

Lessons from a Winter Night

On a clear winter evening (such as tonight in Birmingham), you can go out and observe the stars we will be talking about. If one finds the Belt of Orion, one has the key to the winter sky. From here, one can move upwards in the sky to find the red star Betelgeuse (“the shoulder of the giant”), one can move forward and find the stars of Taurus the Bull, one can follow the curve of Orion’s legs back to find Sirius (the brightest star in the sky as it appears to us).

Taurus is one of the oldest constellations, and marked the spring equinox from 4000 to 1700 BCE; during this time, many considered the spring equinox to be the start of the year. This, naturally, happened in spring and around the time of the rainy season. If one looks at Taurus’ horns, they form an asterism known as the Hyades. The Hyades themselves derive their name from the Greek verb to rain, clearly showing that their rising and setting were linked to rainy weather. Even more interesting, since both of these were linked to the start of year, it was quite natural to place special importance on this constellation. Coincidentally, in many languages, the sign representing “bull” came to be simplified and rotated to form the letter A. This is why A is A.

The ancients had no clear idea of how far away the stars were. Now, we have accurate measures to the closest stars using simple geometry and trigonometry. One method works by observing how much a nearby star will seem to move back and forth during the year as the earth orbits the sun. This is similar to how an object will seem to move if one closes one eye and then the other. Now, imagine the distance from the earth to the sun is one side of a right triangle, one can then use any parallax to find the smaller angle. From here, a form of the tangent function can help one find the absolute distance to the star. Sirius’s distance can be absolutely determined using this method. It is 8.6 light years away. This isn’t a guess, but a demonstration that the same math that helps us understand angles on the earth can give us absolute distances in the heavens.

Finally, we can use all of this knowledge and turn our attention to Betelgeuse. The ancients had no idea of the size of the universe. Ptolemy, for example, thought the universe was roughly 50 million miles across. Let’s put this into perspective: this is roughly the distance Venus is from the sun. Even more interesting, it is only one-sixth the size of Betelgeuse—and Betelgeuse isn’t even the largest star (that’s VY Canis Majoris, which is also in this part of the sky). In other words, most historical estimates of the universe’s size didn’t even encompass the size of our solar system or even the size of some stars. We live in a big world.

The winter sky is full of surprises that one can use to fuel one’s thoughts about one’s place in the universe. Make some coffee, put on a jacket, and go out and revel in both the glory of nature and in our ability to understand it, and reflect on what it all means.

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