

Lab #50: The Pleiades

The Seven Sisters, a bright open star cluster, go by the official names of “The Pleiades”, or M45 (which is the #45 object in the famous catalogue of Charles Messier).

The mythology of the Seven Sisters:

Maia, Alcyone, Merope, Electra, Celaeno, Taygeta, Sterope, plus their father and mother, Atlas and Pleione (which makes it 9 stars altogether).

Out of these, Pleione (5.05^{mg}), Celaeno (5.45^{mg}), and Sterope (5.76^{mg}) are so dim that they are quite hard to make out without a telescope. This leaves six stars visible to the naked eye. They form an open star cluster the size of the full Moon inside the constellation of Taurus.

Another version (which does not agree with our present-day names of these stars) says that only six of the seven sisters are normally visible, the seventh fading, because Merope was the only one who consorted with a mortal (Sisyphos), while all the others were pursued by various gods. (Cf. Merope Gaunt of Harry Potter.)

They are named “Pleiades” (Πλειάδες) after their mother “Pleione (Πληιόνη)”.

They were nymphs in the train of Artemis. According to Hesiodes, they were pursued by Orion, and turned into doves to preserve their safety. (Indeed, Orion follows the Pleiades in the sky’s daily motion.)

In Japan, the Pleiades star cluster is called “Subaru”. The Pleiades is the logo of the Subaru car company.

Another open cluster nearby:

The Hyades (Ύάδες) were also daughters of Atlas, half-sisters of the Pleiades. Their brother Hyas (Ύάς) was slain by a boar he hunted, and the ever-weeping rain-nymphs Hyades mourn their brother. They have been placed in the sky by Zeus as a symbol of family love. They are rarely mentioned by their individual names.

Indeed, when the Hyades (in the constellation of Taurus) are visible, which is in wintertime, Greece has its rainy season.

The bright star Aldebaran appears to belong to the letter V formation of the Hyades cluster, but in reality it is much closer (65 light years, vs. the 150 light years to the Hyades.)

PROCEDURE AND LAB REPORT

Date: _____ Your name: _____ Partner's name: _____ Section: ____/____

Maximum two students may work together as partners!

This exercise is done in a large part at the telescope. For this reason, the report must be printed out and the paper copy must be used.

- (1) Find the Pleiades in the sky. How many stars can you count with the naked eye?

- (2) What magnitude is the brightness of the whole cluster together, according to your estimate? ____ mg.
- (3) Find the Pleiades using SkyGazer, and fill in the data: The Pleiades star cluster is _____ light years away. It is located in the constellation of _____ (official name), that is, the _____ (English name).
- (4) Aim a telescope at the Pleiades. Use the smallest magnification you can to make sure as much of it fits in the field as possible. One of the star charts is a mirror image, and one is a regular image. Find out which one matches with the image in telescope you are using (it depends on the optical system of your telescope and may be different for different telescopes). You are using chart _____. Identify the named bright stars in the telescope's field.
- (5) Find Alcyone and Electra, two stars that are almost exactly east-west from each other.
- (6) As time passes, these stars will move towards the west, and they slowly drift out of the telescope. Use a timer to find out how long it takes for the second of these two stars to follow the first one. Watch the stars drift out of the field: start a timer when the first one leaves the field, and stop it when the second one leaves. You find that the first one to leave is _____, the second one is _____, and it follows in _____ minutes.
- (7) The reason why stars drift out is that Earth rotates. Because Earth rotates one full circle, 360° , in one day, it rotates ____° every hour, that is ____° every minute. This means that the two stars are separated by ____° in the sky.
- (8) An object that subtends a half a degree angle in the sky has a physical size a 100 times smaller than the distance to it. Because these two objects are separated by _____ times a half a degree in the sky, they are separated by a distance _____ times smaller than their distance.
- (9) Knowing how far the stars of the Pleiades are from us, you'll find that these two stars are separated by a distance of _____ light years.

- (10) Because you see many stars in the Pleiades that are much closer to each other than this, you conclude that the closest stars in the Pleiades are separated by much less than _____.
- (11) For extra credit: indicate two reasons why this measurement does not provide a very accurate result for the distance between these two stars. (Nevertheless, the main conclusion is still correct.)
- (i) _____
- (ii) _____
- (iii) Why did we have to take two stars that are exactly East-West from each other?
- _____

The Pleiades

Chart A:



Chart B:

