

## S3\_E1\_UrsaMinorCosmicBackground

Jordan: Hi, I'm Jordan.

Kit: And I'm Kit.

Jordan: Welcome to Starry Time, where stars plus lines

Kit: equal stories.

Jordan: Welcome to season three In the Wild.

Kit: In this season, we'll be discussing a range of constellations found, well, in the wild. For those of you joining us for the first time, welcome. This is a podcast where we discuss the astronomy, mythology, pop culture,

Jordan: Very broad definition of pop culture

Kit: of one of the IAU recognized constellations each month. Our previous seasons have included the zodiac constellations and a set of constellations that we called Quests and Curses.

Jordan: Quests and Curses.

Kit: So be sure to check those out if you haven't already.

Jordan: To kick off this season, we'll be doing a double release. Ursa Minor and Ursa

Major, the Little Bear and the Big Bear. Our mythology and pop culture episodes will combine these two constellations and we'll end with an asterism, Creature Corner about bears themselves.

## **Background**

Kit: But in this episode, we're going to be focusing on the astronomy and other cosmic background of the constellation Ursa Minor. The Little Bear.

Jordan: Little Bear. So we're starting off with the famous one here, Kit. Well, perhaps slightly less famous than the Big Bear, which will have its own cosmic background episode. Ursa Minor is also sometimes known in North America as the Little Dipper.

Kit: This constellation was identified by the Alexandrian mathematician, astronomer, astrologer, geographer and music theorist Ptolemy. And it was identified in his famous astronomical treatise from the 2nd century called the Almagest. That's right, Jordan. This is another great

Jordan: great great great great great great

Kit: of the 48 constellations identified by Ptolemy.

Jordan: As we'll talk about more in next week's episode, However, the Ursa constellations have a long history, in part owing to their importance in navigation.

Kit: Ursa Minor is small but mighty, clocking in at only 256 square degrees of the night

sky and ranking 56th out of the 88 IAU recognized constellations in terms of size.

## **First Impression and Where to Find Ursa Minor**

Jordan: So what did this constellation look like to you?

Kit: Well, this one is again, very famous and it looks like a ladle, which is its name in North America, as you mentioned before, the Little Dipper. Um, being that we're Northern Hemisphere kids, it's really hard for me to see anything else. I. I don't really get to bear a Big Bear or a Little Bear. Um, I really just see that dipper shape. But how about you, Jordan? What did you see?

Jordan: Kit, I'd love to say I'm creative, but I too was indoctrinated into the world of dippers. I'm not even sure what a dipper looks like in real life, for me, that's it.

Kit: So more than ever, our descriptions might not be helpful. So it's always useful to get technical.

Jordan: We love getting technical.

Kit: This constellation's declination is about 80 degrees north and its right ascension is about 15 hours.

Jordan: So if you're looking for it in the night sky, you'll want to look for the Big Dipper or Ursa Major, another pretty recognizable constellation. And then draw a line from the end of the ladle north, where you'll eventually hit Polaris, also known as the North star

which is the handle of this little dipper, Ursa Minor. Given that it includes the North star Ursa Minor is circumpolar, meaning it never sets below the horizon in the Northern Hemisphere. But it is best seen on June nights.

## **Brightest Star**

Kit: So now we know what it looks like, where to find it. Let's get into the stars. Ursa Minor is comprised of seven main stars. And although this constellation is quite a famous one, there are only three of these stars that are brighter than a magnitude of positive 3. Which of course leads us to a very important question. Do you think our friend and the friend of everyone listening to the pod, Johann Bayer, the 16th century astronomer slash lawyer extraordinaire, do we think Johann correctly identified the brightest star in this constellation?

Jordan: All right, so I know Johann was based in the Northern Hemisphere. I really want this for him, but can't say I'm entirely confident he's let me down in the past. But last season he did show marked improvement. So let's just hope he's trending in the right way. Let's believe in him. Let's believe. I believe Bayer, you got this.

Kit: So the brightest star in this constellation is best known by its formal name,

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Kit: Polaris, the North star or the Pole star and its Bayer designation is

Jordan: Hmm-Mmm-Hmm

Kit: Alpha Ursae Minoris

Jordan: Bayer, I knew you could do it.

Kit: Um, Polaris has a variable apparent magnitude, but it's usually around 1.98.

Jordan: It its not the brightest star we've discussed on the podcast, but it's certainly visible to the naked eye.

Kit: Yeah, absolutely. So some folks might be wondering why Polaris is so special. Because it's not particularly bright and it's specialness actually comes from the fact that it seems to have this unchanging position in the night sky. This happens because Polaris is essentially right above the Earth's rotational axis at the North Pole. But of course, as we've discussed before, which star is the North star or seems to be the one that never moves, changes over time.

Jordan: Axial tilt of course.

Kit: Yeah. And so if you've ever seen a picture where there's like, uh, you know, a ring of stars and they seem to be moving around another star that star is usually the North star. At the moment, as an aside, we don't actually have a south pole star although we certainly could, um, in part because the star that's currently beneath our northern [editor's note: Kit meant "southern" here] axis rotational spot, isn't really visible to the naked eye. It's just too dim. But we'll come back to that, I'm sure in a future episode.

Jordan: We'll get there, we promise.

Kit: Okay, back to Polaris. Polaris is actually a triple star system and its primary star is a yellow supergiant that is 5.4 times the mass of the sun and has the luminosity of 1,260 suns.

Jordan: Wow.

Kit: Yeah. Its companions are two main sequence stars, one of which orbits very close at around 18.5 au, and the other that orbits way far away at 24,000 AU. And the system itself, the Polaris system, these three stars are located 430 light years away from us.

Jordan: Three stars, Polaris and quite a range All right Kit, now that you've delivered the good news that the North star it is just a temporary host, what will the next one be? Will it be as good as Alpha Ursae Minoris?

Kit: Well, in around 4000 CE, our North star will be probably close to Gamma Cephei. Further in the future it'll be some brighter, more famous stars, including Denib in the constellation Cygnus and Vega in the constellation Lyra. Although neither of these stars will be precisely at the center of the pole. But they will be much, much brighter than Polaris and Gamma Cephei. And they will eventually sort of occupy that pole star position.

## **Bayer's Variable Star**

So now we know some key facts about Polaris, let's get into our next segment: Bayer's variable star where we move through the Greek alphabet in order usually to learn more about another Bayer designated star in the night sky. Since we're in a whole new

season, we decided to just restart with Beta. So what do you have about Beta Ursae Minoris, Jordan? What did you find out?

Jordan: Well, Kit, it's a bit early in the season episode one to go off the assignment, but no promises for the rest of the season. Kit, you know me. I will follow my heart.

Kit: You should

Jordan: to stay on assignment. At least the star is off this season. Beta Ursae Minoris has the official name Kochab, which seems to have some ambiguous origins. Some sources suggest it might be from either Arabic or Hebrew word meaning planet or star. Regardless, at times, this designation with the Beta is actually the brightest star in the constellation with an apparent magnitude of 2.08. As you mentioned earlier, Polaris is a variable star that sometimes gets as dim as 2.13.

Kit: And just a little reminder, in the apparent magnitude scale, positive numbers are dimmer and negative numbers are brighter. So for reference, our sun has an apparent magnitude of negative 26.83.

Jordan: It's a very logical system. It makes a lot of sense. We don't argue with it.

Kit: Not confusing at all.

Jordan: Not confusing at all. Why the sun isn't just like zero or?

Kit: Right.

Jordan: Kochab is about 131 light years from Earth. It is a K type red or orange giant star that is about 44 times the radius of our Sun. So it's going through that process of glowing up and out before it sheds its outer layers and then likely become a white dwarf with a planetary nebulae around it.

Kit: Our sun will eventually go through a pretty similar process because stars that are low or intermediate mass generally follow this path.

Jordan: Aside from a planet six times the mass of Jupiter, probably the most fun fact about this star is it is one of the

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Jordan: two stars used to find true north around 2500 BC. As such, the distance between Kochab and a star in Ursa Major were used to align the Great Pyramid of Giza.

Kit: Speaking of great, great, great.

Jordan: Let's take a quick break and then we'll come back for your Gold star selection this month.

## **Gold Star**

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, hopefully even our soul. What was your pick this month, Kit?



Kit: Well, I had a few top choices despite the fact that this is an area with relatively few deep sky objects. So I narrowed it down to two runners up in one winner.

Jordan: Look at you starting to bend the rules, just a little bit. So let's have the runners up first, Kit.

Kit: All right, so my first runner up is NGC 6251 which is a radio Galaxy located 340 million light years away and is a Seyfert 2 active galactic nucleus.

Jordan: Say that 10 times fast.

Kit: Yeah.

Jordan: My Gold star winner, NGC 1275 from the constellation Perseus was also a Seyfert Galaxy.

Kit: Precisely. So this one's a runner up. Seyfert galaxies are very cool and they're very weird to think about. Um, and this one has a one sided radio jet and of course a supermassive black hole.

Jordan: I mean this is all looking pretty good.

Kit: But we just talked about Seyfert galaxies recently and I wasn't fully won over. So that's why it's a runner up. My second runner up was R.W. Ursae Minoris because it is a cataclysmic variable star system which had a nova in 1956.

Jordan: Cataclysmic variable star wow. Say more.

Kit: So like many novas, but not supernovas. They're different things. So like many novas, we're basically talking about a donor star feeding a white dwarf. But unlike other recurrent nova, which we've talked about before.

Jordan: Looking at you T Cor Bor.

Kit: Yes. This one though, is irregular and unpredictable and that's kind of weird. And I mostly picked it because I liked the name. It was very dramatic.

Jordan: It's a great name and I can't blame you for picking it for that.

Kit: In the end though, my winner was Ursa Minor Dwarf, which is a dwarf spheroidal galaxy, the center of which is 225,000 light years from Earth.

Jordan: I think this is the first time we've heard this designation of a dwarf spheroidal galaxy. So what's going on here? What are they?

Kit: Yeah, that's kind of what pushed it over the edge to win the Gold Star. So this designation is used to describe small, low luminosity galaxies that are old. So they're not full of dust, they're not making new stars, which is what distinguishes them from dwarf elliptical galaxies. Usually these galaxies are pretty large, like across, but they are really hard to find because of that low luminosity, these sort of low light output that they're giving us because of their age.

Jordan: That makes sense.

Kit: Now the interesting and intriguing thing to me about these galaxies is that they

seem to have really high mass given their low luminosity, which has led some astronomers posit that these are spaces with significant dark matter. And they've given it the title, and I'm going to quote here, most dark matter dominated galaxies.

Jordan: The mystery of it makes Dark Matter an incredibly good choice.

Kit: Yeah, and that's kind of why I like it. Dark Matter is just kind of an interesting, interesting topic. But the basic idea in my understanding is that these galaxies are galaxies are not just globular clusters or faint star clusters because of the dark matter in them. So that's what sort of distinguishes them from just a cluster of stars. But at any rate, the Ursa Minor dwarf itself was discovered in 1955 during the Palomar Sky Survey, and it's a satellite galaxy of our own Milky Way.

Jordan: Wow. I guess I never really thought about that, galaxies could have satellite galaxies. A welcome season three to Gold Star winner number one Ursa Minor Dwarf.

## **Outro**

Jordan: This brings us to the end of our exploration of the cosmic background of the constellation Ursa Minor. Next week we'll be retelling and ret- constellationing the myth of this constellation.

Kit: This has been Kit

Jordan: And Jordan.

Kit: Sisters, who love stars and stories.

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Jordan: And we'll see you next time

Kit: on Starry Time.

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