[music]

[00:00:16] Jordan Tierney: Hi, I'm Jordan-

[00:00:17] Kit Irving: -and I'm Kit.

[00:00:18] Jordan: Welcome to *Starry Time*, where stars plus lines-

[00:00:22] Kit: -equals stories.

[00:00:24] Jordan: In this episode, we'll be focused on the astronomy and other cosmic background of the constellation Centaurus the Centaur.

[00:00:33] Kit: Shockingly, this is not the only centaur in the night sky, but you'll have to wait for next week to find out who exactly this centaur is.

[00:00:43] Jordan: If you do want to learn about the centaur in the night sky that we've already covered, feel free to check out our Season 1 episode on Sagittarius.

[00:00:52] Kit: It's definitely one of my favorites. I have a lot of lore riding on that Sagittarius retcon, so be sure to check it out. Anyway, so after a very brief foray to meet Johannes Hevelius last month, we are back to one of Ptolemy's great-

[00:01:09] Jordan: Great, great, great, great, great, great, great.

[00:01:13] Kit: -48 constellations identified in his second-century work, the *Almagest*.

[00:01:18] Jordan: I did miss Ptolemy last month a little, but I did take that time to learn Ptolemy's first name. Do you happen been off the top of your head to know what Ptolemy's first name is?

[00:01:34] Kit: I thought he was a Cher situation-

[00:01:37] Jordan: -or a Beyoncé situation.

[00:01:38] Kit: Right.

[00:01:39] Jordan: Claudius. Just another one of them, "Claudius is out there."

[00:01:43] Kit: [laughs] I can see why he went by Ptolemy then. More memorable.

[00:01:48] Jordan: Much more curb appeal. All right, so Centaurus is a large constellation coming in at 1,060 square degrees and it ranks ninth out of all the 88 IAU-recognized constellations.

[00:02:03] Kit: In fact, this constellation used to be even larger because, historically, it encompassed the current constellations, Lupus and Circinus.

[00:02:12] Jordan: There'll be more on Lupus later this season as we continue into the wilds.

[00:02:16] Kit: All right, so what did this constellation look like to you, Jordan? What did you see?

[00:02:21] Jordan: This constellation is pretty complex. It looks like there's a lot of moving parts. It sort of looks like a deer or some sort of giraffe with flailing arms and like a horse-like legs and body, abdomen. Do horses have abdomens? Yes, it looks just like a stick figure of a very strange-looking person-monster. What about you? What did you see?

[00:02:51] Kit: Well, person-monster is a good description of a centaur to be fair.

[00:02:56] Jordan: Nailed it.

[00:02:57] Kit: Yes, and I see the horse. It looks like a horse with a giant head. Maybe more like if they said, "Oh, it's a stag," I would be like, "Okay, that makes more sense." I'm willing to give the ancient Greeks the benefit of the doubt here and say, "Yes, it looks like a centaur. Sure."

[00:03:16] Jordan: If either of these descriptions weren't super helpful, let's get a bit more precise and technical.

[00:03:22] Kit: This constellation has a right ascension, around 13 hours, and a declination of -50 degrees. It's a Southern Hemisphere constellation, but it's still visible to people around 25 degrees north latitude.

[00:03:36] Jordan: Around Florida and some parts of Texas in the United States, but you might not be able to see the entire constellation.

[00:03:44] Kit: Yes, I'm actually not sure if I've ever seen this constellation myself, but we were definitely missing out because there are some pretty notable stars in this constellation.

[00:03:54] Jordan: All right, Kit. The brightest star in this constellation is kind of famous. I can say with absolute pride that our good friend Johann Bayer is back. He's back, baby. This is one of his crowning achievements as he correctly designated this star as the one, the only Alpha Centauri.

[00:04:23] Kit: Oh, Bayer, we're so proud. Good job, Bayer. It's good to get that W.

[00:04:28] Jordan: If I say one thing about you, Bayer, to my friends, it's, "Well, he's the guy who did Alpha Centauri. Don't look into his other works." Alpha Centauri is a triple-star system. It includes Alpha Centauri A, also known as Rigil Kentaurus, which is a G-class star, as well as Alpha Centauri B or Toliman, which is a K-type star, and Alpha Centauri C, also known as Proxima Centauri, which is an M-class red dwarf. Although it's the smallest and faintest of the bunch, the closest to us is actually

Proxima Centauri, which is about 4.24 light-years away.

[00:05:09] Kit: Right, and it is, in fact, actually, the closest star to our star system. It'll be that way for the next 25,000 years or so. At which point, Alpha Centauri A and Alpha Centauri B will start alternating in closeness to us for a little while. There's actually a really cool visualization of all the stars that are close to our sun by galactic standards. I will post it over on our socials @starrytimepod on the Universeodon server of Mastodon. I'll put a link in the show notes if that's hard to remember, so you can just go right there.

[00:05:45] Jordan: Excellent, but for now, let's start with the other two stars in this triple system, which are a little bit further away. 4.3 light-years away to be exact.

[00:05:56] Kit: Yes, and you don't get to the next closest star until you get to Barnard's Star, which is about six light-years away. If you want to know everything about that star that we thought was interesting, you can check out our episode on Ophiuchus in Season 1.

[00:06:09] Jordan: Ophiuchus, 13th zodiac constellation, everybody. If you don't know, here's your chance to find out. We do know quite a lot about this star system, but my last fun fact for now is that Proxima Centauri has three confirmed exoplanets. One of them is a super-Earth. It's about 1.07 times the mass of the Earth and is a rocky planet, but it's way closer to Proxima Centauri than we are to our sun. Its orbit only takes 11.2 days.

[00:06:48] Kit: Wow. Remember that it takes us 365 days, plus or minus a little bit, to go around our sun and mercury takes 88 days.

[00:06:57] Jordan: We need to go back and get a calculator out to see how old we are in Proxima Centauri's super-Earth years.

[00:07:05] Kit: [chuckles] Right.

[00:07:06] Jordan: Anyways, Proxima Centauri is much less luminous and hot than our sun, so it could very well still be in the habitable zone.

[00:07:14] Kit: Ah, Planet B.

[00:07:16] Jordan: The second confirmed planet is a so-called mini-Neptune. It's about 1.5 AU from Proxima Centauri and it's firmly outside the habitable zone. The final, most newly discovered and confirmed is Proxima Centauri D, which is about twice the size of Mars, about quarter of the mass of Earth, and orbits Proxima Centauri every 5.1 days.

[00:07:44] Kit: That's so close. Is that one in the habitable zone?

[00:07:49] Jordan: Well, astronomers don't think this entire planet is habitable because it's a little too close to its star. Hence, the five-day year, but some polar

regions might actually be at a habitable temperature.

[00:08:00] Kit: All right, and so how long would it take us to get there? [chuckles]

[00:08:04] Jordan: It depends on how fast we could actually go. A 2018 article from the *MIT Technology Review* estimated that it would take approximately 6,300 years with the technology at that time, which did include the Parker Solar Probe.

[00:08:21] Kit: Yes, and the Parker Solar Probe is still, I believe, the fastest thing we got. It has an estimated top speed of 0.064% the speed of light. This thing is not designed for humans.

[00:08:36] Jordan: Everybody, do you get what we're putting down here? This is our closest possible Planet B option. It's not going to be easy to get there. We're going to need some pretty big scientific breakthroughs in space travel in order to make something like this possible anytime soon. All right, Kit, that's what I have to share on the Alpha Centauri system. I know we'll post some other stuff on our socials since there's a lot we weren't able to cover.

Let's get into our segment, Bayer's variable star, where we move through the Greek Alphabet in order, usually, to learn more about the Bayer-designated star in the night sky of this constellation. Last episode, we were foiled by English astronomer Francis Baily, hate that guy, who designated only a single star in the constellation links. It didn't make our job easy. We also messed up and thinking we'd made it to Delta, which happens, so let's write this ship and talk today about Gamma Centauri. Sound good?

[00:09:44] Kit: Sounds good.

[00:09:45] Jordan: What did you find out about this one, Kit?

[00:09:47] Kit: Gamma Centauri has a visible magnitude of +2.17 and it's actually a binary star system. The two stars individually are both A-type subgiants that are, on average, about 37 AU apart. The whole system is about 130 light-years away from us. These stars probably evolved at the same time, which means that they'll probably reach the end of their lives around the same time.

We'll end up with a pair of orbiting white dwarf stars that are really similar because these stars are really similar. That's kind of cool. I'm imagining that the planetary nebula that they'll leave behind will end up looking incredible. Other than that, there's not too much more to say about this system, except that it's also pretty close to a Tau Centauri, only about 1.7 light-years away.

[00:10:42] Jordan: All right, so it's a little bit of a mid-variable star, but a little something interesting there for sure. Let's take a quick break and then come back for Jordan's Gold Star Selection of the Month.

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[00:11:04] Kit: Welcome back. This segment is called *Gold Star*. In this segment, we alternate-picking the star or space object in our Constellation of the Month that captures our mind, our heart, and our very souls. Where did you go with this one, Jordan? What'd you pick?

[00:11:19] Jordan: Kit, I was torn. My mind said one thing. My heart said another thing. My soul said another. First, I just wanted to give a quick shout-out to some runners-up. The first is NGC 4650A, which is a polar-ring lenticular galaxy.

[00:11:37] Kit: Okay, so I know what a lenticular galaxy is, right? It's between an elliptical and a spiral galaxy, but what's the polar-ring part?

[00:11:46] Jordan: It sounds pretty cool, right?

[00:11:47] Kit: Yes.

[00:11:48] Jordan: Polar-ring galaxies are actually very striking galaxies, where it seems to be like there's a ring of stars around the central galaxy. Astronomers think that they are caused by colliding galaxies, where an older galaxy gobbles up a smaller one. Then the smaller one, stars end up as a ring.

[00:12:10] Kit: Instead of the usual disc around the galaxy, you have a spray of stars.

[00:12:15] Jordan: My next runner-up was NGC 4622, also known as the Backward Galaxy.

[00:12:23] Kit: [chuckles] Backward. Okay, that's a name.

[00:12:26] Jordan: Incredible name. This is an unbarred spiral galaxy. It's not too close to us. 111 million light-years away, a little bit further than the Centauri system. The cool thing about this galaxy is that the inner and outer spiral arms seem to be going in opposite directions like a pinwheel in reverse. Astronomers aren't sure which way it's actually spinning.

[00:12:55] Kit: Do they know what's causing this?

[00:12:57] Jordan: Astronomers think it's actually the result of a galaxy merger. In this case, a smaller galaxy getting consumed into a larger one.

[00:13:05] Kit: It's kind of similar to the first runner-up but a different sort of outcome. All right, so these are both pretty interesting. Where did you end up going for your ultimate Gold Star winner?

[00:13:16] Jordan: I probably chose after all this most famous of the options because when in Centaurus--

[00:13:22] Kit: Hey, you got a Centaurus. I get it.

[00:13:24] Jordan: I decided to give my Gold Star this month to Omega Centauri, which, contrary to its Bayer designation, shocker, Bayer messed this one up too, is actually a globular cluster, except this globular cluster, Kit, it's not like all the other globular clusters.

[00:13:44] Kit: [chuckles] They all say that.

[00:13:47] Jordan: I'm sure they do, but this one is thought to be a dwarf galaxy that was disrupted and perhaps even partially eaten by our very own Milky Way.

[00:13:58] Kit: Huh, okay, so since globular clusters are often more concentrated area-wise than dwarf galaxies, they cover a smaller area, but they're often much more tightly clustered and brighter. I'm guessing this is not the case here.

[00:14:13] Jordan: You're absolutely right. Omega Centauri has an apparent magnitude of 3.7 and is visible to the naked eye. It's only 17,000 light-years away and is four million solar masses, making it one of the most massive globular clusters orbiting the Milky Way. Big, big glob.

[00:14:35] Kit: [chuckles] Yes, it lines up with the idea that maybe it was originally a larger dwarf galaxy, and then part of it got siphoned off. Interesting.

[00:14:44] Jordan: Yes, it was originally identified by our friend Claudius-

[00:14:48] Kit: [laughs] Claudius.

[00:14:50] Jordan: -Ptolemy, as a star back in the second-century *Almagest*. Unsurprisingly, our good friend Bayer, who gets a lot of credit for Alpha Centauri and nothing else this episode, didn't do any additional research and just called this object "a star" in his 1603 work *Uranometria*. It wasn't long after, in 1677, however, that Edmond Halley of Halley's Comet fame described it as, well, a non-stellar object.

[00:15:22] Kit: Bayer, I was so proud of you, and now, ugh.

[00:15:26] Jordan: He made one note about it, which was that it was a star.

[laughter]

[00:15:31] Jordan: Seven decades later, they're like, "Well, that one note you made." Other Gold Star-worthy facts that it may have an intermediate-mass black hole. Sounds pretty cool. It contains about 10 million stars. In the center of the cluster, stars are so densely packed together that they average only about 0.1 light-years away from each other.

[00:15:59] Kit: Wow, that's close, right? That's maybe 6,320-some-odd AU, which is close for stars considering that the nearest star to us that we just discussed is more than four light-years away. These stars are super-duper close. Whether or not it's the basic choice, I don't know, but I feel like Omega Centauri is a great addition to the

Gold Star of the Month Club.

[00:16:27] Jordan: All right, welcome to the club, Omega Centauri.

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[00:16:37] Jordan: This brings us to the end of our exploration of the cosmic background of the constellation Centaurus. Next week, we'll be retelling and re-constellationing the myths of this constellation.

[00:16:52] Kit: This has been Kit-

[00:16:54] Jordan: -and Jordan.

[00:16:55] Kit: Sisters who love stars and stories.

[00:16:58] Jordan: We'll see you next time-

[00:16:59] Kit: -on *Starry Time*.

[music]

[00:17:21] [END OF AUDIO]