Spectral Analysis of the Constellation Stars of Taurus (The Bull)

Anthony S. Harding Jr.

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Abstract

This paper will elucidate the spectral features of the main stars in the constellation Taurus. The selection of stars was arbitrarily chosen to coincide with those typically used to trace the constellation lines that form the geometric shape of the constellation itself[1]. Though other stars within the boundary of the constellation (as determined by the IAU) may be objects of interest, the analysis is confined to the stars forming the constellation lines.

The stars in the constellation will generally be presented in order of their accepted Bayer designations, using Greek letters to rank them roughly in order of decreasing brightness. Alpha (or α) is usually the brightest star in a constellation. Afterward, Beta (β), Gamma (γ), and so on are used to indicate decreasing apparent magnitude. It is usually the brightest stars that define the constellation lines. Of course, there are deviations from this rule that have been retained for historical consistency.

Equipment Used

All spectra used in this analysis were captured using the following equipment and resources:

Telescope: Celestron Advanced C6-N Newtonian Telescope, with an aperture of 6 inches, and a focal length of 750mm. This makes the focal ratio f/5.

Mount: Meade LX85 German Equatorial Go-To Mount. The mount was aligned using the three-star method.

Camera: ZWO ASI290MM monochrome camera.

Transmission Grating: The SA100 grating was employed to produce the spectra used in this analysis. The grating has 100 lines per millimeter.

Capture Software: The ASI Studio suite of programs was used in the capture process. Following capture, the same suite was used to stack images and export them as TIF files for evaluation and analysis.

Analysis Software: Rspec v2.1.1 by Field Tested Systems, LLC.

Reference Material Used in Analysis: The *Spectral Atlas for Amateur Astronomers* by Richard Walker and *Spectroscopy for Amateur Astronomers* by Marc F. Trypsteen and Richard Walker were both used to assist in identifying specific facets of the resulting spectra, and proved invaluable in this process. Wikipedia and Stellarium were also instrumental in obtaining information regarding the various stars. Stellarium was used to define the stars comprising the constellation lines.

Data Processing Details

All of the spectra obtained for this analysis were collected on the evening of October 10, 2024 (EST). Additional specifics for each capture are included with each star's spectrum in the pages that follow. The times presented there are given in UT, as is desirable for any astronomical work. Also included are the exposure length, number of frames captured, and the percentage of those frames which were applied to the stacking process. The determination of this percentage was subjectively chosen based on the quality of the footage captured—the accuracy of the tracking, the steadiness of the atmosphere at the time, etc.

The tracking of the Meade LX85 mount used in the capture process has limitations regarding its accuracy. Therefore, some gain was applied during the captures in order to shorten the exposure times. This was kept to a minimum, as excessive use of it does compromise the quality of the exposures. No bias, dark, or flat frames were used for these captures, nor were reference stars captured for individual sessions. The captures must therefore be considered “Quick and Dirty,” and so are unsuitable for professional or purely scientific applications. However, this author believes that they are adequate for general demonstration purposes. Refinements to these results are certainly possible if extra steps are taken to account for camera read noise, image defects in the optical train, and specific atmospheric influences that differ from those encountered when generating the initial response curve. Prior to this imaging run, a new response curve was generated (using Alpha Lyrae) on the evening of August 31, 2024. (It is my intention to create a new response curve at roughly annual intervals to reflect the aging of the camera and the optical train of the telescope.) Also, no sharpening or other image modifications were made to the stacked images. Most of the spectra therefore show telluric absorption bands; some of these are labeled, where others are not.

This constellation was missed last year, so a special effort was made to capture it this time around.

α Tauri

Alpha Tauri, more commonly known as Aldebaran, is classified as a middle K-type star[1]. Based on this classification, we can expect to see a star much cooler than our own Sun, with perhaps even a TiO line or two peeking through.

The processed spectrum is presented below:

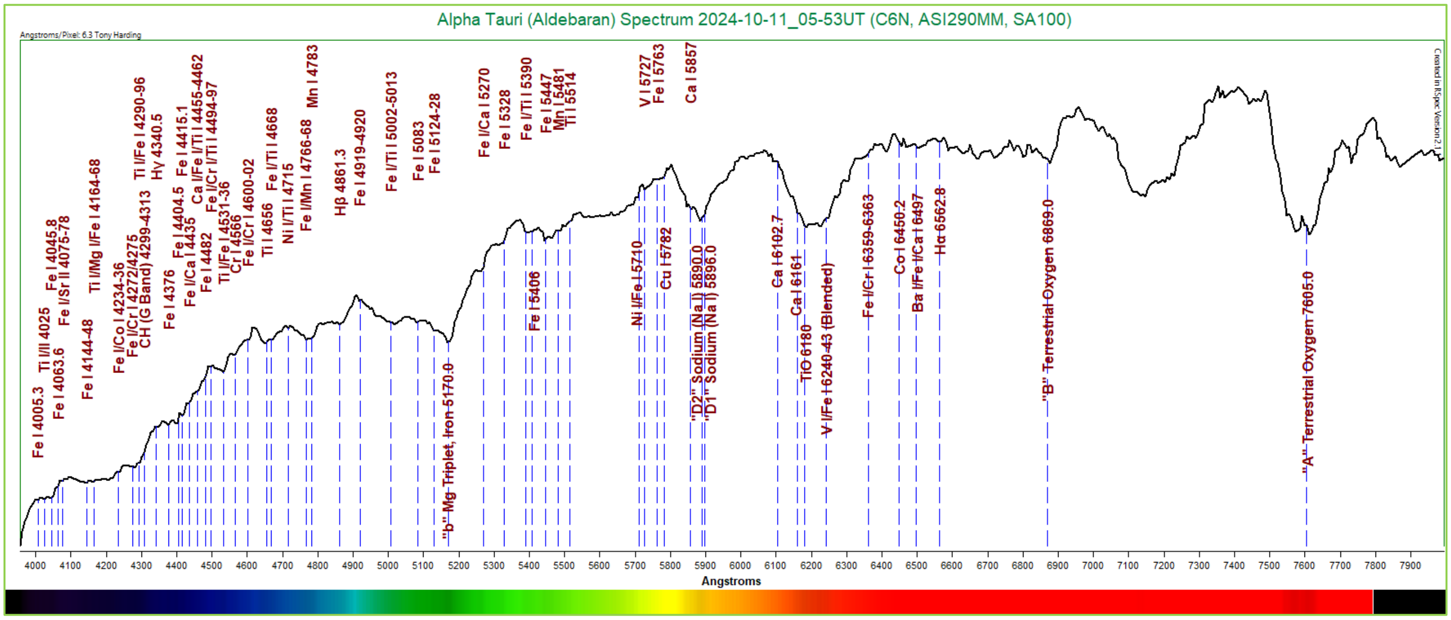

Figure 1: Alpha Tauri (Aldebaran) Spectrum (6.3 Angstroms/pixel)
Capture Details 1: Exposure 111ms, Gain 0, 60% of 1104 frames stacked, Integration Time 73s

Here we can definitely see a cooler star reflected in the overall shape of the continuum. Of the hydrogen Balmer lines, the Hα, Hβ, and Hγ lines can be seen. The Hβ line at 4861.3 Angstroms is the most prominent, and it appears somewhat muted. The magnesium triplet at 5170 Angstroms is very deep and obvious here. The sodium D2 and D1 lines are also strong; the calcium line just below them at 5857 Angstroms is small, but sharp. A deep gouge out of the continuum can be seen at 6102-6243 Angstroms, caused by calcium, molecular TiO, vanadium, and iron. Other fainter absorptions include iron, titanium, molecular CH, calcium, chromium, nickel, manganese, vanadium, copper, cobalt, and barium.

Using Wien's Law, we shall attempt to estimate the star's effective temperature. From the spectrum above, the peak energy wavelength would appear to lie near 7354 Angstroms. Using this value, we calculate a temperature of approximately 3940K. The listed temperature for the star is roughly 3900K[2]. Our estimate actually falls within the margin of error of the official estimate (+/- 50K).

β Tauri

Beta Tauri, known as Elnath, is classified as a double star of the late B-type[1]. This indicates we should see a much hotter star than Aldebaran, with pretty strong hydrogen Balmer lines.

The processed spectrum is presented here:

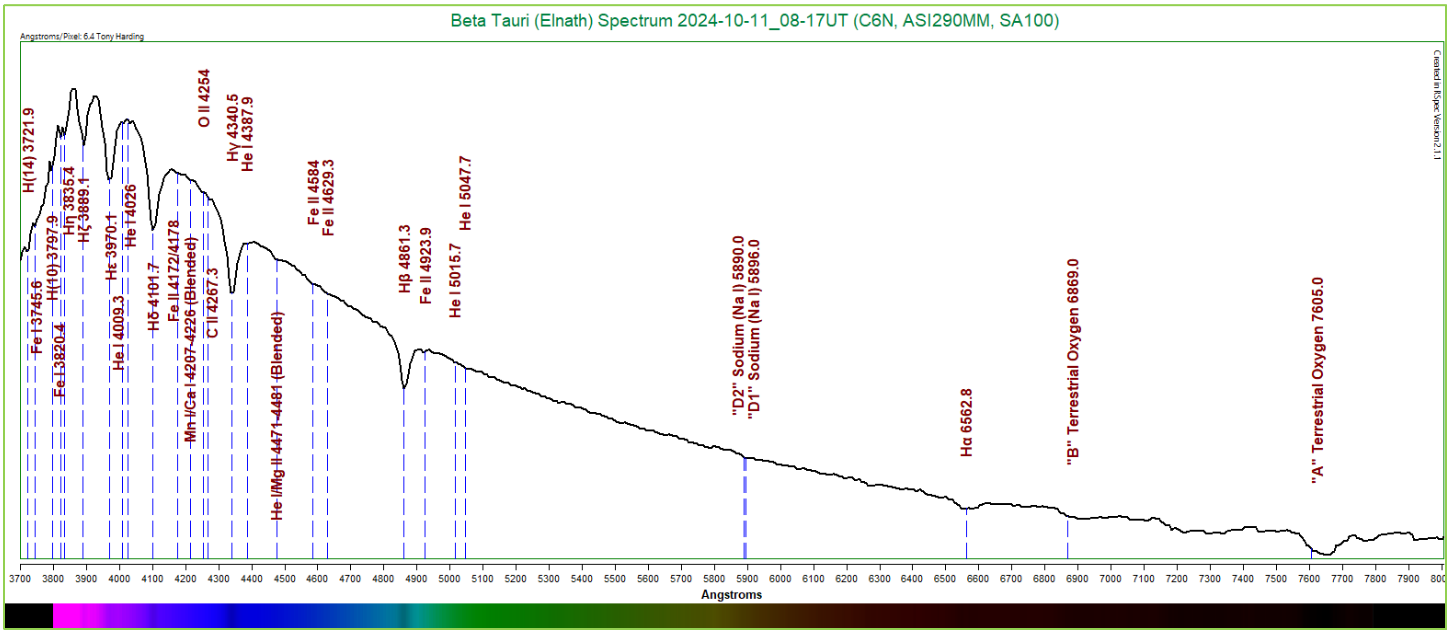

Figure 2: Beta Tauri (Elnath) Spectrum (6.4 Angstroms/pixel)
Capture Details 2: Exposure 220ms, Gain 86, 70% of 1103 frames stacked, Integration Time 169s

Here we can definitely see a curve representative of a hotter star, with the apparent peak lying in the lower wavelength region. The hydrogen Balmer lines are fairly strong and sharp (with the exception of the Hα line). The iron line at 3820.4 Angstroms accompanies the Hη line, the two creating a neat pair of nearly twin absorptions. Several neutral helium lines can be seen, at 4009.3, 4026, 4387.9, 5015.7, and 5047.7 Angstroms. None of them are particularly strong, and some of the weaker ones are certainly dubious identifications. The sodium doublet at 5890-96 Angstroms is barely visible, probably being interstellar in nature. Other metals labeled include iron, manganese, oxygen, and carbon.

Using Wien's Law again, we will calculate an effective temperature for the star. This specimen being an early-type star, however, means that our estimate will certainly fall far short of the mark. From the spectrum above, the peak energy wavelength appears to lie at 3860 Angstroms. With this value we calculate an effective temperature of 7507K. The professionally calculated temperature for the star is 13600K[2]. Indeed, our estimate is short by nearly 45%.

γ Tauri

Gamma Tauri, also called Prima Hyadum, is a close, dubious double star of the very late G-type[1,2]. This classification indicates we should see a spectrum indicating a star a bit cooler than our Sun, with a high number of fine metal lines spread throughout.

The processed spectrum for the star is found below:

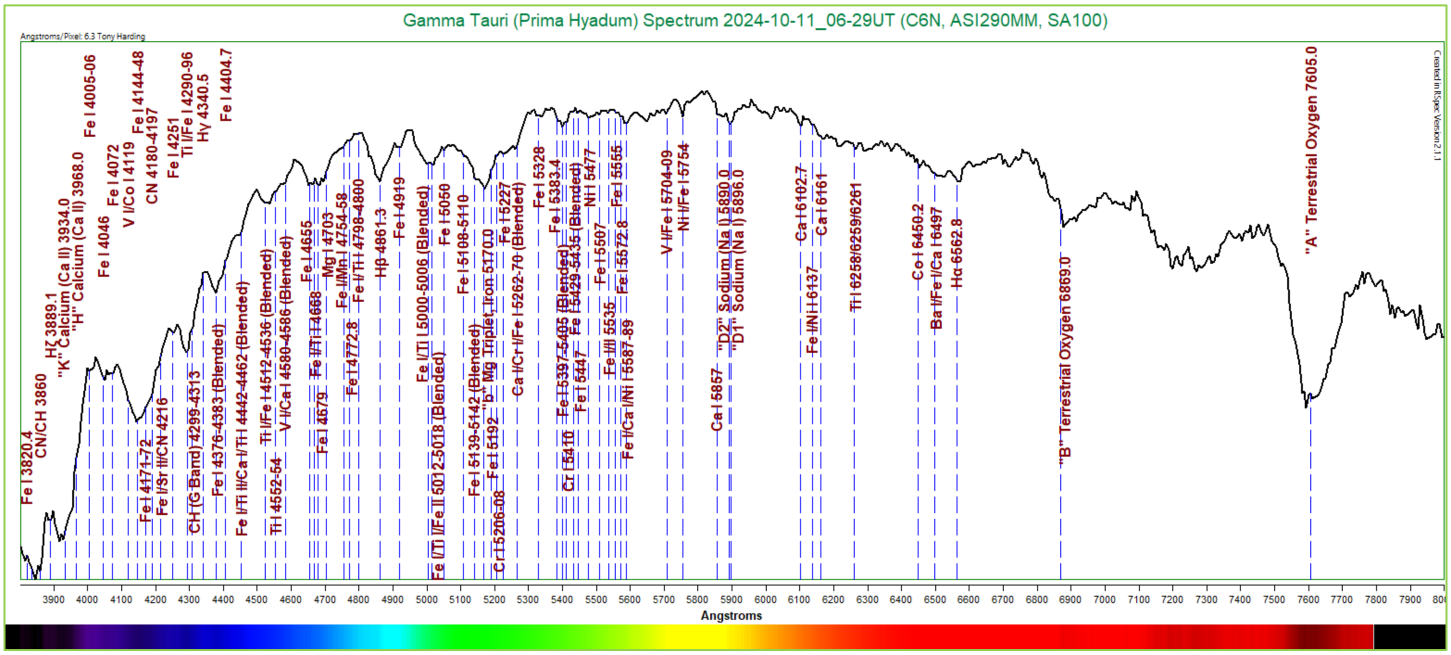

Figure 3: Gamma Tauri (Prima Hyadum) Spectrum (6.3 Angstroms/pixel)
Capture Details 3: Exposure 274ms, Gain 199, 20% of 1105 frames stacked, Integration Time 60s

This spectrum appears representative of the G-types. Several of the hydrogen Balmer lines are evident, some of them only very weakly. The CH/CN absorption at 3860 Angstroms is fairly well defined. The calcium K and H lines at 3934 and 3968 Angstroms are carving a nice gouge out of the continuum here. Also notable is the CH (G Band) absorption at 4299-4313 Angstroms, with an attendant titanium/iron line. The magnesium triplet at 5170 Angstroms is nicely on display as well, with several iron and chromium lines adjacent to it. The sodium doublet at 5890-96 Angstroms is very sharp, along with a rather deep accompanying calcium absorption just below it at 5857 Angstroms. Other labeled absorptions include lots of iron, vanadium, titanium, magnesium, chromium, nickel, cobalt, and barium.

We will once again employ Wien's Law to estimate the star's effective temperature. From the plot above, the peak energy wavelength appears to lie at 5825 Angstroms. Using this value, Wien's Law returns an effective temperature of 4975K. The professionally determined temperature is 4844K[2].

δ-1 Tauri

Delta-1 Tauri, also called Secunda Hyadum, is a spectroscopic binary star of the very late G-type[1,2]. The companion seems to possess largely undetermined characteristics at this point (other than an estimated mass of approximately 1.3x the solar mass). Regardless, we can expect to see features very similar to those presented for Gamma Tauri previously—lots of iron lines in a star slightly cooler than the Sun.

The processed spectrum for Delta-1 Tauri can be found here:

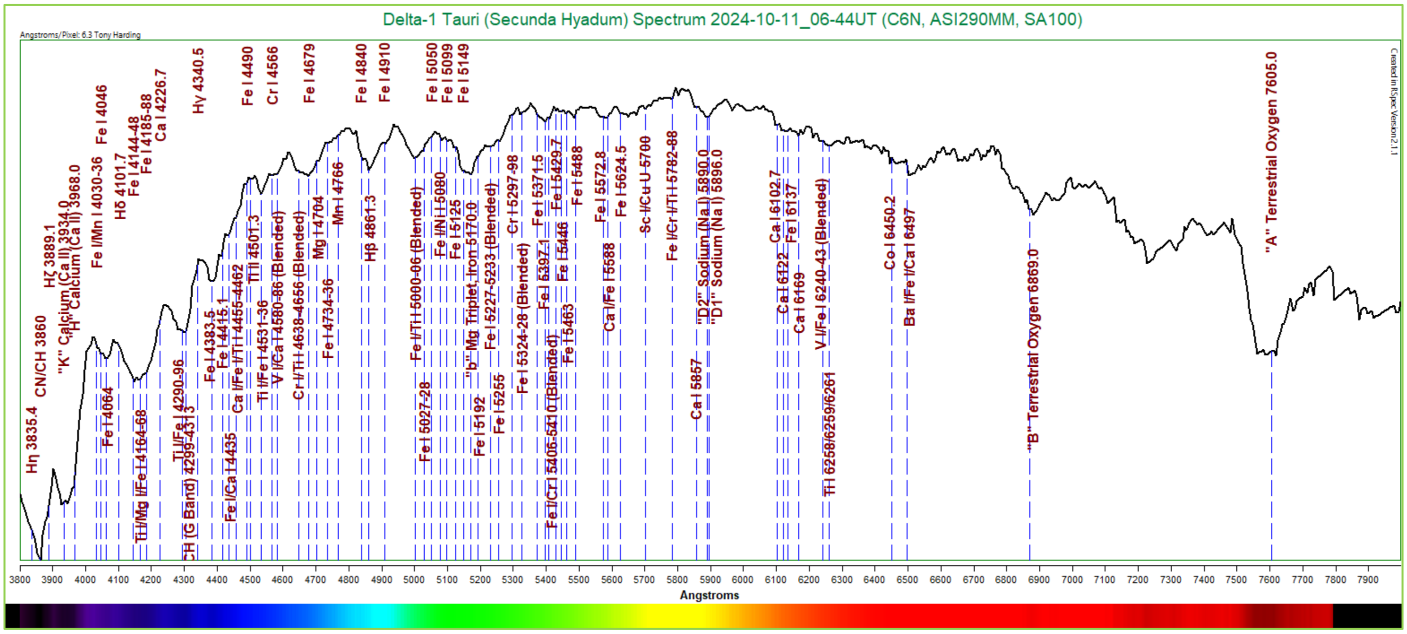

Figure 4: Delta-1 Tauri (Secunda Hyadum) Spectrum (6.3 Angstroms/pixel)
Capture Details 4: Exposure 274ms, Gain 200, 40% of 1104 frames, Integration Time 121s

Indeed this spectrum does resemble the one obtained for Gamma Tauri. One distinguishing feature here is an unusually flat-bottomed atmospheric oxygen absorption at 7605 Angstroms. The hydrogen Balmer lines are moderately strong at best. The CN/CH molecular absorption is quite strong and sharp. The ionized calcium lines at 3934 and 3968 Angstroms are again carving out a fairly deep cut in the continuum. Another good-sized gouge can be seen in the 4144-4188 Angstroms range, this one due to iron and titanium. The CH (G Band) absorption is also fairly strong at 4299-4313 Angstroms. The magnesium triplet at 5170 Angstroms is deep, and is apparently being broadened by an iron line just below it at 5149 Angstroms. The sodium doublet at 5890-96 Angstroms is well-defined, but not nearly as pronounced. The calcium line just below it at 5857 Angstroms is also distinctly visible. Other visible metals include iron, titanium, calcium, vanadium, chromium, magnesium, manganese, scandium, and barium.

Using Wien's Law, we will estimate the effective temperature of the star. From the spectrum, the peak energy wavelength appears to be at 5795 Angstroms. With this value we obtain a temperature estimate of 5000K. The established temperature of the star is also 5000K[2]. It is certainly unusual to land precisely on the target like this!

δ-3 Tauri

Delta-3 Tauri is a binary star whose primary is classified as early A-type[1,2]. The secondary is very dim, and so shouldn't contribute anything significant to our low-resolution results. The hydrogen Balmer lines should be very strong in this spectrum, and we should see a curve demonstrating the star's higher temperature.

The spectrum is presented here:

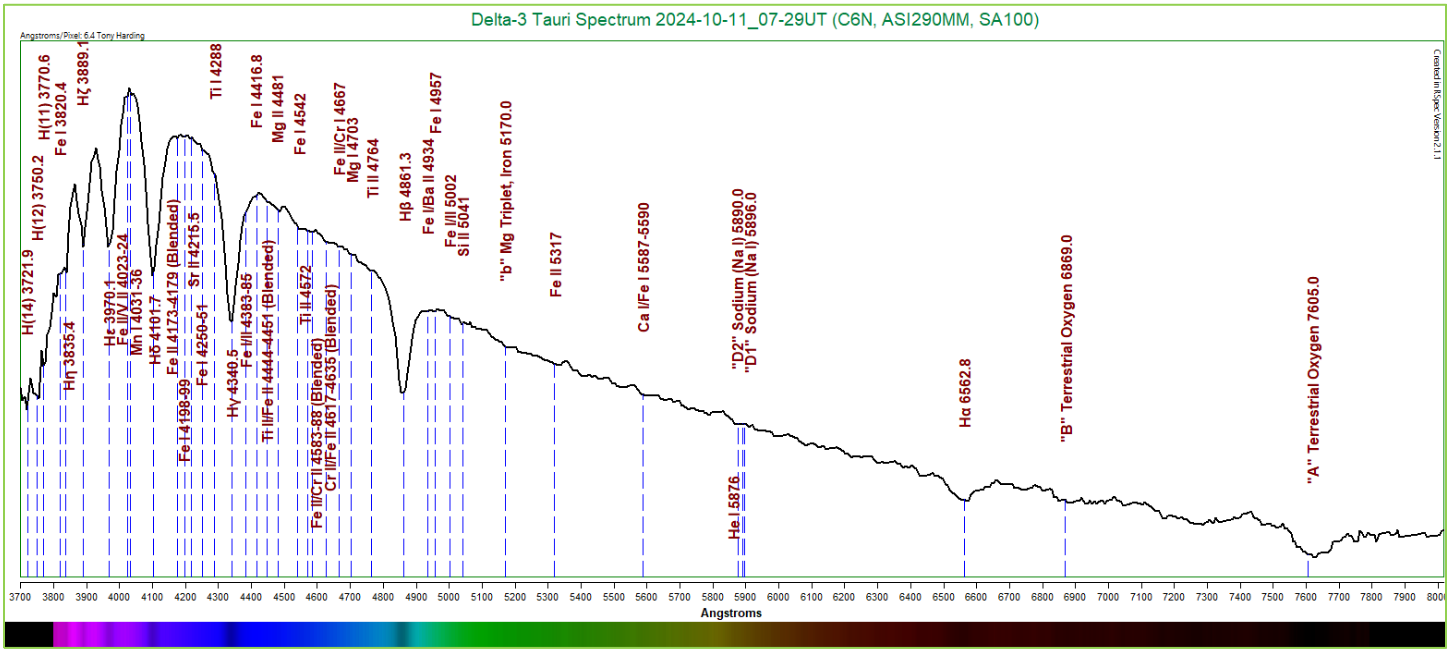

Figure 5: Delta-3 Tauri Spectrum 6.4 Angstroms/pixel
Capture Details 5: Exposure 423ms, Gain 200, 75% of 861 frames stacked, Integration Time 273s

As expected, we see that the hydrogen Balmer lines are very strong. Even the Hα absorptions is pretty pronounced. The magnesium triplet at 5170 Angstroms is very weak. The sodium doublet at 5890-96 Angstroms is marked but not clear, making this identification dubious. (It may simply be an interstellar absorption.) However, the He I line just below it at 5876 Angstroms is clear. Other noted absorptions include iron, manganese, strontium, titanium, magnesium, chromium, and silicon.

Wien's Law will be applied to obtain an effective temperature estimate. This being an early-type star, however, indicates that our estimate will be woefully short of the professionally determined value. The peak energy wavelength appears to lie at 4030 Angstroms. Using this value, we obtain a temperature estimate of 7191K. The established temperature for the star is 9025K[2]. As expected, our estimate is too low.

ε Tauri

Epsilon Tauri, also known as Ain, is classified as a very late G-type star[1]. This being the case, we should see a result very similar to that obtained for Delta-1 previously—a cooler star with lots of metal lines interspersed throughout its spectrum.

The spectrum is found here:

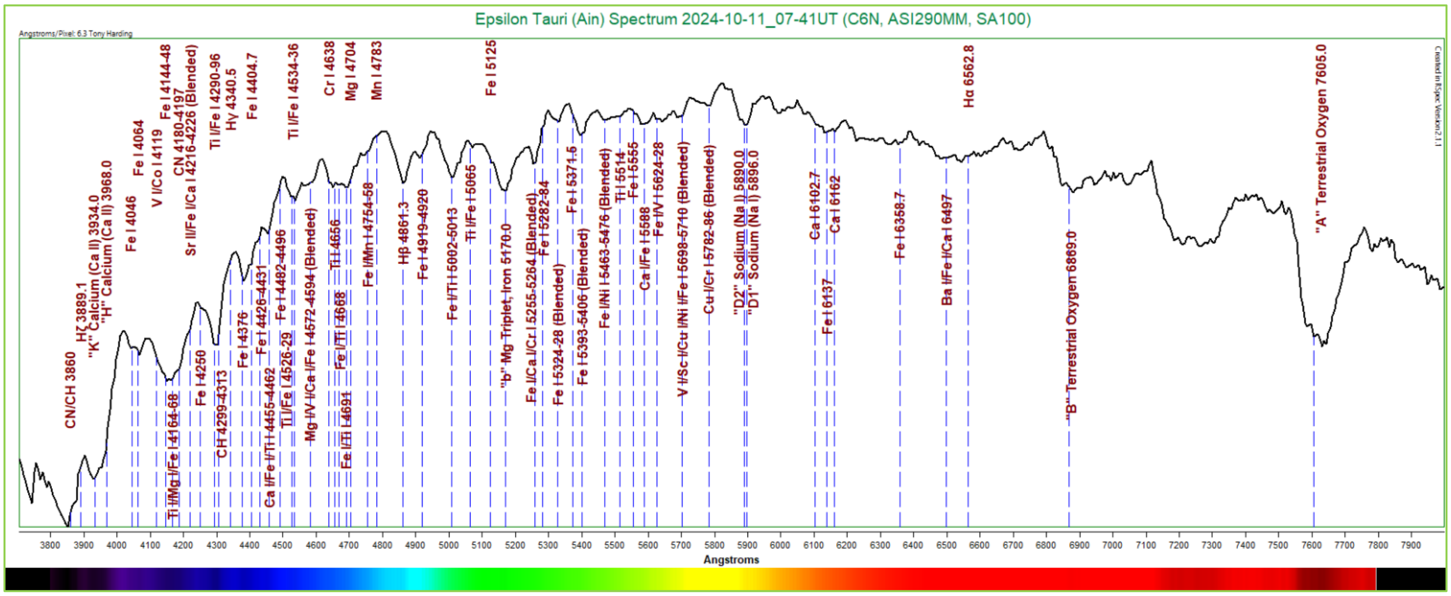

Figure 6: Epsilon Tauri (Airn) Spectrum (6.3 Angstroms/pixel)
Capture Details 6: Exposure 343ms, Gain 190, 60% of 1059 frames stacked, Integration Time 217s

Indeed we do see a similar spectrum to that obtained for Delta-1 Tauri. The hydrogen Balmer lines are relatively weak, with several not identifiable at all. The molecular CN/CH absorption at 3860 Angstroms is profound. The ionized calcium lines at 3934 and 3968 Angstroms are also cutting a deep groove out of the continuum. Another deep gouge can be seen at 4119-4148 Angstroms caused by vanadium, titanium, and iron. The CH (G Band) absorption at 4299-4313 Angstroms is also obvious, aided by the titanium/iron absorption just below it at 4290-96 Angstroms. The magnesium triplet at 5170 Angstroms is pronounced as well. The sodium doublet at 5890-96 Angstroms is weaker, but still quite obvious. Other fainter absorptions include lots of iron, strontium, calcium, magnesium, manganese, vanadium, copper, and barium.

Employing Wien's Law, we will calculate an effective temperature for the star. From the flux curve above, we observe that the peak energy wavelength appears to be at 5826 Angstroms. Using this value, we calculate an effective temperature of 4974K. The professionally determined temperature is 4950K[2]. In this case, our crude estimate is pretty close to the mark!

ζ Tauri

Zeta Tauri, also known as Tianguan, is a spectroscopic binary whose primary member is classified as an early B-type star[1,2]. The companion is very dim compared to the primary, so we shouldn't expect much (if any) contribution to our results. We can expect a spectrum reflective of a very hot star, with some helium lines visible. The hydrogen Balmer lines should also be visible, but should not appear very strongly. Additionally, the star is classified as a shell star, so we may see an emission line in the mix.

The spectrum is found here:

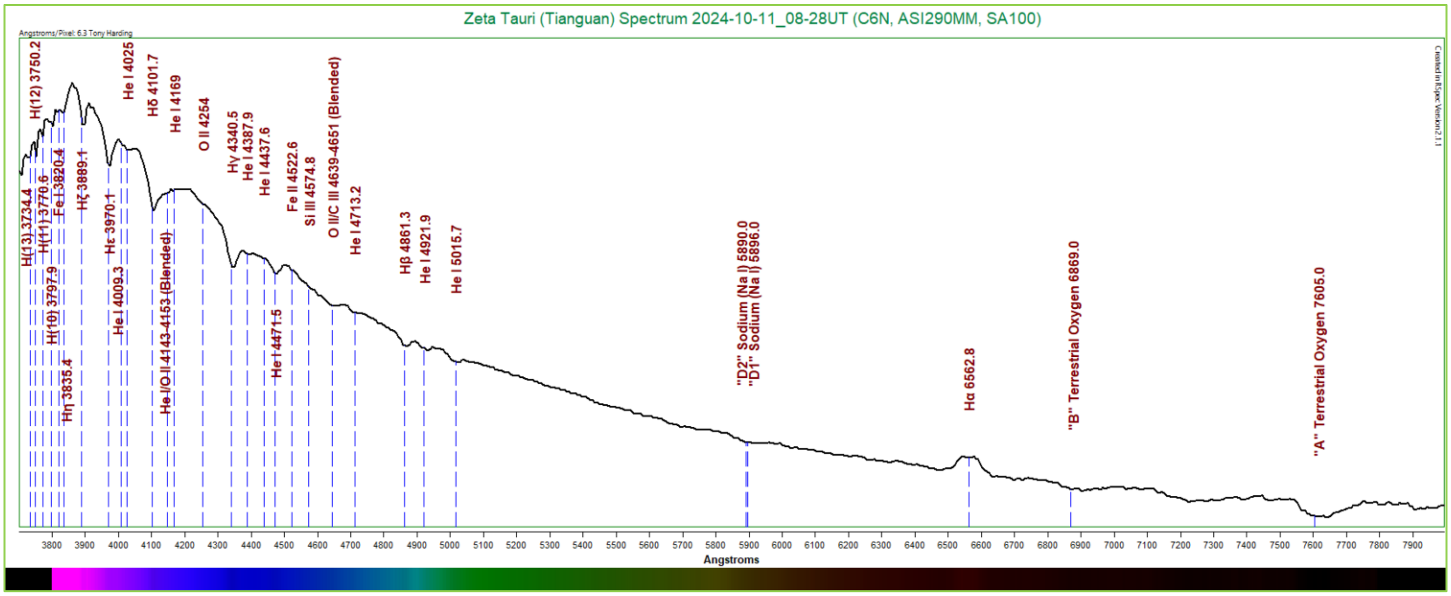

Figure 7: Zeta Tauri (Tianguan) Spectrum (6.3 Angstroms/pixel)
Capture Details 7: Exposure 169ms, Gain 200, 50% of 1089 frames stacked, Integration Time 92s

Here we see quite a different spectrum from the previous stars in the constellation. The curve peaks very low in our range, indicating a very hot star. As expected, the hydrogen Balmer lines are present, but not overly strong. However, we do get a bonus with this one—the Hα line is showing a clear emission. The emission is showing a double peak; it does seem to dip near its center. A great number of neutral helium lines are evident—at 4009.3, 4025, 4169, 4387.9, 4437.6, 4471.5, 4522.6, 4713.2, 4921.9, and 5015.7 Angstroms. These range from fairly obvious to very weak. The sodium doublet at 5890-96 Angstroms is visible, but not very strongly. Other faint absorptions include iron, ionized oxygen, doubly ionized silicon, and doubly ionized carbon.

As a demonstration of the inaccuracy of Wien's Law when applied to such an early-type star, we will calculate the apparent effective temperature and compare this with the accepted value. The peak of our spectrum shows an apparent wavelength of 3860 Angstroms. Using this value, Wien's Law returns a temperature of 7507K. The accepted value for the star's temperature is listed as 15500K[2]. Our estimate is less than half of the actual value.

θ-2 Tauri

Theta-2 Tauri, also known as Chamukuy or Hyadum IV, is a wide double star. The primary is classified as a late A-type star[1], and is a very close double itself; it is also slightly variable. Based on the reported type, we can expect to see fairly strong hydrogen Balmer lines, with additional metals present (especially iron). We can also expect our effective temperature estimate to be much closer to the mark than was the case for Zeta Tauri.

The processed spectrum of the star follows:

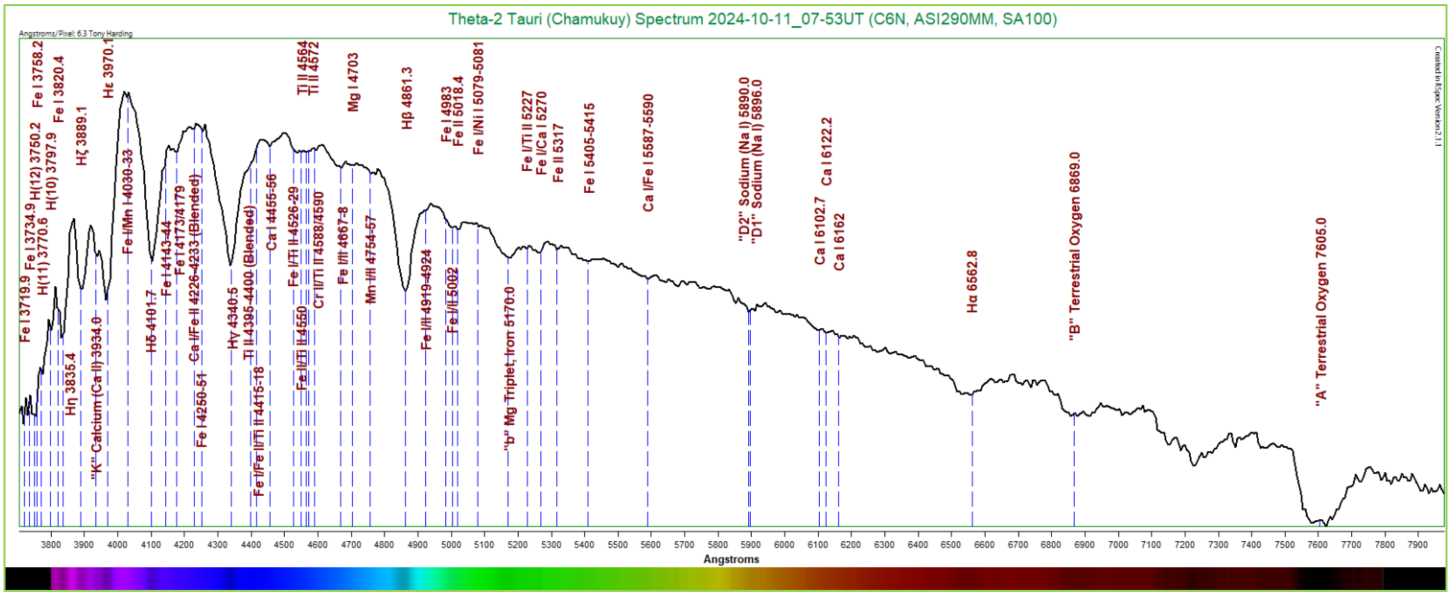

Figure 8: Theta-2 Tauri (Chamukuy) Spectrum (6.3 Angstroms/pixel)
Capture Details 8: Exposure 343ms, Gain 184, 40% of 1064 frames stacked, Integration Time 145s

This spectrum shows fairly strong hydrogen Balmer lines. We can see the ionized calcium K line emerging at 3934 Angstroms, sitting just below the Hε absorption. In the 4526-4590 Angstroms range a notable but small gouge is taken out of the continuum; this is caused by iron, titanium, and chromium. The magnesium triplet is visible here—not extremely strongly, but definitely notable. Two iron/calcium absorptions are apparent just above it at 5227 and 5270 Angstroms. The sodium doublet at 5890-96 Angstroms is visible here—again, not too strongly, but definitely apparent. Three calcium absorptions are labeled in the 6102-6162 range, but these may be false identifications. These lines are not always visible in G-type stars, so these must be treated with extreme uncertainty. Other labeled metals include iron, calcium, titanium, chromium, magnesium, and manganese.

We will use Wien's Law to obtain an effective temperature for the star. Using the apparent peak energy wavelength at 4021 Angstroms, we calculate a temperature of approximately 7207K. The professionally determined temperature is 7800K[2]. We are a little less than 10% off the mark. Not great, but not exactly terrible, either.

λ Tauri

Lambda Tauri is an eclipsing binary star whose primary component is an early B-type star[1,2]. The companion star is an early A-type star, and is listed as being only about 2% as luminous as the primary. This being the case, we should expect the primary to overwhelmingly dominate the spectral features. The spectrum should show hydrogen Balmer lines clearly, along with some helium lines.

The spectrum is presented here:

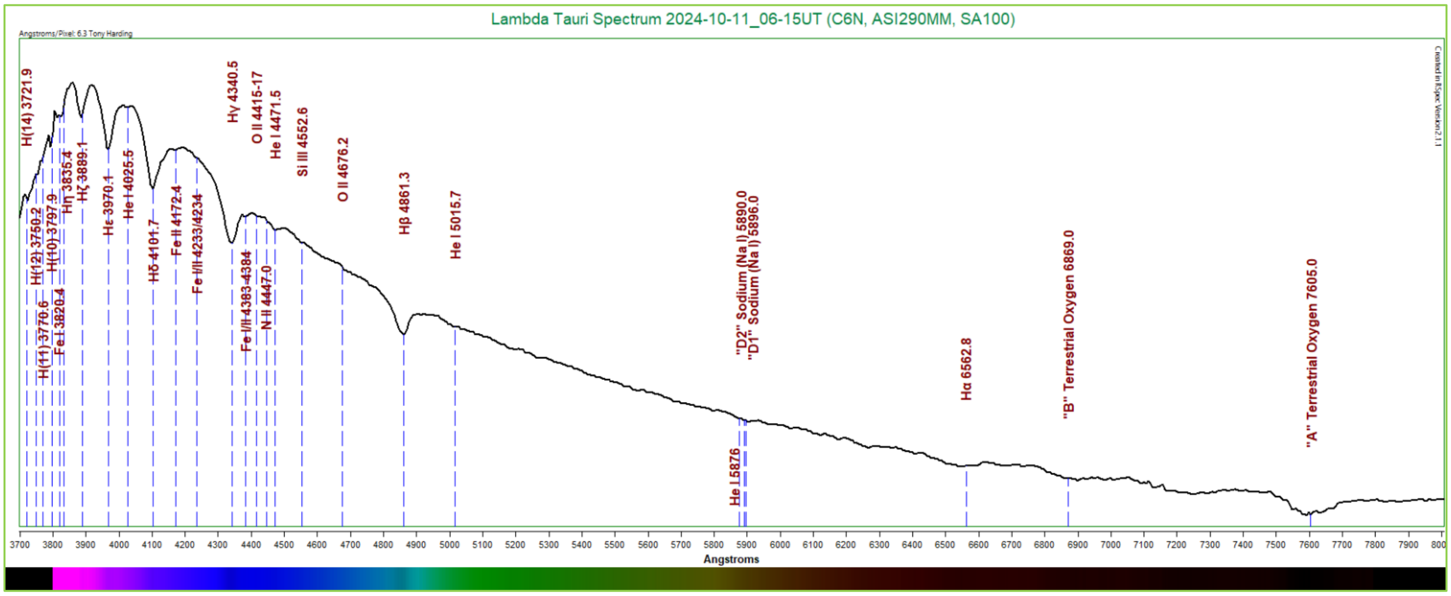

Figure 9: Lambda Tauri Spectrum (6.3 Angstroms/pixel)

Capture Details 9: Exposure 390ms, Gain 166, 20% of 931 frames stacked, Integration Time 72s

The hydrogen Balmer lines show up well, if not exceptionally strongly. Several weak helium lines are visible, at 4025.5, 4471.5, 5015.7, and 5876 Angstroms. The sodium D2 and D1 lines are present, but are very weak and probably interstellar in nature. Only a few other weak metals are present, including neutral and ionized iron, ionized oxygen, and doubly-ionized silicon.

Using Wien's Law, we will calculate an effective temperature for the star. Again, since the star is an early B-type specimen, our estimate will certainly be woefully short of the mark. From the spectrum above, the peak appears to lie at 3859 Angstroms. Using this value, Wien's Law produces an answer of 7509K. The actual value is estimated to be 18700K[2]. Our estimate is indeed woefully short of the actual value.

o Tauri

Omicron Tauri is spectroscopic binary star whose primary component is classified as a middle G-type star[1,2]. This indicates we should see a spectrum reflective of a star just slightly cooler than our own Sun, with large numbers of metal lines present throughout.

The processed spectrum is presented here:

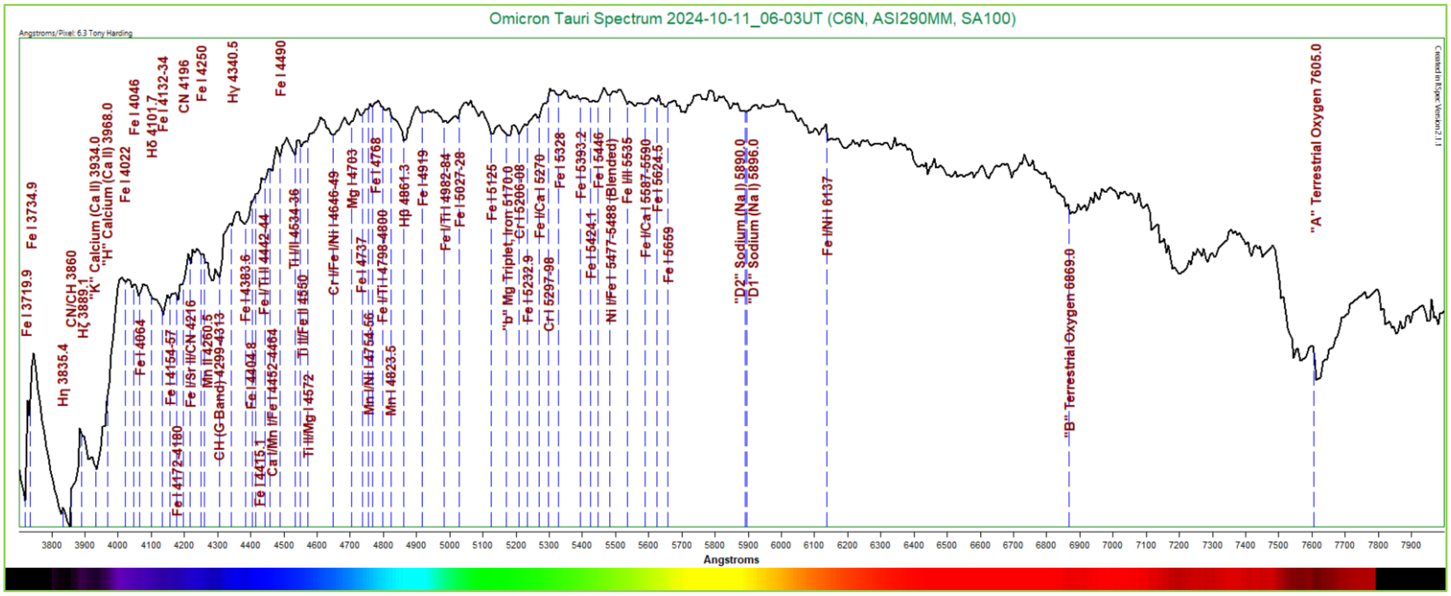

Figure 10: Omicron Tauri Spectrum (6.3 Angstroms/pixel)
Capture Details 10: Exposure 234ms, Gain 192, 20% of 1035 frames stacked, Integration Time 48s

We can see from the general shape of the curve that we are dealing with a somewhat cooler star. Many of the hydrogen Balmer lines are either reduced in appearance or missing entirely. The molecular absorptions are quite notable here. The CN/CH absorption at 3860 Angstroms is very strong. The CN absorption at 4196 appears distinct. The CH feature at 4299-4313 is likewise easily spotted. The magnesium triplet at 5170 Angstroms is causing a scoop out of the continuum, and is attended by several iron and chromium lines. The sodium doublet at 5890-96 Angstroms is present, but not terribly strong. Other metal lines include lots of iron, manganese, calcium, magnesium, titanium, chromium, and nickel.

Using Wien's Law, we will calculate an effective temperature for the star. The peak energy wavelength on this curve is not entirely clear, but it appears from a rough visual estimation to lie between 5466 and 5787 Angstroms. Taking the median value gives us 5626 Angstroms. With this value we obtain a temperature estimate of 5150K. The professionally determined temperature is listed as 5094K[2]. All things considered, our estimate is not too bad!

τ Tauri

Tau Tauri is spectroscopic multiple star system whose primary component is classified as early B-type[1,2]. From this, we can expect to see spectral features very similar to those obtained for Lambda Tauri previously—easily recognized hydrogen Balmer lines with some neutral helium lines also visible.

The spectrum for the star is presented below:

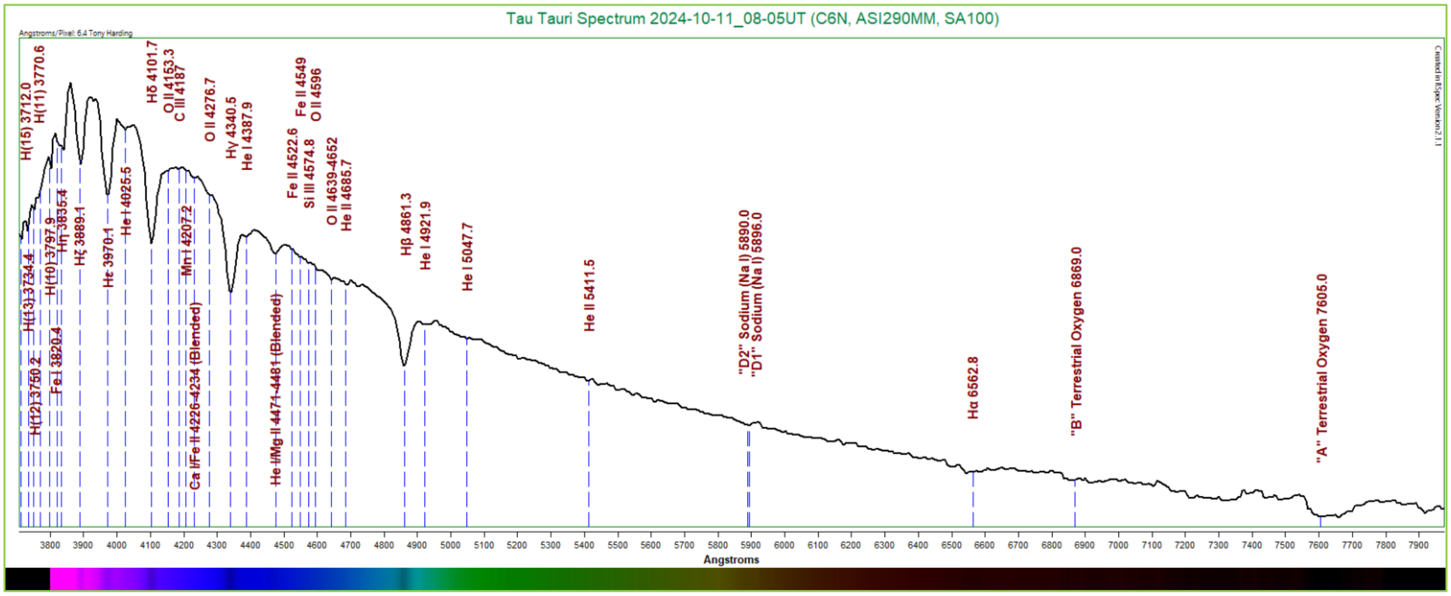

Figure 11: Tau Tauri Spectrum (6.4 Angstroms/pixel)
Capture Details 11: Exposure 499ms, Gain 200, 80% of 728 frames stacked, Integration Time 290s

The general shape of this curve is similar to that obtained for Lambda Tauri. The hydrogen Balmer lines are sharp and clear, and the apparent peak of the curve lies near the lower wavelength end. Consistent with an early B-type star, we see numerous helium lines, at 4025.5, 4387.9, 4471 (with ionized magnesium), 4685.7, 4921.9, and 5411.5 Angstroms. The sodium doublet is weakly visible, certainly due in this case to interstellar absorptions. Other, fainter absorptions include iron, manganese, oxygen, carbon, and silicon.

We will apply Wien's Law to obtain a temperature estimate for the star, but due to it being an early B-type star we must expect this estimate to fall far short of the actual value again. From the curve above, the peak energy wavelength appears to lie at 3860 Angstroms. With this value, we obtain a temperature estimate of 7507K. The listed value for the star's temperature is 18700K[2]. As expected our estimate is woefully short.

27 Tauri

27 Tauri is a member of the Pleiades star cluster and is also known as Atlas. It is a triple star system, with the components too close together to be resolved. The combined spectral type is reported as late B-type[1,2]. We can therefore expect a star somewhat cooler than Tau Tauri, but with a spectrum apparently still peaking near the lower end of the wavelength range. We can expect strong hydrogen Balmer lines, with perhaps a few helium lines visible.

The finished spectrum is presented here:

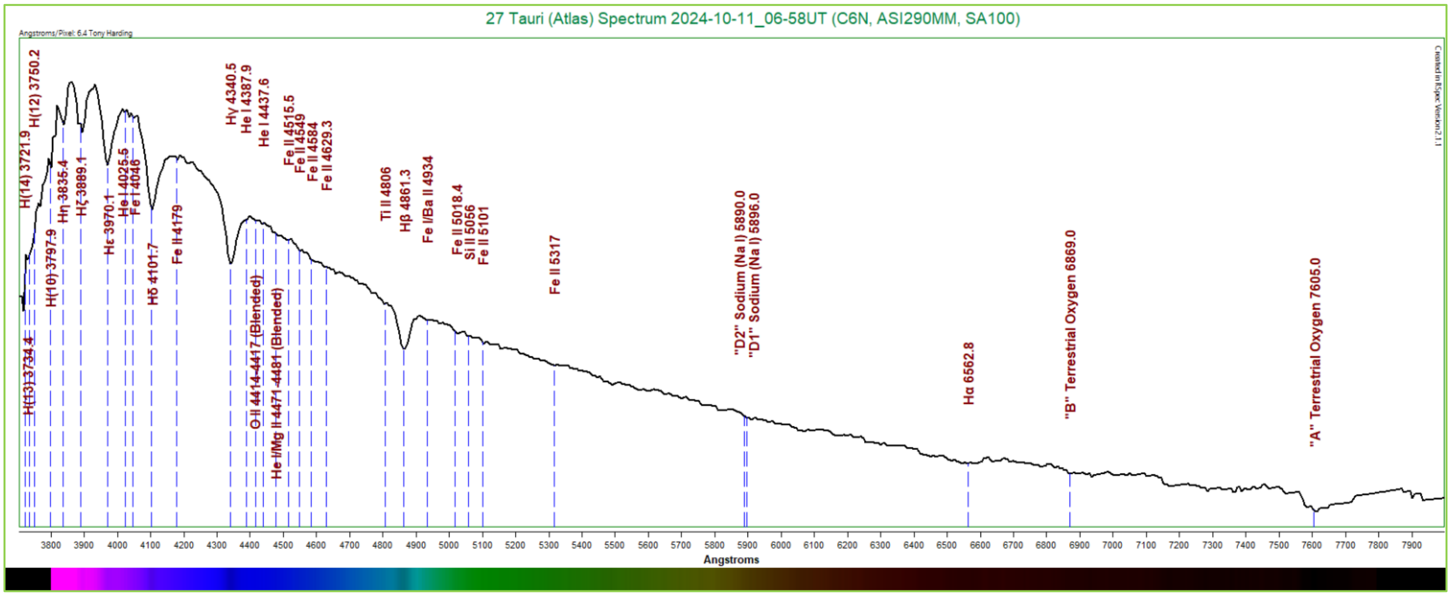

Figure 12: 27 Tauri (Atlas) Spectrum (6.4 Angstroms/pixel)
Capture Details 12: Exposure 390ms, Gain 137, 70% of 935 frames stacked, Integration Time 145s

The spectrum presented above looks quite similar to the previous one, but with some different elements labeled in accordance with the lower temperature. Most of the hydrogen Balmer lines are obvious, with the exception of the Hα line, which appears quite weak. Several neutral helium lines are present here, at 4025.5, 4387.9, 4437.6, and 4471 Angstroms (the last one blended with ionized magnesium). The sodium doublet appears very weakly, and is likely due to interstellar absorptions. Other indicated metals include neutral and ionized iron, ionized oxygen, ionized titanium, and ionized silicon.

We will again employ Wien's Law to estimate the temperature. Again, we are dealing with an early-type star, so the estimate will fall short (but perhaps slightly closer to the mark than for Tau Tauri earlier). The apparent peak energy wavelength falls near 3861 Angstroms. This value returns an estimated effective temperature of 7505K. The listed temperatures of the two primary components average 13580K[2]. Our estimate is off by quite a bit, but is respectively closer to the mark than the estimate calculated for Tau Tauri.

δ-2 Tauri

Delta-2 Tauri is the first of three additional stars captured during the run. This one lies near Delta-1 and Delta-3 Tauri, and is classified as an early A-type star[1]. Based on this, we can expect to see very strong hydrogen Balmer lines in the spectrum, with a sprinkling of other very faint features.

The finished spectrum is found here:

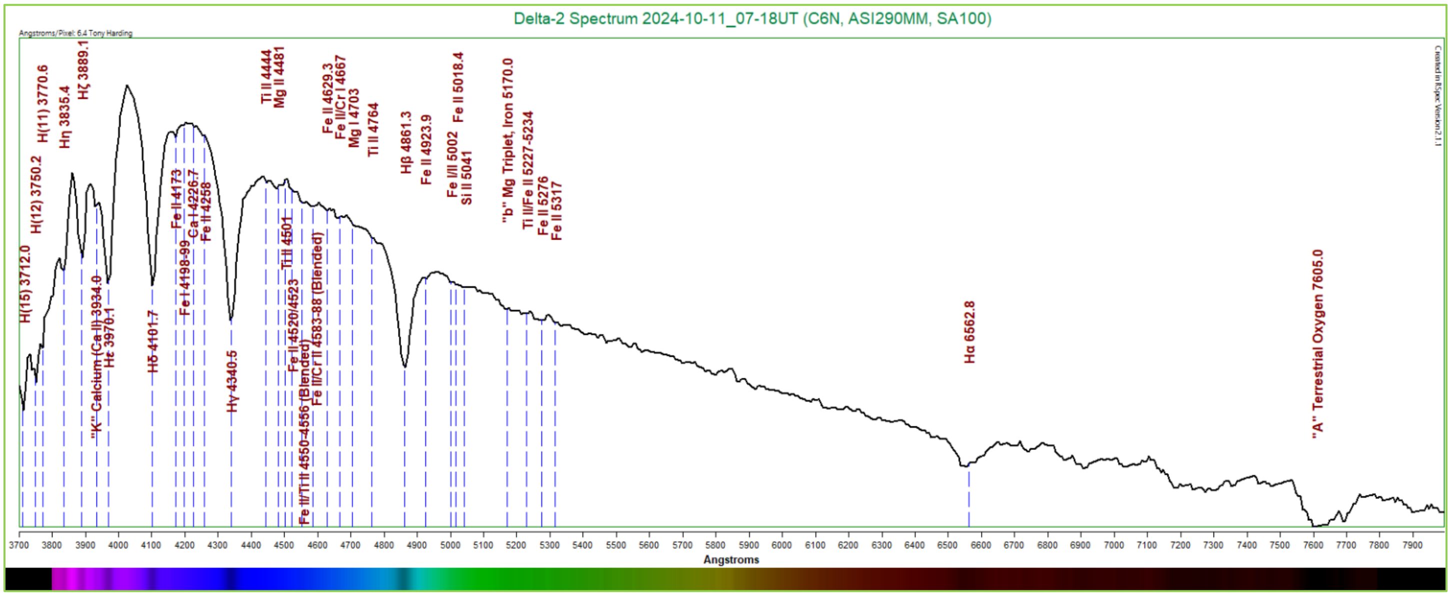

Figure 13: Delta-2 Tauri Spectrum (6.4 Angstroms/pixel)
Capture Details 13: Exposure 670ms, Gain 200, 80% of 542 frames stacked, Integration Time 290s

The hydrogen Balmer lines in this spectrum are profoundly strong. The ionized calcium K line at 3934 Angstroms is visible here, providing a step on the lower side of the Hε absorption. The magnesium triplet is beginning to emerge here also, but is evident only by a small, subtle dip in the continuum line. Other fainter metals visible include neutral and ionized iron, calcium, titanium, magnesium, and ionized silicon.

We will now calculate an effective temperature for the star using Wien's Law. Though this star is undoubtedly cooler than the last few, it is still hot enough that we must expect our estimate to fall short. Visual inspection of the spectrum seems to show that the peak energy wavelength lies at 4025 Angstroms. With this value, we calculate an effective temperature of approximately 7199K. The professional temperature estimate is listed as 7997K[2]. Our estimate is definitely closer to the mark than those obtained for the last few stars, but still about ten percent too low.

θ-1 Tauri

Theta-1 Tauri is the companion to Theta-2 Tauri, together presenting an attractive wide double star. Theta-1 Tauri is also called Hyadum III and is classified as a very late G-type star[1]. From this, we can expect to see features representing a star somewhat cooler than our own Sun, with numerous metal lines present (particularly iron).

The spectrum can be seen below:

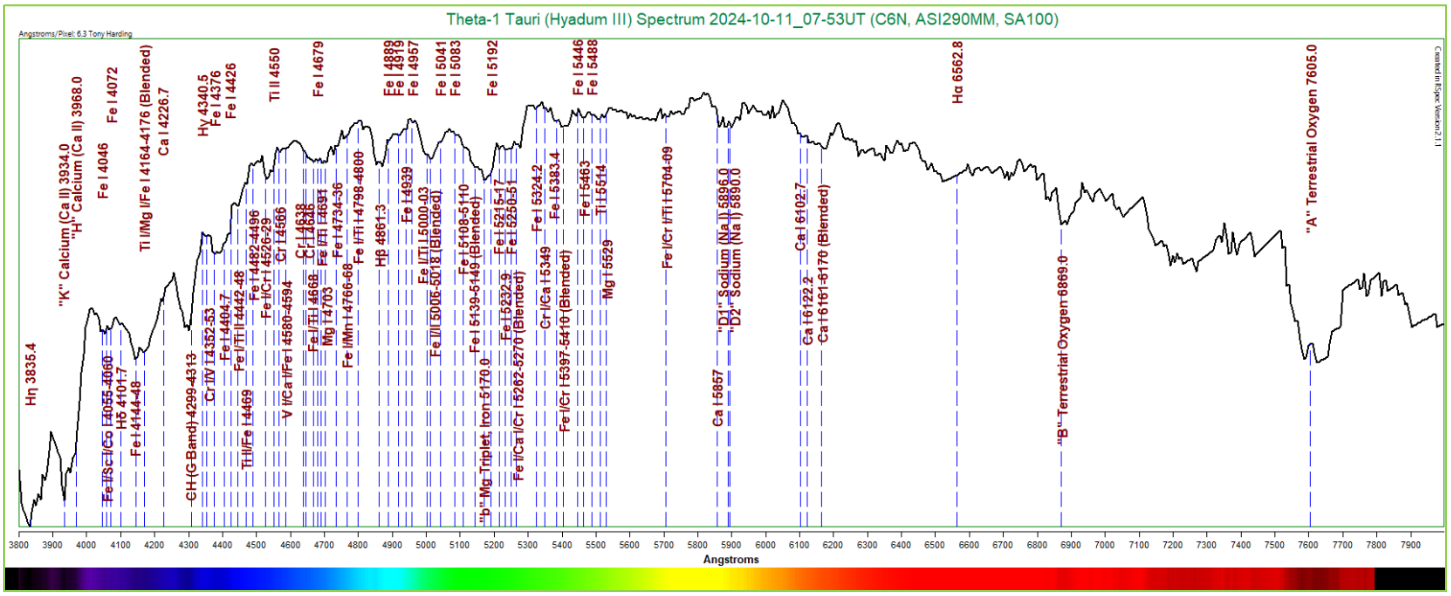

Figure 14: Theta-1 Tauri (Hyadum III) Spectrum (6.3 Angstroms/pixel)
Capture Details 14: Exposure 343ms, Gain 184, 40% of 1164 frames stacked, Integration Time 159s

Here we see a curve representative of a cooler star, with the peak lying near the center. Several of the hydrogen Balmer lines are evident, though weakened. The calcium K and H lines are 3934 and 3968 Angstroms are distinct, carving a deep cut out of the continuum. The molecular CH (G Band) absorption at 4299-4313 Angstroms is also very sharp and deep. The magnesium triplet at 5170 Angstroms is notable, with its attendant smaller iron lines flanking it. The sodium doublet at 5890-96 Angstroms appears rough and broad here, and the calcium line just below it at 5857 Angstroms is visible. Other metals labeled include lots of iron, titanium, calcium, chromium, vanadium, and magnesium. As is typical for G-type stars, the lines are at times crowded very close together, so be careful when tracing them.

Using Wien's Law, we will calculate an effective temperature for the star and compare this to the established value. Examining the curve, the peak appears to lie near 5817 Angstroms. Using this value, we obtain a temperature estimate of 4981K. The professionally determined value is approximately 4940K[2]. Our estimate is only off by 41K!

28 Tauri

28 Tauri is a member of the Pleiades star cluster, and is more commonly called Pleione. The star is a close binary system, with the primary component classified as a late B-type star[1,2]. Very little is known about the companion, but the primary is known to have a circumstellar disc of material around it; this may show itself as an emission feature. The star also rotates extremely rapidly, nearly at its breakup speed. Based on the star's fundamental type, we expect strong hydrogen Balmer lines to be visible.

The spectrum follows:

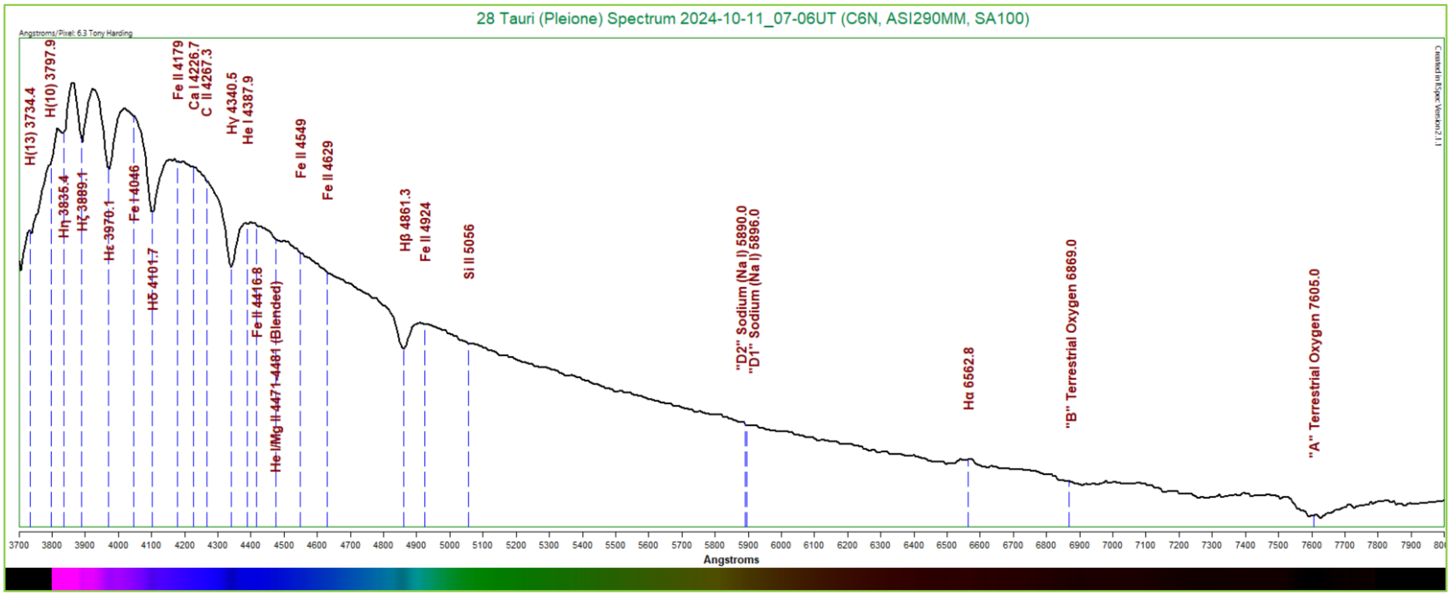

Figure 15: 28 Tauri (Pleione) Spectrum (6.3 Angstroms/pixel)
Capture Details 15: Exposure 757, Gain 200, 50% of 480 frames stacked, Integration Time 181s

This spectrum definitely came out very clean-looking. The hydrogen Balmer lines are visible, as expected. Note the Hα line; it is showing a slight emission, with a double-peak structure. Two helium lines are visible in the spectrum—at 4387.9 and 4471 Angstroms (the latter blended with ionized magnesium). A very subtle dip is indicated for the sodium doublet at 58690-96 Angstroms, likely due to interstellar absorptions. A few other extremely faint metals are indicated, including iron, calcium, carbon, and silicon.

Using Wien's Law, we will calculate an effective temperature for the star and compare this to the professionally determined value. Of course, with this being an early-type star we must accept that our estimate will be far too low. From the curve above, the peak energy wavelength appears to be at 3865 Angstroms. Adopting this value, we calculate an effective temperature of 7498K. The professionally estimated temperature of the star is 11058K[2].

Conclusion

This constellation proved to be a bit challenging to capture all the constellation line stars. However, since I was on vacation at the time, I was able to capture them all during a single long overnight session. No real surprises were encountered during the data acquisition or processing. Other commitments and a raging case of bronchitis delayed the completion of this report.

Contact

Any comments, questions, criticisms, etc. can be directed to anthonyspectro@gmail.com.

References

[1]: As determined using Stellarium v1.1. (Of course, not all sources agree as to the exact stars used in forming the shapes of the constellations. Alternate designations are also applied to most stars.)
[2]: As indicated by Wikipedia.
[3]: *Spectral Atlas for Amateur Astronomers* by Richard Walker
[4]: *Spectroscopy for Amateur Astronomers* by Marc F. Trypsteen and Richard Walker