

Killer Asteroid Project

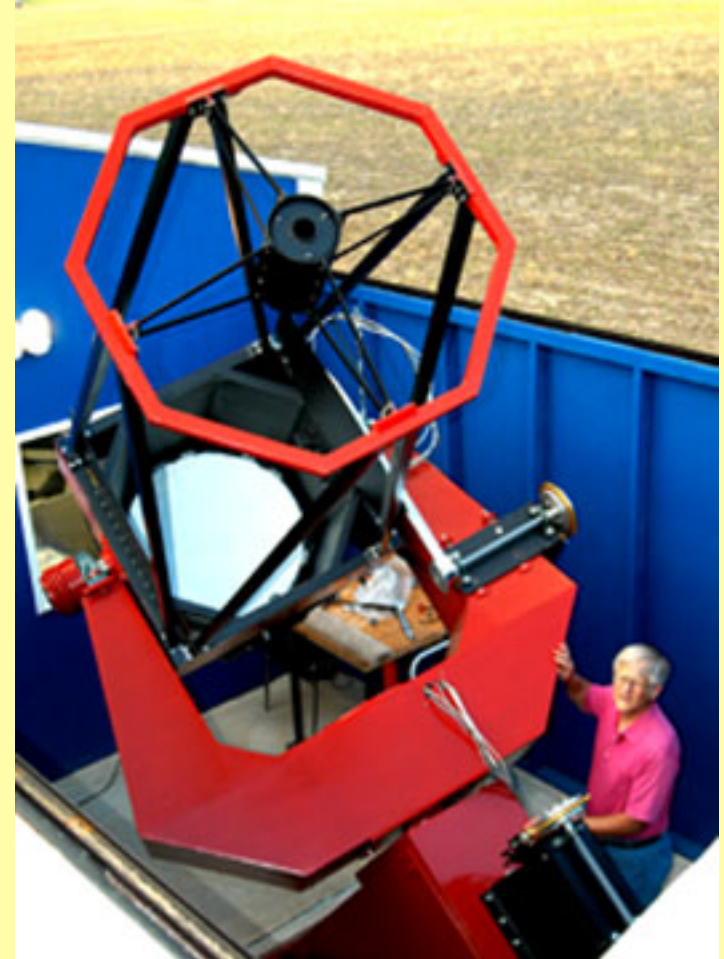


Astrometrica: Advanced NEO Search



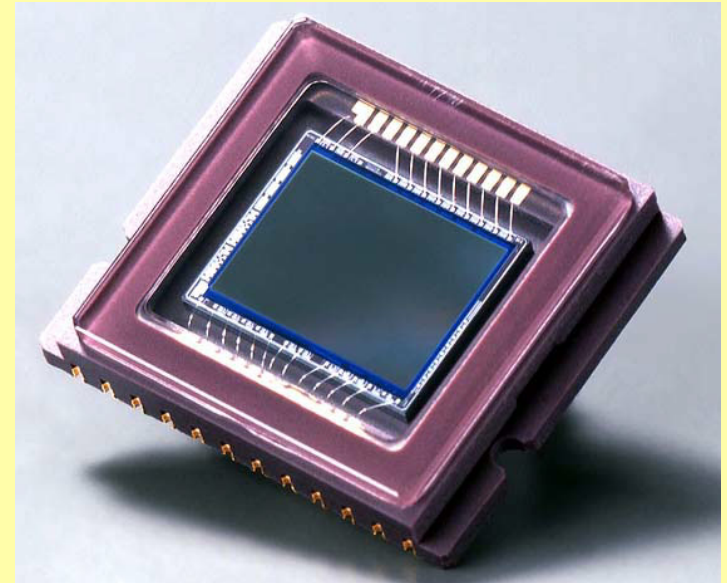
ASTRONOMICAL RESEARCH INSTITUTE

- We will be using data from the Astronomical Research Institute located just south of here in Charleston, IL, run by Bob Holmes
- Primarily, we will use data from their 32 inch telescope.



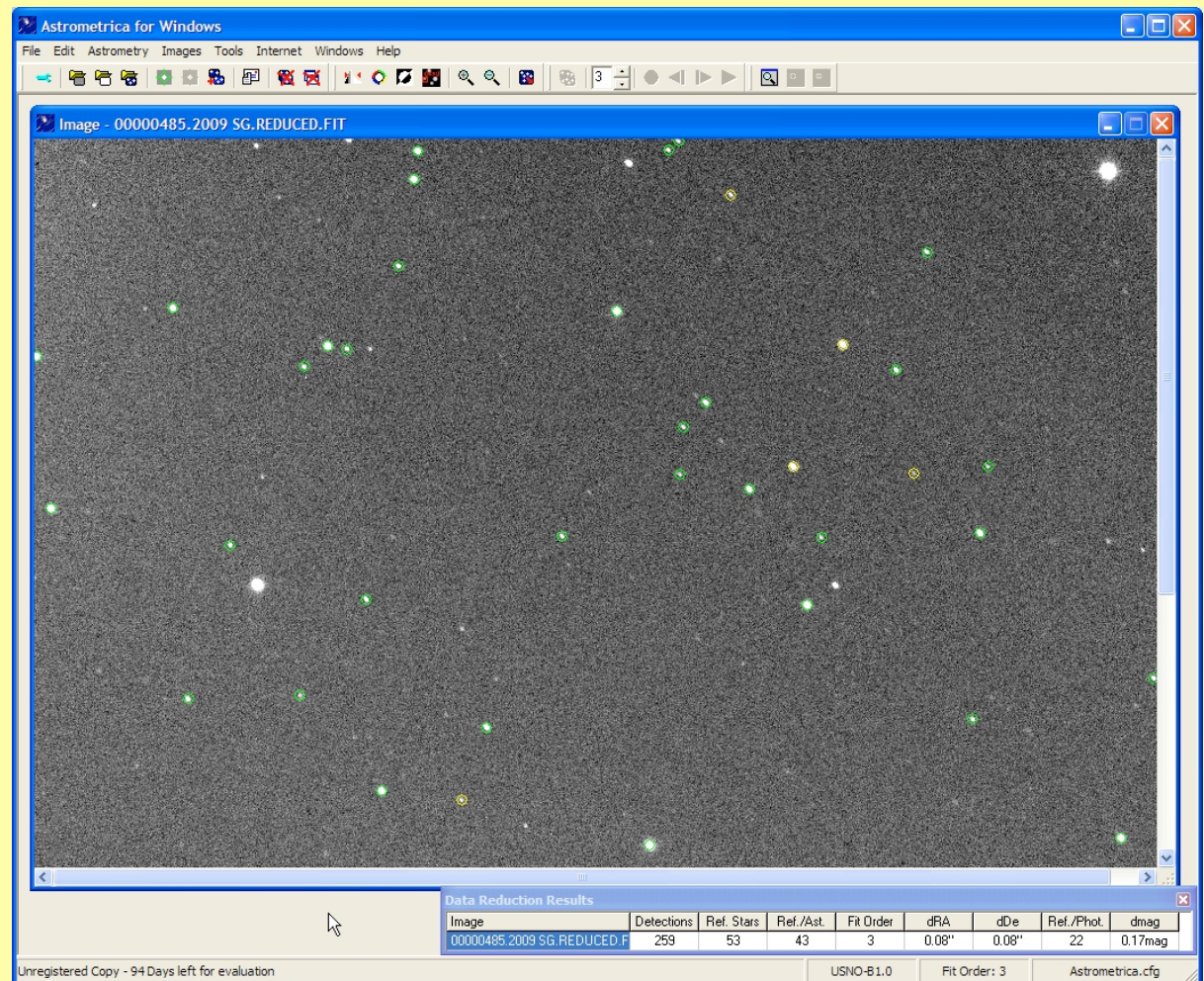
CCDs

- For the last few decades, astronomers have used CCDs (Charged Couple Devices) on telescopes.
- We hardly ever stick our eye up to telescopes anymore.
- These are similar to the CCDs that you use in your digital camera.
- Basic idea is to turn light photons into electrons, so we can record it onto computers.



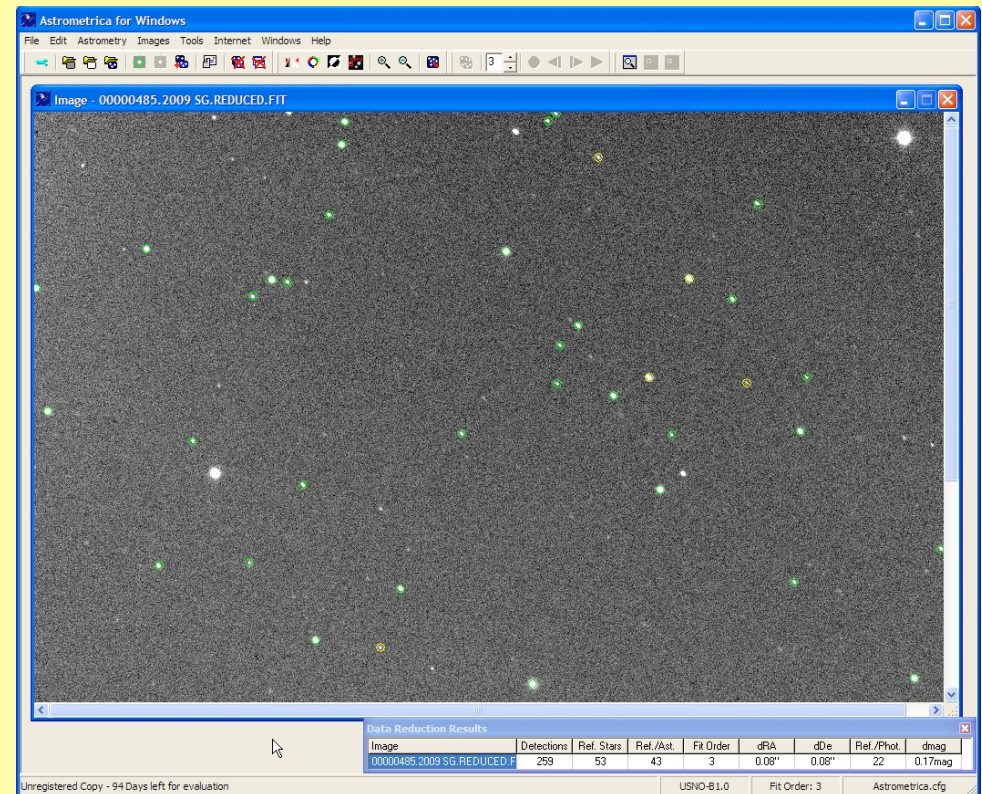
CCDs

- An example of an image taken with the 32 inch telescope.
- To get the most sensitivity, we are only using one color.



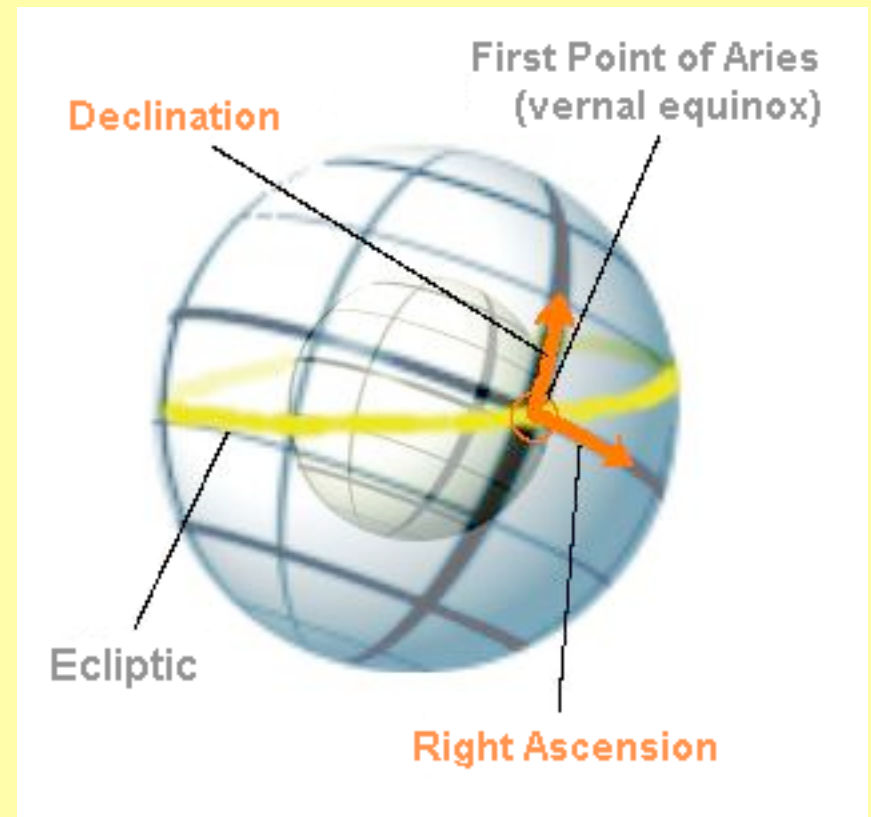
Location, Location, Location

- The main thing in asteroid searching is knowing what blobs are not asteroids.
- So, we have to know the location of the stars and other bodies on the CCD image.
- This means we need to solve for where we are pointing by using standard known stars in the field.



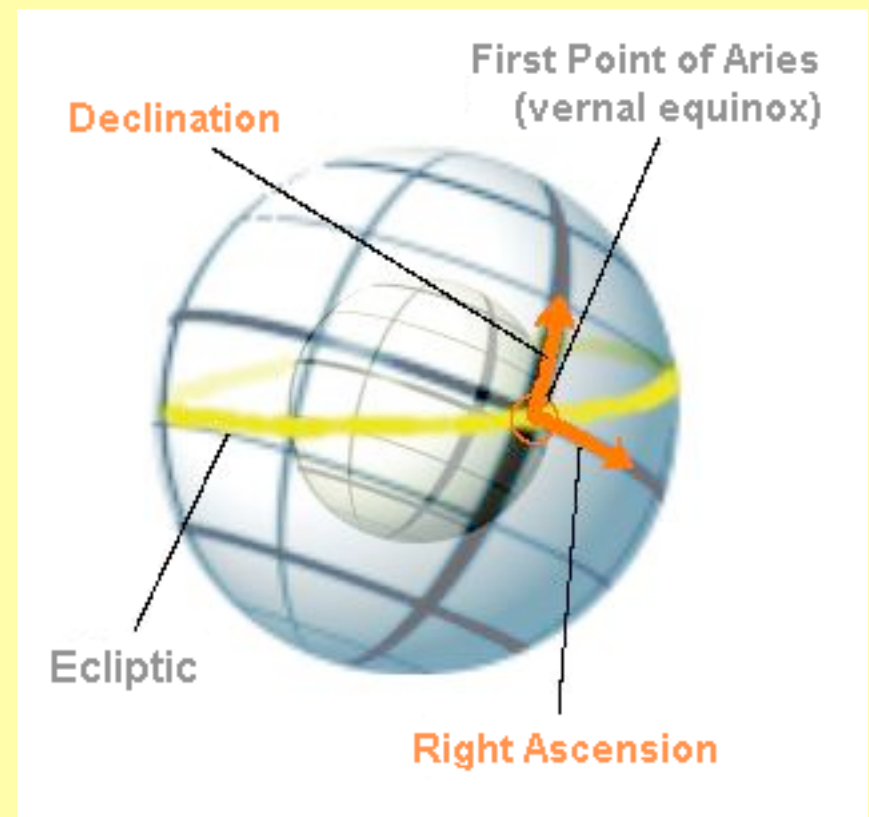
Location, Location, Location

- We will need to realize that the coordinate system we use is similar to longitude and latitude on Earth.
- We draw an imaginary line into the stars from the Earth's equator. That line is 0 degree declination (Dec).
- Above and below, much like latitude, we have plus 90 degrees Dec at the North Celestial sphere, or Polaris.



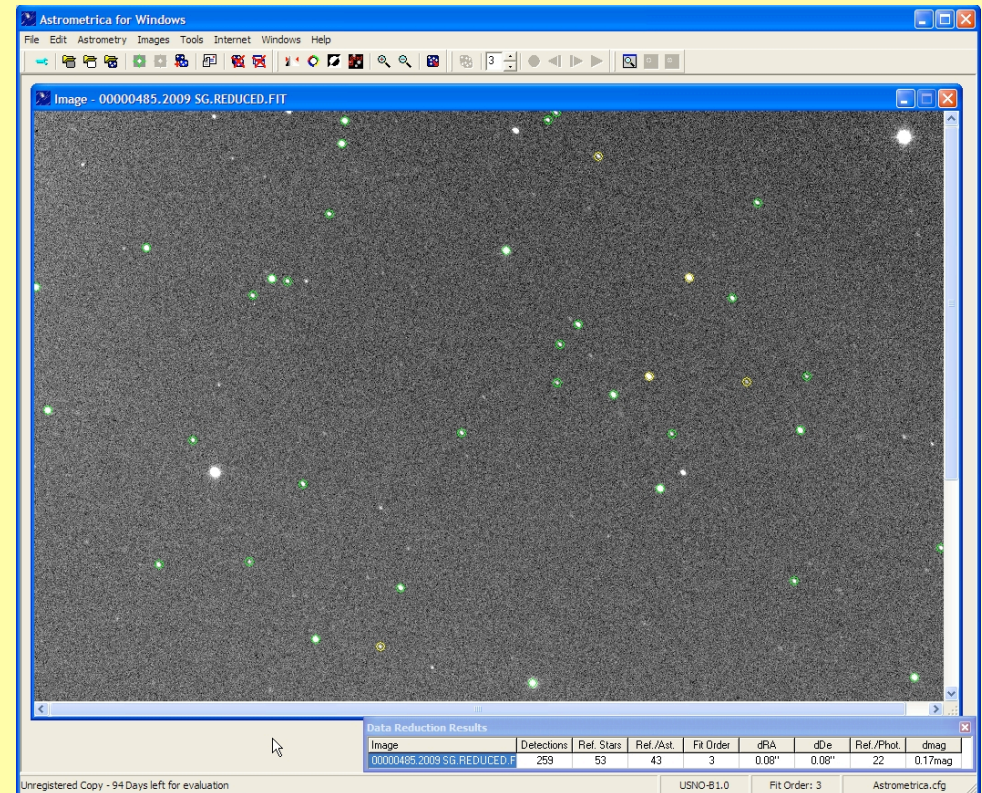
Location, Location, Location

- Similarly, Right Ascension is like longitude on Earth.
- However, zero RA is at the point where the Sun is on the Vernal Equinox (March).
- RA is measured in hours; 0 hours to 24 hours, is the full sky.



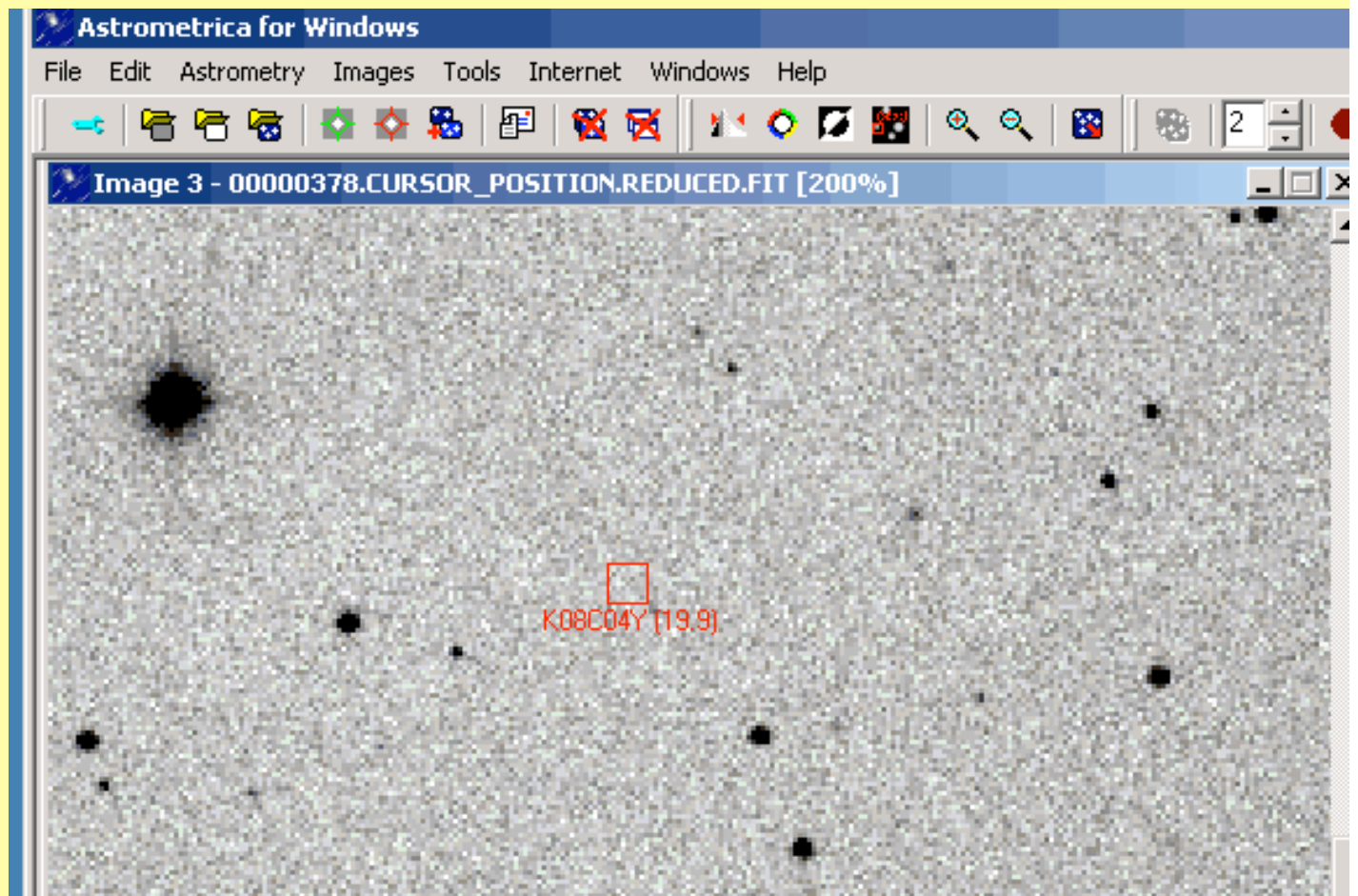
Location, Location, Location

- So we need to solve the RA and Dec of the images using known stars.
- In general, Dec is up down in the images (positive is up), and RA is left right (positive to the left).
- Additionally, the brightness is calibrated too.
- It will be in magnitudes.



Blink It!

- By selecting a sample of times, we can see the brighter asteroids.
- In this case, we keep the proper coordinates
- Best way to find new asteroids.



Once we find the Asteroid

- We can derive how the asteroid is moving with respect to the image of stars
- Get the speed in arcseconds/minute and the direction it is moving, PA
- Then, we can stack these to get the best signal to noise and measure the asteroid.

Stacking

- We will stack images to get more info.
- In some cases, we will track on the asteroid, which is moving differently than the stars.



Asteroid Tracking



Tracking involves offsetting each image in the direction opposite of that the asteroid is moving. Each image is offset by the distance the asteroid would have moved in each successive image. The asteroid appear to be stationary, but turns the stars into streaks.

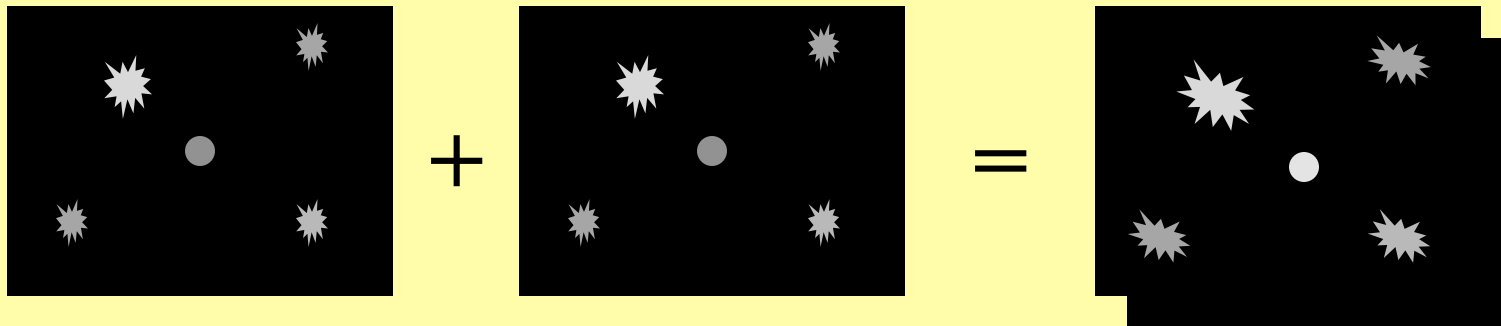
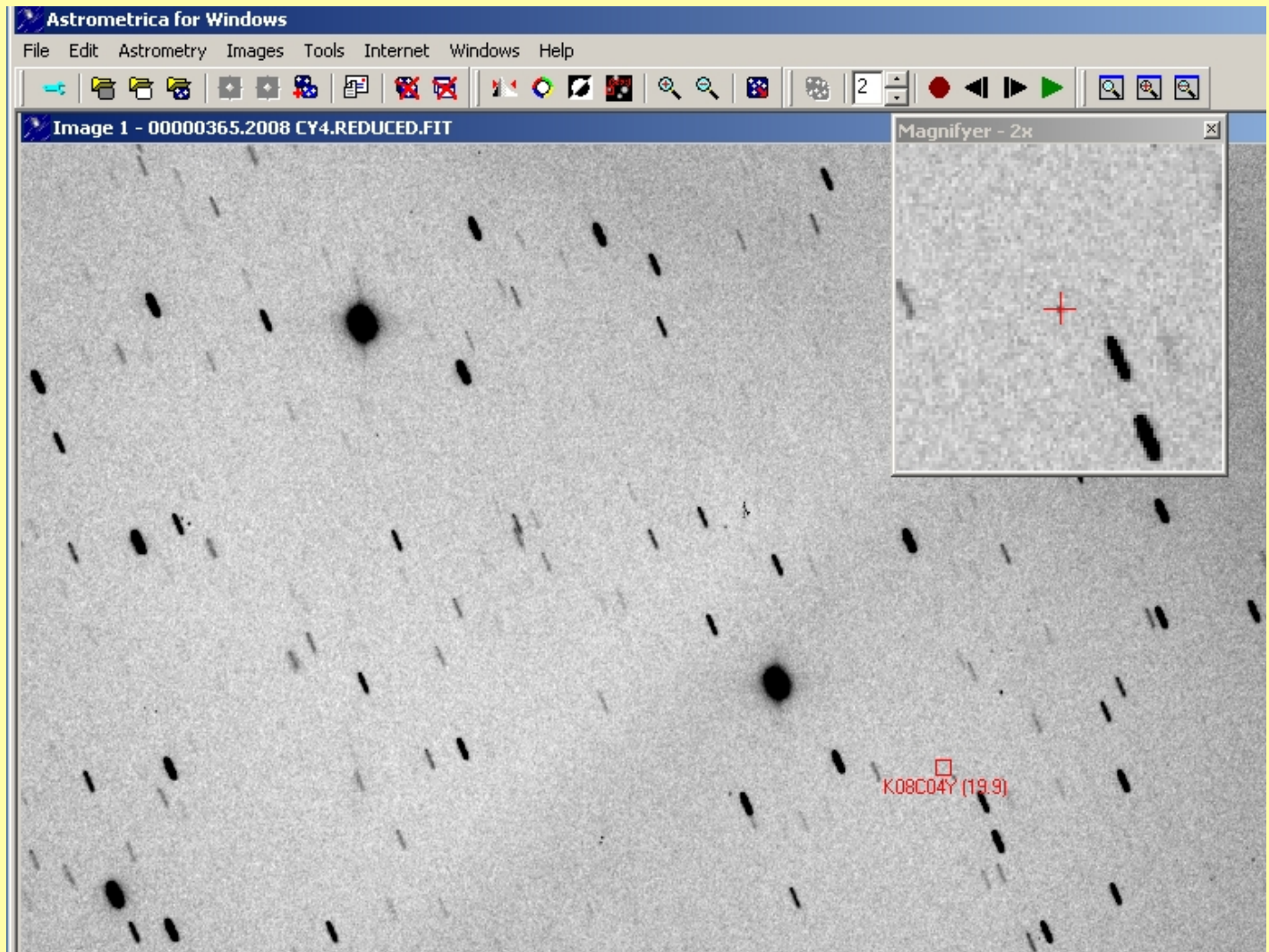


Image 1 + Image 2 = Image after S&T

By tracking the image before stacking, the asteroid becomes brighter in the stacked image and does not form a streak.

Tracking

- Stars will be streaked
- The asteroid will be point source



Measure Properties

- Then we can measure position and brightness.

