not move very much in successive images. (The formula in the manual is missing the extra factor of $\cos\delta$; they sneak it in later in their definition of ΔRA.)

If you do this exercise, you'll be in a good position to do a proper asteroid search using our telescope for one of your observatory practicals. The CLEA project also provides a program similar to the one you use in this exercise, but which is better adapted to be used as a research tool. We will also have this available on our PCs and you can use it to analyze images that you take from our observatory.

G. Cowan
2 December, 2005