

IWAA 2018 - Zánka, Hungary

The Cosmic Distance Ladder - Homework

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Problem 1 - Life of an ancient astronomer 2

Aristarchus measured that during a lunar eclipse the time of totality is half of the time between the total time while at least a bit of the Moon is in the umbra. Based on this and his earlier results, what is the ratio of the size of the Earth and the Moon? Based on our current knowledge, what would be the exact ratio of the two times?

Problem 2 - Tilted galaxies

In a real galaxy survey, we see the galaxies from random directions, not always edge-on. This fact modifies the real usage of the Tully-Fisher relation, since when you observe the broadened linewidth, you have to take the inclination of the galaxy also into consideration. Calculate the distance of a spiral galaxy, if the difference in redshift at the two edge of the galaxy is $1.18 \cdot 10^6$. We see the disc of the galaxy by a 45° angle, and the apparent magnitude of the galaxy is 10^m . Assume the following form of the Tully-Fisher relation for this galaxy:

$$M = -9.5 \log V + 2$$

Problem 3 - Barnard's star

By making two astrometric observations in 2004 and 2014, you found out, that the position of Barnard's star changed with $51.5''$. When will be the star the closest to the Solar system? What will be its distance than? The parallax of the star is 545.5 mas and its radial velocity is -110.6 km/s.