

Perseus: Cosmic Background

Intro

Jordan: Hi, I'm Jordan.

Kit: And I'm Kit.

Jordan: Welcome to Starry Time, where stars plus lines

Kit: equal stories.

Jordan: For this month, we'll be exploring the constellation Perseus. You know, the ancient Greek quote hero.

Kit: Yes, just Perseus. Another one like Hercules. Uh, so in this episode, we're going to talk about the astronomy and other cosmic background of this constellation. If you listened to our episodes on Cassiopeia, Cepheus and or Andromeda earlier this season, it should come as no surprise to you that Perseus is another of the 48 great

Jordan: great great great great great great great great great great great

Kit: Constellations identified by Ptolemy in his second century Almagest. And, uh, this should be no surprise because Perseus is also part of that entire saga.

Jordan: And it is quite a saga indeed. We needed several months away from that myth

verse, to be honest, before we could really return to talk about Perseus. But we'll save those thoughts for next week's myths and retcons episode.

Kit: Yeah, and, uh, Perseus also has some other notable myths that we will roll into that episode next week.

Jordan: Lot going on with our guy. Perseus. Speaking of the constellation we call Perseus was sometimes called Perseus and the head of Medusa. And the constellation was illustrated with Perseus holding the Gorgon's head. But the IAU doesn't use this name, does not allow Perseus to accessorize with the dead skull of his victim. And it didn't really catch on. So we will just refer to it as Perseus for this month.

Kit: Yeah, it's probably for the best. And, you know, I sort of wish that Perseus didn't catch on, but, you know, I, um, think this should just be a Maenad constellation.

Jordan: I mean, my retconstellation might be Medusa holding up the head of Perseus but when we take over the IAU, I'm sure we'll, you know, make sure a lot of changes that we see fit are finally made.

Kit: All right. I will hold off on my Perseus character gripes much like I did when we got to the Orion myth gripes. Um, yeah, it's not, it's not, uh, I think the problem is, like, I'm not as attached to this constellation as I am attached to the constellation Orion. And so all I can think about is Perseus the quote unquote hero. And I really need to let that go so we can really get into the astronomy of this constellation

Jordan: Kit, to be fair, we all do have our biases. However, this constellation is actually larger than Orion. It is the 24th of the IAU recognized constellations compared with

Orion's 26th ranking.

Kit: So perhaps the difference isn't in the size so much as the findability in the night sky.

Initial Impressions and How to Find this Constellation

So before we get technical about it, what does this constellation look like to you, Jordan?

Jordan: Based on the pictures I saw, this one was pretty representational. It actually looked vaguely like a, uh, stick figure or vaguely like half of a stick figure at least. It also reminded me of the ancient Greek letter lambda. But, yeah, this one I wouldn't say was super complex, but I can see how it could become a person. How about you? What do you see here, Kit?

Kit: Yeah, same. So I kind of see like this one leg, stick figure figure with a tiny little hat and flailing arms. So, yeah, something definitely human like here. Yeah, I begrudgingly will admit that there's something human like, but, you know, it's not as tidy and clear as the three stars of Orion's belt and the head and the two feet and the arms. But, you know.

Jordan: I'm glad that you also saw the or imagined the flailing arms. That definitely stuck out to me. Maybe that's just the Perseus we want to see. Just arms failing, toppling over down the stairs. But yes, as we mentioned earlier, Orion is a lot to live up to. And you're right, Perseus doesn't have a lot of super bright stars to find. Perhaps the easiest way is to go first to his mother in law, Cassiopeia.

Kit: Right. The constellation Cassiopeia is a vaguely W or M shape in the night sky. Very, I think, noticeable.

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Kit: If Cassiopeia's up there looking like a W, then you'll find Perseus below and to the left. If she looking like an M, then Perseus will be to the lower right. If you follow one of the center stars of Cassiopeia.

Jordan: And its other neighboring constellations we've discussed on the pod before, including Aries and Taurus to the south and Auriga

Kit: AURIGAAA

Jordan: to the east and Andromeda to the West.

Kit: And if all that doesn't help, it has a right ascension of about 4 hours and a declination of 40 degrees north.

Jordan: If you live above positive 40 degrees latitude, this constellation never sets below the horizon, but otherwise you can see it high in the night sky in the rest of the northern hemisphere and in parts of the southern hemisphere in November.

Brightest Star

Kit: So now that we know what it looks like and where to find it, let's talk about the

brightest star in the constellation.

Jordan: Kit, I have excellent news.

Kit: Okay

Jordan: Our favorite late 16th century astronomer slash lawyer Johann Bayer absolutely crushed this assignment, knocked it out of the park. Designating the brightest star in this constellation as Alpha Persei, which is better known by its formal name of Mirfak.

Kit: Oh, uh, I'm so proud of our guy. I mean, really, it's so hard to be a late 16th century astronomer slash lawyer. You had to have so many jobs. I mean, wow.

Jordan: Bayer, we never doubted you. So, the formal name Mirfak comes from an Arabic phrase meaning elbow. It is a yellow white supergiant star with an apparent magnitude of positive 1.81. And it's located about 510 light years from Earth. It is more massive, larger, and more luminous than our sun by, like, a lot. Like. Like, a lot. A lot. For example, it has 68 times the radius of our sun, and it is 8.5 times the mass of our sun.

Kit: Yeah, that's big. So remember that the radius of our sun is about 432,000 miles, which is 109 times the radius of the Earth. So this is a big star. It's likely evolved right, um, on that main sequence, and it's probably gonna be ready for a collapse sometime soon.

Jordan: Back in 2010, astronomers published a paper suggesting the star might have a gas giant about six times the mass of Jupiter orbiting this star. But this hasn't yet been

confirmed, and there is some evidence to suggest the initial findings might have been incorrect or a star spot or another artifact in the data.

Kit: Yeah, I guess we're going to need some more research on this star to learn more.

Jordan: Perhaps it's there, perhaps it's not. One other interesting thing I've learned about this star is that it is the only star in Perseus that's considered a navigational star.

Kit: Oh, yeah. I don't think we've talked about navigational stars on the pod before. Maybe we want to do a quick snapshot on them and loop back on it some other time, but just maybe a short picture of what a, uh, navigational star is?

Jordan: Kit, of course. And there are 58 special celestial navigation stars in the night sky. Well, technically, there's 57 and Polaris, but these stars are used to navigate by seafarers, especially since on the sea, all you got is ocean. Ocean. And if you look around, Kit, you wouldn't believe me, but more ocean. So if your satellites go down, or perhaps you're trying to navigate by sea before we even had satellites, perish the thought, and you want to ensure you're going the right way, you could use these very special stars to help guide your ship.

Kit: Yeah, very cool. Uh, and you know, there is celestial navigation when you are, you know, wandering around in other places, but it's pretty clear why you might need stars since there is no landscape to look at, uh, when you're on the ocean.

Bayer's Variable Star

Jordan: Let's move into our next segment, which is Bayer's variable star. Here we follow the Greek alphabet to learn more about the Bayer designated stars in the night sky. Last month, I swerved a little bit and tried to find something a little bit more interesting. No respect to Nu Lyrae, but where did you go with this one, Kit? Did you follow the alphabet and the assignment,

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Jordan: or were you swept away by some other star of interest?

Kit: Well, I'm famously only a rule bender, not a rule breaker, so I'm gonna do a little like. Yesa and here.

Jordan: Kit, you're almost the avatar of rule bending.

Kit: Thank you. Okay, so first things first. Let's talk about Xi persei, which is. It's spelled sort of like, or it's transliterated as xi, but it's pronounced, I think, K-See or K-Sai something like this. It's Greek so I don't know. It's a Greek letter. Um, this would come after Nu in the Greek alphabet. Um, and this star also has the name Menkib, which is derived from an Arabic word meaning shoulder. It has an apparent magnitude of positive 4.06, and it is an O type blue giant star.

Jordan: Since it is a blue giant, it's gotta be pretty bright, right? So it's got to be far away if the apparent magnitude is so high.

Kit: Mm mhm hmm. Absolutely. So its absolute luminosity is way, way, way brighter than our sun. And the star itself is 30 solar masses. So it's huge and it's very bright and

luminous. But it's 1200 light years away, so. So it's quite far away. Exactly. Um, this star is also a suspected runaway star, and its radiation is part of the reason why the California nebula, which is located in Perseus seems to be glowing. If you've ever seen a picture of that nebula.

Jordan: All right, Xi Persei. I don't know how to say you either, but pretty cool.

Kit: Yeah. So there was actually something kind of interesting about it. So I wanted to, uh, wanted to make sure we got back on track, but I also really feel it's necessary that we do a quick shout out to Beta Persei.

Jordan: Kit. That is why you are avatar, the last rule, bender.

Kit: Well, I have to, because Beta Persei is probably the most famous star in this constellation. It's also called Algol, which is derived, again, from an Arabic phrase meaning the head of the ghoul or the head of the ogre. And this star is, um, considered unlucky. It's known as the demon star. It's known as Satan's head. So, yeah.

Jordan: Wow, that's quite an escalation. We started from elbows and shoulders, but you keep making your way up to the head and stuff starts getting really real here.

Kit: Yeah. So in the ancient Greek mythos, this star is symbolizing that head of Medusa that we mentioned earlier. And it, in reality is actually, um, a three star system. So it's been confirmed to have three, um, stars. There might be some additional companions, maybe even a five star system, or there might be some, you know, optical binaries. Um, and the main star is, in fact, an actual variable star.

Jordan: Which means its brightness as perceived from Earth, aka its apparent magnitude, changes over time, usually in a set interval or within a relatively short period of time. So this isn't something like a supernova or a nova, where it brightens temporarily and then fades.

Kit: Exactly. So it sort of has this brightening and dimming effect that happens over time. And this variable brightness in Beta Persei is caused by the orbits of the stars, which cause them to eclipse one another at these regular intervals. So every three days or so, um, one of the pairs, which is an eclipsing binary pair, orbits each other, they eclipse each other, and this pair is 0.062 au from each other.

Jordan: Kit, that is very, very close.

Kit: Uh-huh.

Jordan: Let's remember that one AU is about the distance from the Earth to the sun. Though in 2012, the IAU made a more specific redefinition.

Kit: Yep, absolutely. So there's a slightly more technical definition, but in general, we're talking about, you know, much, much, much smaller, these stars, right, orbiting one another very closely. Um, and there are some really cool visualizations of this system, so I will be sure to post those over on our socials at starrytimepod on the Universeodon Mastodon server, and of course, over on Twitter.

Jordan: Kit, I can't thank you enough for getting Bayer's Variable Star back on track. Let's take a quick break, and then we'll come back to find out about my pick for gold star of the month.

Gold Star

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 minds, our hearts, and our very souls. So, Jordan, what was your pick this month for gold star?

Jordan: Well, Kit, there was a fair amount to choose from this month in Perseus but as soon as I read about this one particular deep sky object, my decision was made for me.

Kit: Yeah, this part of the night sky is really interesting because it does align with the galactic plane of the Milky Way, but there's a lot of sort of molecular clouds that are hiding and obscuring the usual stuff that we see in this part of the night sky and that we can sort of see on the galactic plane.

Jordan: Yes, Kit. Exactly. And one of the major things in this constellation is the Perseus cluster, which is also known as Abell, or Abell 426. And it's one of the closest galaxy clusters to earth at about 76.6 million light years away.

Kit: You know, just a veritable hop and a skip away.

Jordan: You know, Kit, it's all relative. It is one of the closest. But what really captivated my heart was the giant elliptical galaxy at the center of this cluster called NGC 1275, also known as Perseus A, or Caldwell 24.

Kit: And these names are all so exciting and so captivating.

Jordan: Yeah, you instantly remember them. NGC. What was the number again? NGC 1275. And Cornwell? No, Caldwell 24. This galaxy is a Seyfert galaxy, which, at visible spectrum, look like regular old galaxies, but they have extremely bright active nuclei. And such active galaxies, as they are called, are designed as active galactic nucleuses, or AGN's.

Kit: Yep, and you're right. So we can see these AGN's, these really active, bright nuclei outside of the visible spectrum, so things like radio and x ray, and this is important, The Milky Way, our home galaxy, is not an AGN

Jordan: Kit, unfortunately, you are correct. Our Milky Way, whatever it has going for it does not have active galactic nucleus status, because these AGN galaxies have supermassive black holes that are actively accreting matter. NGC 1275, as a Seyfert galaxy, has a quasar like center. NGC 1275 is special since these Seyfert galaxies only account for about 10% of all the galaxies that we found

Kit: So, rare and very active. Right. And this idea that, you know, we in the Milky Way, we do have a supermassive black hole at our center, but it's not accreting matter. So. Okay, I'm still with you.

Jordan: Kit, yes, this is a rare and active galaxy. So pretty special to me.

Kit: Mhm.

Jordan: And what stood out to me about it, in addition to that, is that there's these super elaborate filaments that surround the galaxy. And these filaments, well, essentially they're cool gas that's been surrounded by super, very hot interstellar gas. And now

here's where things get even more interesting. This cooler gas is basically deposited from the center of the galaxy by radio bubbles.

Kit: A radio bubble.

Jordan: Radio bubbles.

Kit: What?

Jordan: Yes. So good. Basically, bubbles of relativistic plasma rise out of that active nucleus and into the surrounding hot, hot gas and somehow have remained in place instead of, you know, warming up or collapsing into stars. Because of this, some astronomers have hypothesized that the magnetic field around these filaments is keeping them intact.

Kit: Oh, that is so interesting. Right. We have this, like, really weird dynamic around it where it's like, yeah, what? How are these cool parts of gas? Like, how is this gas like this? Like, how is it here? That's cool.

Jordan: Two more things here, Kit. First, these bubbles create sound waves, which apparently

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Jordan: sound like a b flat, approximately 57 or so octaves below middle C.

Kit: Oh, my god. First of all, that is so low and also so specific. Right? Like, some

astronomer was able to figure this out. That's amazing. You can, like, hear radio bubbles. That's. That's, like. Yeah, it's a little bit mind boggling.

Jordan: Kit, let me send you the link to put on our socials, for sure. There's an excellent New York Times article. Add it to your mixtape. And finally, we've also observed two supernovae in NGC 1275. As if we needed any other reason to give this extremely cool space object the gold star of the month award.

Kit: What a great choice. This is a new galaxy type for the pod, complete with a supermassive black hole, my first love, mysterious and beautiful filaments. Uh, a music of its own. And supernovae. Welcome to the Gold Star Club NGC 1275.

Outro

Jordan: That brings us to the end of our exploration of the cosmic background of our constellation Perseus. Next week, we will be retelling and reconstellationing the myths of this constellation.

Kit: This has been Kit

Jordan: And Jordan.

Kit: Sisters, lovers of stars and stories.

Jordan: And we'll see you next time

Kit: On Starry Time.

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