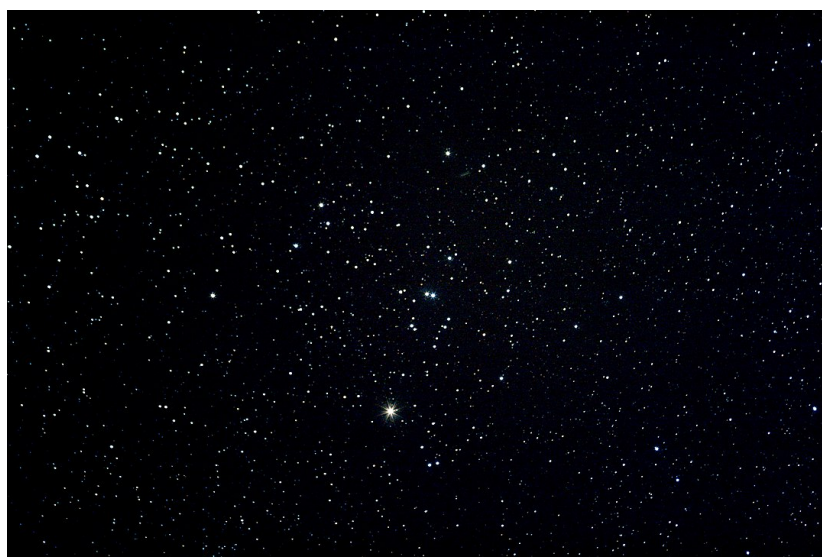


Physics 312: Homework #3

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The Hyades cluster is the nearest star cluster to Earth. That makes it very important, but as you can see from the image of the Hyades above, it's not entirely clear which stars are in the Hyades and which are not. Your job in this assignment is to use statistics to decide which stars belong in the Hyades.

We know a few things about the Hyades Cluster. It is an over-density of stars, which means there are more stars per unit volume there than in on average over the whole sky. It is centered roughly at a right-ascension of 67 degrees and a declination of 16 degrees. The Hyades are between 40 and 50 parsecs away, meaning they have what's known as parallax angles between 20 and 25 milli-arcseconds. Star clusters all form out of a single cloud of dust and gas which then gets blown out of the star cluster once the stars turn on. The Hyades is old enough that it had lost its gas and dust, but the stars should still all be moving together through the galaxy, meaning that their velocities in right-ascension and declination should be statistically similar.

The data file `Hyades_Plx_20_25.dat` contains position, brightness, color, and velocity data for all of the stars over the whole sky measured by the European

Space Agency's Hipparcos mission whose parallax is between 20 and 25 milli-arcseconds. Use this data to make a statistical argument for which stars in the data file are members of the Hyades cluster. Your statistical argument should include whatever data or combination of data you find useful.

Data File Contents

HIP: Hipparcos ID Number

Vmag: Visual magnitude. Magnitudes are inversely proportional to the luminosity (total energy output) of the star, so a magnitude of 1 would be brighter than a magnitude of 2. For more information on magnitudes, see [https://en.wikipedia.org/wiki/Magnitude_\(astronomy\)](https://en.wikipedia.org/wiki/Magnitude_(astronomy))

RA: Right-ascension. The longitudinal (east-west) location on the celestial sphere, in degrees.

DE: Declination. The latitudinal (north-south) location on the celestial sphere, in degrees.

Plx: Parallax angle. The apparent shift in angular position of the star as the Earth's vantage point changes during the Earth's orbit around the Sun, in micro-arcseconds. This is inversely proportional to distance.

pmRA: Change in parallax angle in the direction of right-ascension, in micro-arcseconds per year. This is inversely proportional to the component of the velocity of the star across the sky in the east-west direction.

pmDE: Change in parallax angle in the direction of declination, in micro-arcseconds per year. This is inversely proportional to the component of the velocity of the star across the sky in the north-south direction.

e.Plx: Uncertainty in the parallax angle measurement, in micro-arcseconds.

B-V: Color of the star, as measured by its magnitude when viewed through a blue-filter (one that blocks colors other than blue) minus its magnitude when viewed through a red-filter. Since magnitudes are inversely related to brightness, smaller values indicate bluer stars and larger values indicate redder stars.