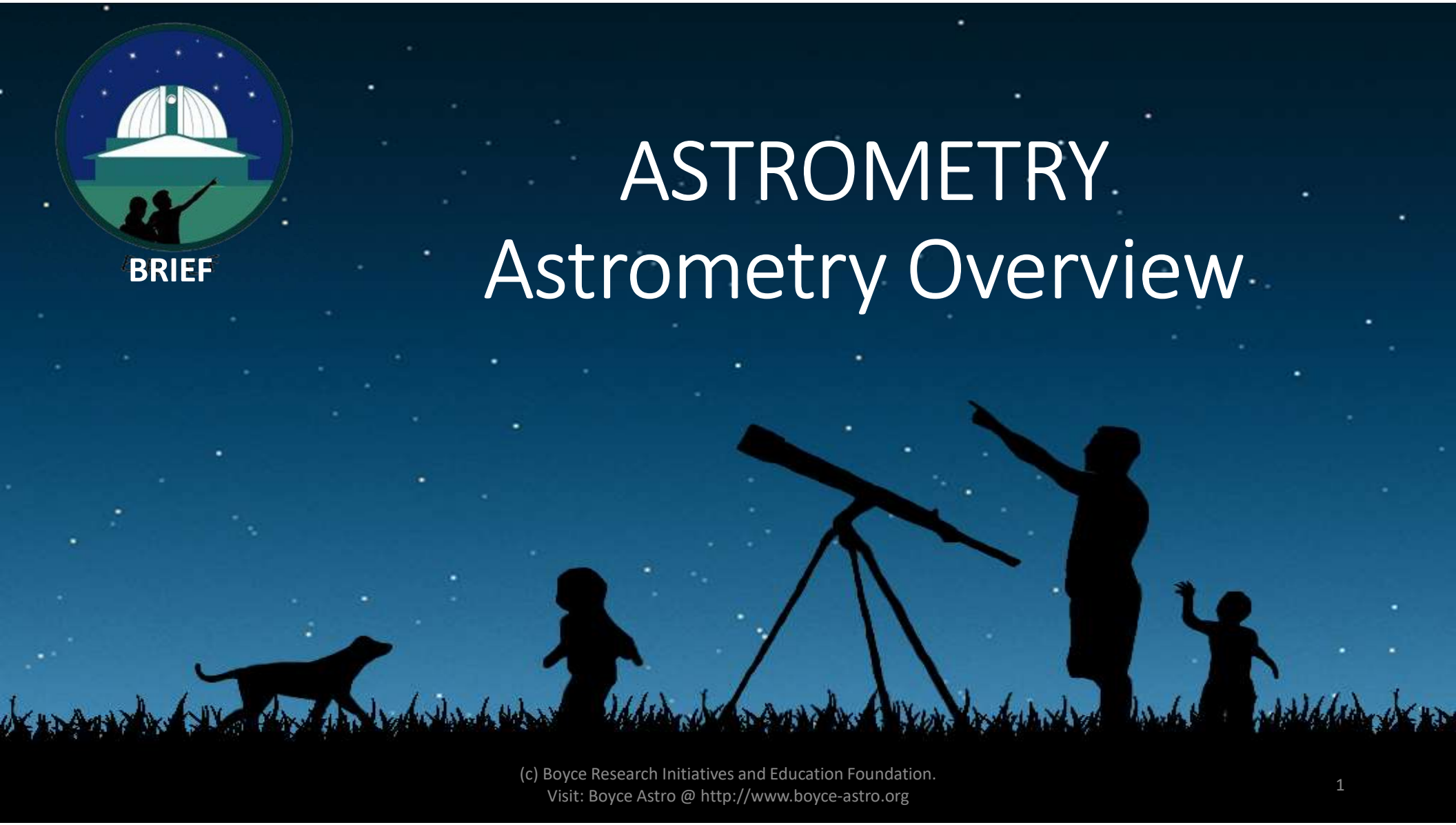
BRIEF

# ASTROMETRY
# Astrometry Overview



**Overview**

Astrometry is the area that deals with the *positions* and *motions* of celestial objects.

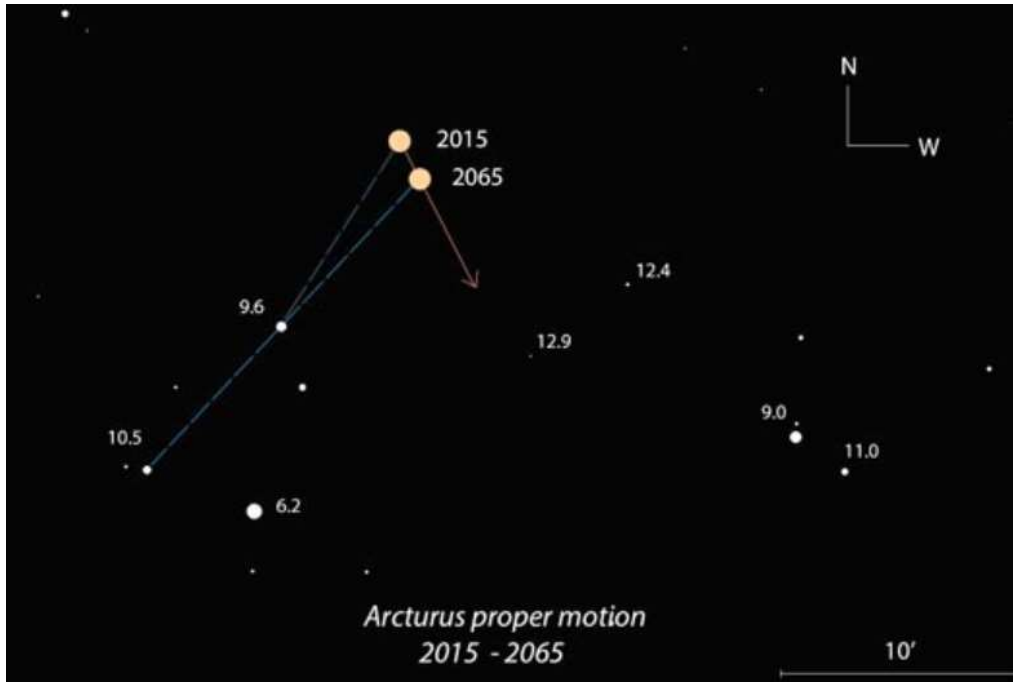
It has two main scientific objectives to provide:

- A stellar reference frame to which the motions of celestial objects (Solar System and beyond) may be referred
- Basic observational data for the studies of stellar properties (luminosities, mass, etc.) by describing the spatial distribution of stars within the Galaxy, and their motions.

Measurements of distances to celestial objects, by triangulation for example, is at the core of astrometry and forms the basis of all astrophysics; without knowing the distances to planets, satellites, stars, and galaxies, no correct understanding of the cosmos in which we live can be achieved.

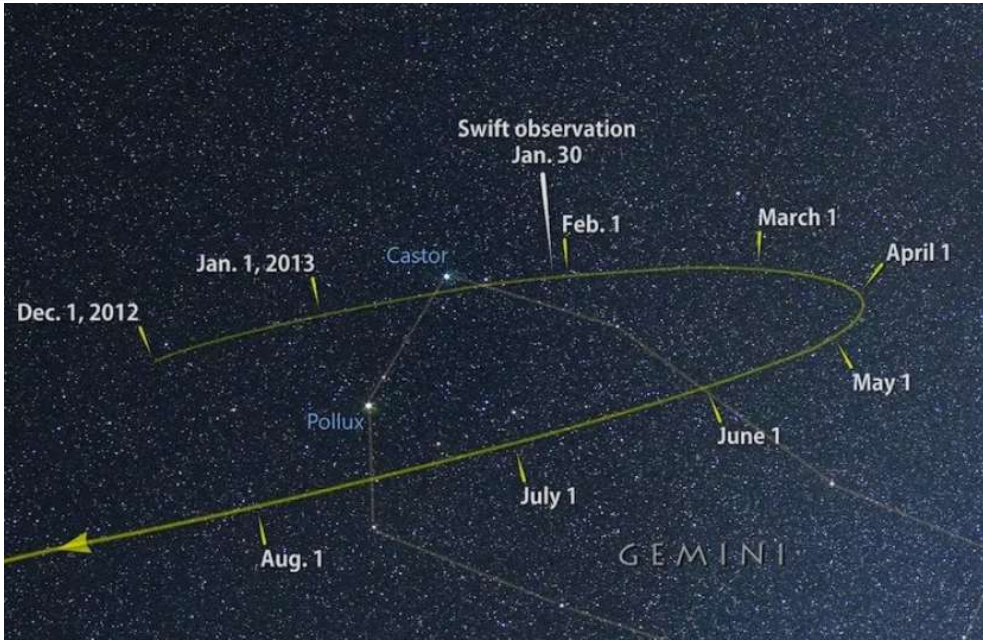
**Astrometry**

Astrometry is focused on the measurement of the positions and apparent motions of celestial objects in the sky and the factors that can affect them



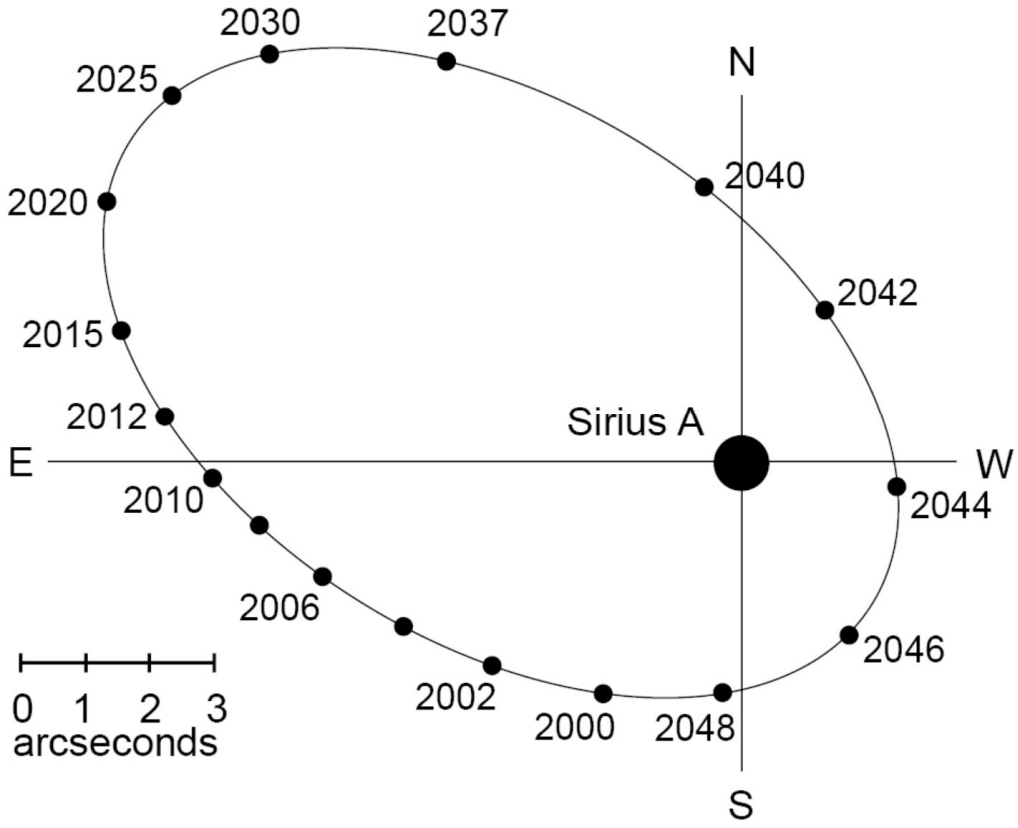
**Astrometry**

Stars and other objects, such as comets and asteroids, constantly change their positions. Astrometry is used to measure these changes.



**Astrometry**

In the case of double stars, they change their “position angles” and “separations” over time which can be used to determine the gravitational nature of these stars.



**Astrometry Basics**

Parallax

Distances to Stars

Which Star is closer, A or B?

Proper Motion

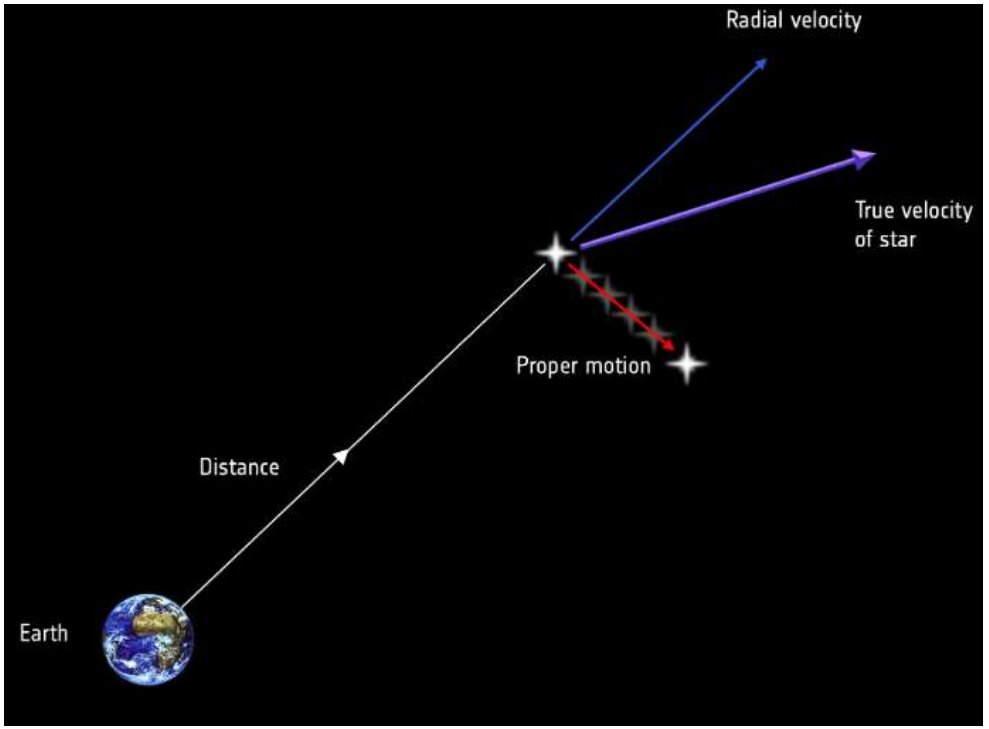
Motion Left after Parallax Has been removed.

Radial Velocity

The motion along the line of site

Space Motion:

When you combine all three astrometric measurements you can look at groups of objects moving together and begin to analyze formation models and statistics of nearby stars.



**Astrometry and Exoplanets**

When hunting exoplanets, astrometry looks for a minute but regular wobble in a star's position.

If such a periodic shift is detected, it is almost certain that the star is being orbited by a companion planet. Such measurements are very difficult from Earth.

The future of astrometry lies in space as atmospheric interference limits the accuracy of ground-based measurements.

The recent, and still ongoing mission, Gaia, is providing a broad survey of the galaxy's stars. Current data release reveals accurate astrometric data of ~1.7 Billion stars…..give or take a few.

**Astrometric Accuracy Over Time**

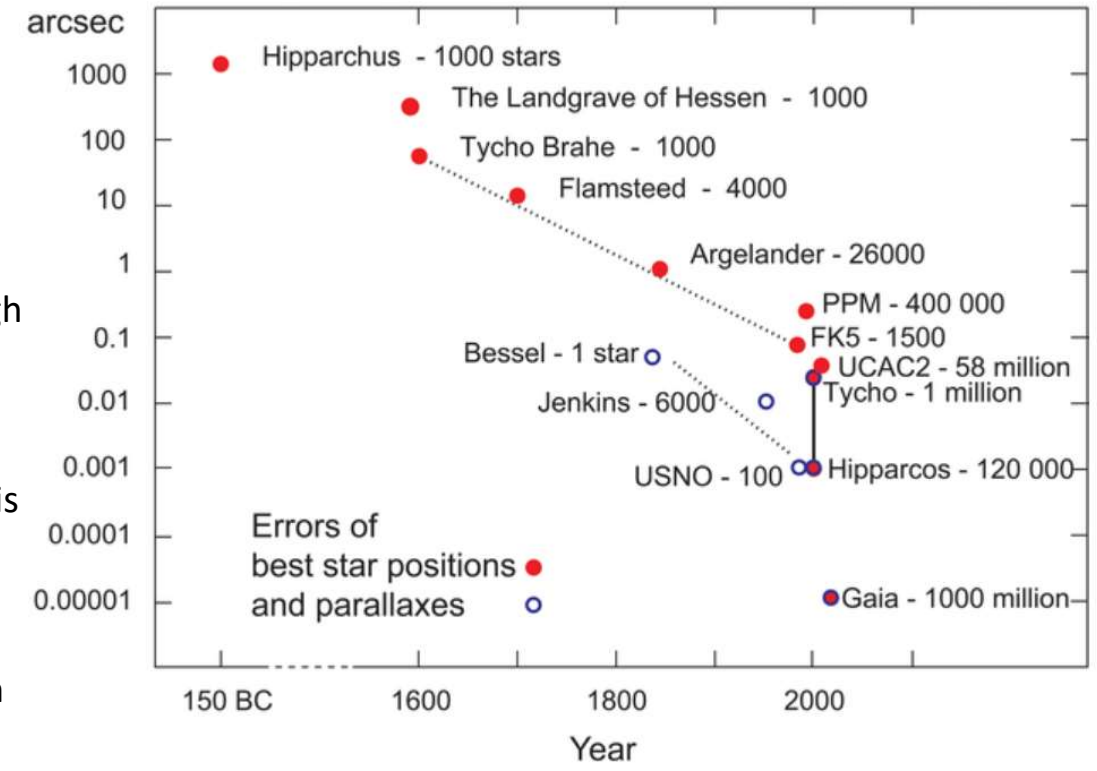
History has shown a dramatic increase in astrometric accuracy.

Tycho Brahe achieved the first significant breakthrough in astronomical accuracy through keeping detailed records of stellar and planetary positions.

Johannes Kepler used these measurements to form his 3 laws.

400 years later, Hipparcos, the first space astrometry mission, achieved the next significant improvement in astrometric accuracy.

Now, ESA's Gaia mission is providing unprecedented accuracy and inclusion in its latest data release (DR2).

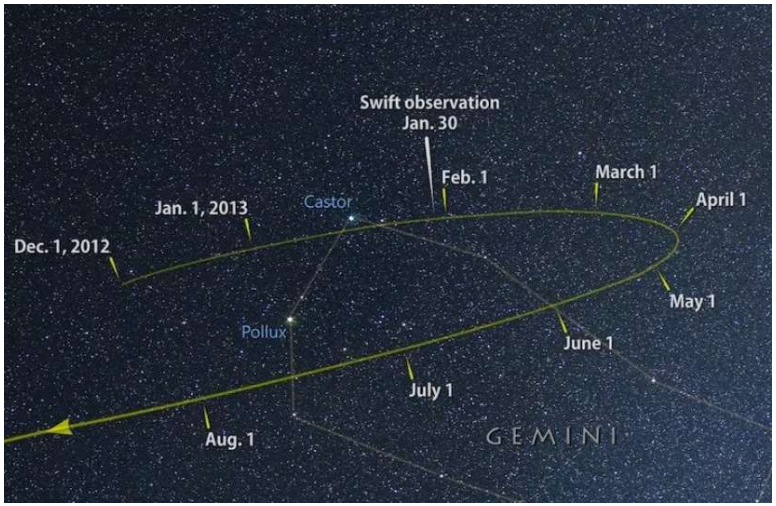


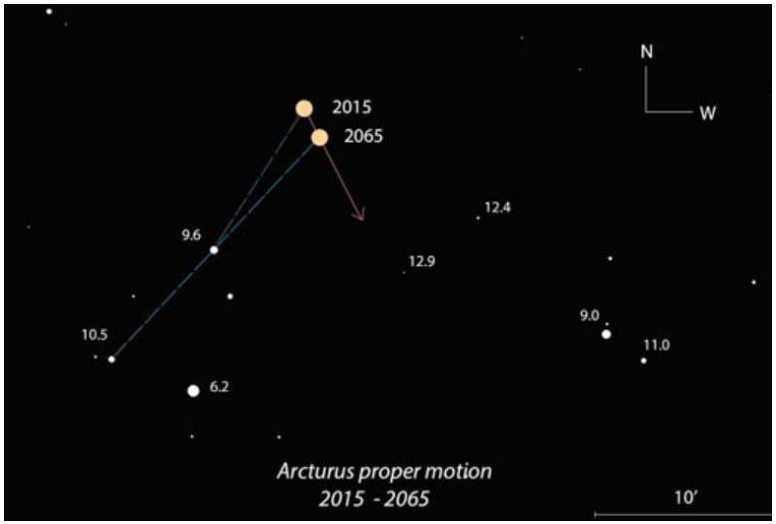
**Summary**

Astrometry is concerned with the positions of objects.

Positions are noted in RA and Dec with separations from other objects listed in Degrees, Arcminutes, and Arcseconds.

The cousin of Astrometry is Photometry which is focused on the measurement of light output.



***Questions?***