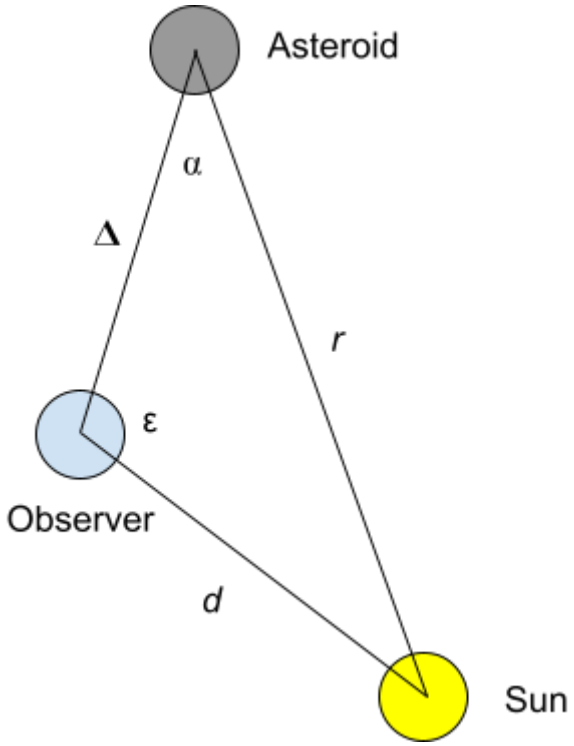
ASTR 597: Asteroids Homework

Problem #1: An asteroid's absolute magnitude, commonly denoted as *H*, is the visual magnitude an observer would record if the asteroid were placed 1 Astronomical Unit (au) away, and 1 au from the Sun and at a zero phase angle (α; see the included figure).



Sketch out the Observer-Sun-Asteroid configuration satisfying the above requirement (assuming the observer is on the Observer). What is the value of *d* (the Observer-Sun distance) in such configuration?

Problem #2: The relationship of an asteroids's magnitude to flux, at phase angle α=*0* (also known as "being in the opposition"), follows the familiar definition:

$$m = H - 2.5log(f/f_0)$$

Starting with the above, derive the expression for *m(r, Δ)*, the magnitude as a function of the Sun-Asteroid distance r, and the Observer-Asteroid distance Δ, at phase angle α=*0*. When deriving this expression, keep in mind that the asteroid shines in *reflected* light.

Problem #3: Taking:

$$r = \Delta + 1au$$

(i.e., the asteroid is at opposition) show the asymptotic behavior of *m(Δ)* as $\Delta \rightarrow \infty$.

How does it compare to the behavior of ***flux*** as a function of distance for stars (which falls off as 1/distance^2)? Why the difference?