

# Cygnus: Cosmic Background

## Intro

Jordan: [Music]

Jordan: [Music] 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 Cygnus, the swan

Kit: This week's episode will be focused on the astronomy and other cosmic background of this constellation.

## Background

Jordan: The constellation Cygnus is fairly large. In fact, it's the 16th largest IAU recognized constellation, clocking in at 804 square degrees. Or if you look up at the night sky, 1.95% of it is Cygnus.

Kit: We've talked about only a few larger constellations in season one, but in this season,

Jordan: quests, quests, quests, quests. And Curses. Curses, Curses, Curses.

Kit: In this season, um, it's only the second largest that we've discussed. It comes in right after Hercules, which is 2.97% of the night sky. And like many other constellations we've covered, Cygnus was one of the 48 great

Jordan: great great great great great

Kit: constellations in Ptolemy's second century Almagest.

Jordan: Areas of Cygnus are also part of the asterism, the northern cross, as well as the summer triangle.

## **First Impressions & Where to Find Cygnus**

Kit: So what did this constellation look like to you, Jordan? Did you see the swan? What did you see when you looked this one up?

Jordan: This one I totally got. I wouldn't say it was super complicated, but I could see like an arrow. I could see a swan. It reminded me of, like, when you're first taught how to draw birds. But, yeah, no, it doesn't surprise me that it became a swan uh, according to a lot of myths. And, and how about you? What did you see?

Kit: So definitely agree. The most prominent feature is that sort of like, cross shape. But if you look at the IAU constellation map, you do see some of the smaller lines that are drawn in between. Deneb, which is the star, sort of at one part of the cross, and then the sides, which do make it look like a wing. But honestly, the thing that I really saw was Aang's airbender staff slash glider from the Avatar the Last Airbender. But I might just have that, might just have that on the brain.

Jordan: No, I mean, it would make a great ornithopter. It would make a great flying device of some sort. Swan and or staff slash glider.

Kit: So Cygnus is a relatively well known and recognizable constellation in part because of its brightest star, which we'll talk about in a moment. But if you want to get technical.

Jordan: Of course we want to get technical.

Kit: It is a northern hemisphere constellation with a right ascension of 21 hours and a declination of positive 40 degrees.

Jordan: You can find Cygnus near the Milky Way, as the constellation runs sort of parallel to the beautiful edgewise view of our galaxy. It's also close to and below Cepheus.

Kit: Yeah. So Cygnus is usually high in the night sky during the summer months when you're in the northern hemisphere.

Jordan: Which is possibly, I don't know, I don't want to make any big leaps, but possibly why one of its stars is part of the summer triangle.

Kit: This constellation can be seen between latitudes positive 90 and negative 40. So you. Even though it is a northern constellation, parts of the southern hemisphere can also see it as well.

## **Brightest Star**

Jordan: So one of the reasons that Cygnus is such a recognizable constellation is because of its brightest star, which is the tail of the swan and one of the vertices of the summer triangle. But how bright exactly is this star? And, Kit, more importantly, can our good friend Johann Bayer continue his success?

Kit: These are very important questions. The second one, of course, but the brightest star in Cygnus is known as Deneb, and the name Deneb comes from the Arabic phrase tail of the hen, which makes sense since it's the tail of the swan. And this star is bright. It has an apparent magnitude of positive 1.25. It is a blue white supergiant, and it is the 19th brightest star in the entire night sky.

Jordan: 19th brightest. Let's hope Bayer got it right. Not as bright as Capella from the constellation we covered last month Auriga.

Kit: Yeah, we are actually getting pretty close to covering

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Kit: those top 20 brightest stars, even though we're only in season two. We've covered seven of them so far, and we'll have a few more this season.

Jordan: Spoilers.

Kit: Okay, so Deneb has the Bayer designation of,

Jordan: dun dun dun dun dun dun dun dun dun.

Kit: Alpha Cygni

Jordan: Bayer my guy, you are on a roll. As long as these stars are super, super bright, you are able to redeem yourself. So, yes, another win for our friend, 17th century astronomer slash uranographer Johann Bayer

Kit: I think probably what's really interesting about Deneb is that it is 2600 light years from Earth and it is still among the brightest stars in the night sky.

Jordan: 2600 light years. For reference, the brightest star in Auriga which is Capella, that's only 43 light years from Earth

Kit: Yeah. So in the top 20 brightest stars, Deneb is more than twice as far away as any of the other brightest stars. And it is the farthest away of the top 90 or so brightest stars in the night sky. So it is so, so, so far away, yet so, so bright.

Jordan: This means it's super luminous. That'd be the right term, correct?

Kit: Yeah. So it is much bigger than our sun. It's putting out a lot more light, and the estimates of luminosity vary, but the current figure puts it about 196,000 times the sun's luminosity.

Jordan: Excuse me, did I hear that right? 196,000 times the sun's luminosity?

Kit: Yeah. So that's kind of the most interesting thing about Deneb. There's not too much more to say about it. It's just super, super luminous. And it is one of the brightest stars in the night sky despite being quite, quite far away.

## **Bayer's Variable Star**

Jordan: Excellent. Now let's move into our next segment, Bayer's Variable Star, where we follow the Greek alphabet to learn more about the Bayer designated stars in the night sky. I haven't been keeping track, although I should be. But where are we these days, Kit, as far as the Greek alphabet goes?

Kit: Well, we have made it to Mu Cygni

Jordan: Tell me more.

Kit: So, unfortunately, Mu Cygni neither has a cool name or very much to say about it. It is a binary star system with an apparent magnitude of 4.49, so quite dim. It's 72 light years from Earth and still has that pretty dim apparent magnitude. And, you know, I'm just being honest with you. There's not a lot going on here.

Jordan: Not every one of these stars is gonna be a winner. With that, let's take a quick break because the pressure is certainly on when I tell you my Gold Star.

## Gold Star

Kit: [Music] Welcome back. This segment is Gold Star. In this segment, we alternate picking the star or space object in our constellation of the month that captures our mind, our hearts, and our very souls. So, Jordan, what was your pick this month?

Jordan: This one was tough. There's actually a lot of interesting stuff in this constellation. And before I do reveal my winner, I do want to shout out a couple of other favorites. First, we have a red hypergiant that has the largest known radius of any star we have discovered, coming in between 1183 and 2270 times the radius of the sun. And that is a star called NML Cygni

Kit: Oh, I did read about this star, and, um, yeah, it's huge and just sort of like a frame of reference, the radius of our sun is 432,690 miles. So our sun is big compared, you know, to Earth And this is just so much bigger.

Jordan: It's a pretty cool hypergiant.

Kit: Literally a cool hypergiant

Jordan: Kit, a second compelling option was Kepler 11, which is a star with six planets located 2150 light years away. First discovered in 2011. For folks who might not be familiar, the Kepler Space Telescope was

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Jordan: launched in 2009, and the mission lasted for about nine years. The mission of

the Space Telescope was to detect exoplanets, and one of the areas it surveyed was this constellation Cygnus.

Kit: Yeah. And as a result, Cygnus has a lot of stars with known exoplanets since this Space Telescope was pointed right in that direction.

Jordan: Exactly. So Kepler 11 was detected during this mission. The system has a G type star that's just a bit bigger, hotter and younger than the sun, and it has six planets which transit the star as viewed from Earth. And what they realized as they were studying the system is that the planets are roughly all on the same plane. All of these planets are on an average of one degree apart versus the average of 2.3 degrees, which is the solar system that you and I live in.

Kit: Yeah. So Kepler 11, definitely, much much flatter, for sure.

Jordan: The system is very compact. Five of the six of the planets are orbiting the sun closer significantly than the Earth does.

Kit: Yeah. And so just a reminder, again, right, for putting it into our sort of solar system frame of reference. The average distance between Mercury and the sun is about 36 million miles, compared with our average distance here on Earth of 93 million miles. So it is definitely there, very close to this G type star, for sure. Did you find out if any of these planets were Earth like?

Jordan: Kit, if they were, they probably would have been my Gold Star, don't you think?

Kit: Good point.



Jordan: But no, probably not. They range in size from slightly more massive than Earth to the mass of something much larger than Earth like Neptune. And scientists believe that as a whole, these planets have much lower density than we do here on Earth.

Kit: Yeah, it's interesting. I'll be sure to post, uh, on our socials about this system because there's some cool images of it and, you know, thinking about this, like, flatter system. So I'll be sure to post that. But I guess this really begs the question of what did you pick for your Gold Star if it wasn't either of those things?

Jordan: Kit, what I'm gonna go with is a celestial object that I first read about at the very beginning of the Internet, and it is Cygnus X 1 pretty simple name doesn't really pop out at you, and even when you look at it, it doesn't look like much in the visible spectrum. However, back in 1964, a rocket flight detected large amounts of x rays in this area. And there was a lot of scientific speculation about what could be emitting these x rays. And so, in December 1974, Kip Thorne and a young man named Stephen Hawking.

Kit: Ever heard of him?

Jordan: Ever heard of him? So Hawking and Thorne made a bet, whether this region had a black hole or not. Hawking bet Thorne that it was not a black hole, stating in his 1988 book, "A Brief History of Time," quote: "this was a form of insurance policy for me. I have done a lot of work on black holes and it would all be wasted if it turned out that black holes do not exist. But in that case, I would have the consolation of winning my bet, which would win me four years of the magazine Private Eye. And if black holes did prove to exist, Kip will get one year's worth of Penthouse Magazine."

Kit: I appreciate that Hawking is just setting himself up for success either way, and I do feel like this says a lot about his personality for sure. I like it.

Jordan: Love it. Hawking made sure that either way, he wins. In the end, after about 40 years worth of research, scientists have suggested that this is a black hole that was in fact created from a stellar collapse. And this black hole itself is currently eating a companion blue star, which resulted in all of the x ray emissions that we originally detected all the way back in the 1960s.

Kit: It's a good story, but I'm really not sure about Thorne's desire to have a Penthouse subscription. That is like a weird energy. I bet he wishes he asked for a detective magazine or something

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Kit: less, you know, um, um.

Jordan: Perhaps a bit less bawdy?

Kit: Yeah, something a bit less bawdy. For sure.

Jordan: Yeah, maybe in hindsight something a bit less bawdy. But despite this crazy bet, there's a lot of cool stuff about Cygnus X 1. And the story, along with how it plays itself out, demonstrates the systematic and iterative nature of scientific discovery, which definitely helps Cygnus X 1 pull ahead of the other few options that we brought to the table for Gold Star of the month.

Kit: It's an excellent choice and everybody can look forward to lots and lots of deep space pictures from the constellation Cygnus on our socials over at Starrytimepod on the Universeodon server, on Mastodon, and also on Twitter. So keep an eye out for those. There's some really cool looking stuff in Cygnus and I'll be posting those throughout the week. [Music]

## **Outro**

Jordan: That brings us to the end of our exploration of the cosmic background of this constellation, Cygnus the swan. Next week we'll be retelling and reconstallationing 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. [Music].

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