2015

Taurus

Luis M. Torres Cantu
Parkland College

TAURUS

Parkland College
Luis Torres
Astronomy 102

Introduction:

The project's main focus will be on ten of the stars which make up the Taurus asterism. There is also some information of the Messier objects that are located inside the boundaries of the Taurus constellation.

The purpose of this project is to demonstrate our knowledge gained from Astronomy class. From being able to distinguish between an asterism and a constellation, to understanding the makeup of stars. As we progressed through the class we learned how to calculate the age of stars and predict their end result.

Taurus is more likely recognized because it is one of the zodiac constellations. It is classified as such, due to the fact that the sun passes through this constellation at some point during the year, May to June to be precise.

To the viewer, I hope I am able to instill some curiosity gaining more knowledge of what makes up our universe. In the very least enjoy the beauty that is out there.

Messier 1: The Crab Nebula

Located at a distance of 6,500 light years. First observed by Chinese astronomers in 1054. (5)

Calculating the length of a year:

Since Earth has a tilted axis and it rotates around the sun, we can't observe most constellations year round. We can calculate the length of a year by looking at the stars, more specifically, the time in which they rise above the horizon.

I found the rise time of Lambda Tauri for five different days spread over a week each time.

Date	Rise Time for Lambda Tauri		
	Hour	Minute	Second
May 23	6	8	19
May 30	5	40	48
June 6	5	13	16
June 13	4	45	45
June 20	4	18	14

I calculated the change in rising time for that star. This difference was converted into decimal minutes in order to make the calculations easier. Since we know that a day contains 1440 minutes in a day we can divide it by the average change in rise time calculated to get the number of days in a year.

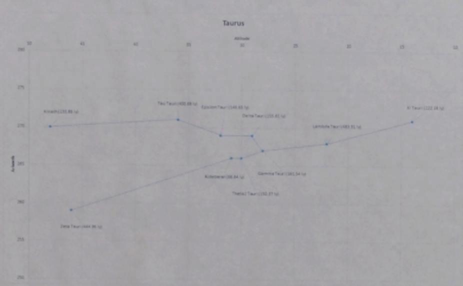
Dates	Change in Rise Time		Change in Time Decimal Minutes	Change in Time Per Day in minutes/day
	Minutes	Seconds		
5/23–5/30	27	31	27.52	3.92
5/30–6/6	27	32	27.53	3.93
6/6–6/13	27	31	27.52	3.92
6/13–6/20	27	31	27.52	3.92

Average change in time per day: 3.92 minutes/day

Calculated days in a year: 367.35 days

Calculated percent error: .574%

Possible sources of error: The size of the data is very small and rounding mistakes when converting from minutes and seconds to decimal minutes.

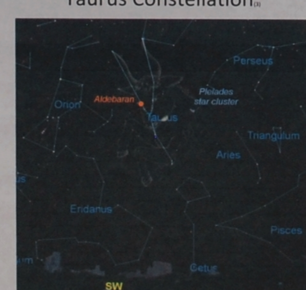


The Myth:

The Taurus asterism may be attributed to Greek mythology.

Zeus was in love with the Phoenician princess Europa. In order to get close to her, Zeus transformed into a white bull and blended with her father's herd. Europa was intrigued by the gentle white bull. After some time they end up near the sea shore where she ends up getting on top of the bull's back. Zeus made his way to the island of Crete where they conceive three offspring one of which becomes the legendary king of Crete, Minos. (2)

Taurus Constellation(3)



Special Relationship of Stars

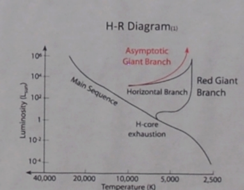
Star Name	Azimuth	Altitude	Distance
Zeta Tauri	259°	46°	444.96ly
Xi Tauri	271°	14°	222.18ly
Theta2 Tauri	266°	30°	150.37ly
Tau Tauri	271°	36°	400.68ly
Lambda Tauri	268°	22°	483.91ly
Gamma Tauri	267°	28°	161.54ly
Epsilon Tauri	269°	32°	146.65ly
Delta Tauri	269°	29°	155.61ly
Alnath Tauri	270°	48°	133.89ly
Aldebaran	266°	31°	66.64ly

A common misconception is that all the stars in an asterism must be relatively close. To an extent they are in a perceptively small area in the sky, however, as we can see by the chart above that is not the case. Because of our limited field of view we observe a certain alignment in the sky, we get a two dimensional image. If we were to change our field of view, we would have a different perspective giving us some depth into the arrangement of more distant stars.

There are some great scripts in the planetarium that gives us a different vantage point and clearly see the orientation of the stars. Not only that, but there are others that let you see how much different our known asterisms would look in some distant future, as stars continue to shift in the universe.

Messier 45: The Pleiades

Average distance of 444 light years away. Galileo was the first astronomer to view the Pleiades under a telescope in 1610. (4)



Sources:

1) "Asymptotic Giant Branch (AGB) Stars" *Noa.edu.* National Science Foundation 14 Aug 2013. Web. 26 Nov. 2015

https://www.noao.edu/outreach/press/pr03/images/agb_graph_big.gif

2) Dibon-Smith, Richard. "Taurus." *The Constellations*. N.p., n.d. Web. 8 Nov. 2015

http://www.dibonsmith.com/tau_con.htm

3) Fazekas, Andrew. "5 Sky Events This Week: Winged Equine, Jovian Shadows, and Seven Sisters." *National Geographic*. National Geographic, 3 Feb. 2014. Web. 9 Nov. 2015.

http://voices.nationalgeographic.com/files/2014/02/feb7-2014.jpg

4) "Messier 45: Pleiades." *Messier-objects*. Messier Objects, 27 May 2015. Web. 09 Nov. 2015.

http://www.messier-objects.com/wp-content/uploads/2015/05/Pleiades.jpg

5) "Messier 1: Crab Nebula." *Messier-objects*. Messier Objects, 7 Jan. 2015. Web. 9 Nov. 2015.

http://www.messier-objects.com/wp-content/uploads/2015/01/Messier-1.jpg

Evolution of Stars

Star Name	HIP #	Spectral Type	Mass (Solar)	Stages Completed	Completed Lifetime	Remaining Stages	Remaining Lifetimes	Fate of Stellar Core	Mass Range
Zeta Tauri	26451	B4III	14.5	MS	4.76 x 10^7	RGB, HB, SG, SN	5.24 x 10^6 years	neutron star	from 1.4 to 3 solar masses
Xi Tauri	16083A	B9V	3.4	none	none	MS, RGB, HB, AGB	9.52 x 10^8 years	Planetary Nebula/White dwarf	less than 1.4 solar masses
Epsilon Tauri	20889	K0III	2.3	MS	1.89 x 10^9 years	RGB, HB, AGB	1.89 x 10^8 years	Planetary Nebula/White dwarf	less than 1.4 solar masses

*RGB - Red Giant Branch HB – Horizontal Branch SG – Super Giant SN – Super Nova MS – Main Sequence
AGB – Asymptotic Giant Branch PN – Planetary Nebula

Star Data

Star Name	HIP #	Spectral Type	Mass (Solar)	Main Sequence Lifetime	Completed Lifetime	Remaining Lifetime	Death Order	Fate of Stellar Core
Aldebaran	21421	K5III	2.8	1.28 x 10^9 years	1.28 x 10^9 years	1.28 x 10^8 years	4	white dwarf
Alnath(Beta Tau)	25428	B7III	10.1	9.80 x 10^7 years	9.80 x 10^7 years	1.08 x 10^7 years	2	neutron star
Delta1 Tauri	20455	G8III	2.2	2.07 x 10^9 years	2.07 x 10^9 years	2.07 x 10^8 years	8	white dwarf
Epsilon Tauri	20889	K0III	2.3	1.89 x 10^9 years	1.89 x 10^9 years	1.89 x 10^8 years	5	white dwarf
Gamma Tauri	20205	G8III	2.2	2.07 x 10^9 years	2.07 x 10^9 years	2.07 x 10^8 years	8	white dwarf
Lambda Tauri	18724	B3V	7.6	1.73 x 10^8 years	none	1.90 x 10^8 years	6	white dwarf
Tau Tauri	21881A	B3V	7.6	1.73 x 10^8 years	none	1.90 x 10^8 years	6	white dwarf
Theta2 Tauri	20894	A7III	5.4	3.43 x 10^8 years	3.43 x 10^8 years	3.43 x 10^7 years	3	white dwarf
Xi Tauri	16083A	B9V	3.4	8.65 x 10^8 years	none	9.52 x 10^8 years	10	white dwarf
Zeta Tauri	26451	B4III	14.5	4.76 x 10^7 years	4.76 x 10^7 years	5.24 x 10^6 years	1	neutron star

We learned that stars are born from other stars exploding and there being enough pressure exerted on intergalactic gas and dust to induce star formation. Taurus's stars were not born around the same time, for one, because some are so far apart, that it would be unlikely that they were even part of the same dust cloud. A better way to measure their evolution would be to calculate their completed life cycle for each star

I chose three different stars and do an in depth look into their evolutionary track: Zeta, Xi, and Epsilon Tauri. I wanted a varied sample to research but the stars in Taurus are fairly similar.

All of the stars studied in these table will hit the main sequence, where stars will fuse hydrogen at their core. The more massive stars will fuse their hydrogen much faster and move away from the main sequence branch.

Xi and Epsilon Tauri will make their way into the Red Giant stage, our Sun will share this fate. In the RGB stage, the star is fusing Hydrogen in an outer shell and Helium in its core. The star expands, but at the same time its surface temperature is relatively cooler. After the RGB stage the Horizontal Branch is when the star begins to fuse Carbon and Oxygen in its core. Its temperature begins to rise while at the same time the star shrinks, leaving its luminosity fairly constant thus the name.

The AGB branch is taken when some stars, once again expand and become much brighter, at this time, the stars will begin to shed most of their mass back into space. Both Xi and Epsilon will share the same fate as White Dwarfs; stars as big as Earth, yet having close to the mass of the Sun.

On the other hand, Zeta Tauri, being so much more massive, will have a Super Giant stage, where the star fuses different elements in their core, up to Iron, enveloped by other elements around in shells. These stars can explode shedding most of their mass in a very short amount of time. This explosion can induce star formation. The nucleus of this explosion is a neutron star, a very dense, very small remnant.