

= Ursa Minor =

Ursa Minor ( Latin : " Smaller She @-@ Bear " , contrasting with Ursa Major ) , also known as the Little Bear , is a constellation in the Northern Sky . Like the Great Bear , the tail of the Little Bear may also be seen as the handle of a ladle , hence the North American name , Little Dipper : seven stars with four in its bowl like its partner the Big Dipper . It was one of the 48 constellations listed by the 2nd @-@ century astronomer Ptolemy , and remains one of the 88 modern constellations . Ursa Minor has traditionally been important for navigation , particularly by mariners , because of Polaris being the North Star .

Polaris , the brightest star in the constellation , is a yellow @-@ white supergiant and the brightest Cepheid variable star in the night sky , ranging from an apparent magnitude of 1 @.@ 97 to 2 @.@ 00 . Beta Ursae Minoris , also known as Kochab , is an aging star that has swollen and cooled to become an orange giant with an apparent magnitude of 2 @.@ 08 , only slightly fainter than Polaris . Kochab and magnitude 3 Gamma Ursae Minoris have been called the " guardians of the pole star " . Planets have been detected orbiting four of the stars , including Kochab . The constellation also contains an isolated neutron star ? Calvera ? and H1504 + 65 , the hottest white dwarf yet discovered , with a surface temperature of 200 @,@ 000 K.

= = History and mythology = =

In the Babylonian star catalogues , Ursa Minor was known as MAR.GID.DA.AN.NA , the Wagon of Heaven , Damkianna . It appeared on a pair of tablets containing canonical star lists that were compiled around 1000 BC , the MUL.APIN , and was one of the " Stars of Enlil " ? that is , the northern sky . The possible origin of its name was its appearing to rotate like a wheel around the north celestial pole .

The first mention of Ursa Minor in Greek texts was by philosopher Thales of Miletus in the 6th century BC . He pointed out that it was a more accurate guide to finding true north than Ursa Major . This knowledge had reportedly come from the Phoenicians in the eastern Mediterranean , and the constellation bore the term Phoinik? . Homer had previously only referred to one " bear " , raising the question of what he saw the stars of Ursa Minor as , or whether they were recognized as a constellation at all .

Ursa Minor and Ursa Major were related by the Greeks to the myth of Callisto and her son Arcas , both placed in the sky by Zeus . In a variant of the story in which Boötes represents Arcas , Ursa Minor represents a dog . This is the older tradition , which explains both the length of the tail and the obsolete alternate name of Cynosura ( the dog 's tail ) for Polaris , the North Star . Cynosura is also described as a nurse of Zeus , honoured by the god with a place in the sky . An alternate myth tells of two bears that saved Zeus from his murderous father Kronos by hiding him on Mount Ida . Later Zeus set them in the sky , but their tails grew long from being swung by the god . Because Ursa Minor consists of seven stars , the Latin word for " North " ( i.e. , where Polaris points ) is septentrio , from septem ( seven ) and triones ( oxen ) , from seven oxen driving a plough , which the seven stars also resemble . This name has also been attached to the main stars of Ursa Major .

Ursa Minor has traditionally been important for navigation , particularly by mariners , because of Polaris being the North Star . Polaris is currently less than one degree away from the north celestial pole ( hence the alternative name Pole Star ) so its position in the sky is largely unaffected by the rotation of the Earth . From any point in the Northern Hemisphere the direction to Polaris is always north and its angular altitude is roughly equal to the latitude .

In Inuit astronomy , the three brightest stars ? Polaris , Kochab and Pherkad ? were known as Nuutuittut " never moving " , though the term is more frequently used in the singular to refer to Polaris alone . The Pole Star is too high in the sky at far northern latitudes to be of use in navigation .

= = Characteristics = =

Ursa Minor is bordered by Camelopardalis to the west, Draco to the west, and Cepheus to the east. Covering 256 square degrees, it ranks 56th of the 88 constellations in size. Ursa Minor is colloquially known in the US as the Little Dipper because its seven brightest stars seem to form the shape of a dipper (ladle or scoop). The star at the end of the dipper handle is Polaris. Polaris can also be found by following a line through the two stars  $\alpha$  and  $\beta$  Ursae Majoris that form the end of the 'bowl' of the Big Dipper, for 30 degrees (three upright fists at arms' length) across the night sky. The four stars constituting the bowl of the Little Dipper are of second, third, fourth, and fifth magnitudes, and provide an easy guide to determining what magnitude stars are visible, useful for city dwellers or testing one's eyesight.

The three-letter abbreviation for the constellation, as adopted by the IAU (International Astronomical Union) in 1922, is "UMi". The official constellation boundaries, as set by Eugène Delporte in 1930, are defined by a polygon of 22 segments (illustrated in infobox). In the equatorial coordinate system, the right ascension coordinates of these borders lie between 08h 41.4m and 22h 54.0m, while the declination coordinates range from the north celestial pole south to  $65^\circ 40'$ . Its position in the far northern celestial hemisphere means that the whole constellation is only visible to observers in the northern hemisphere.

== Features ==

=== Stars ===

The German cartographer Johann Bayer used the Greek letters alpha to theta to label the most prominent stars in the constellation, while his countryman Johann Elert Bode subsequently added iota to phi. Only lambda and pi remain in use, likely because of their proximity to the north celestial pole. Within the constellation's borders, there are 39 stars brighter than or equal to apparent magnitude 6.5.

Marking the Little Bear's tail, Polaris, or Alpha Ursae Minoris, is the brightest star in the constellation, varying between apparent magnitude 1.97 and 2.00 over a period of 3.97 days. Located around 432 light years away from Earth, it is a yellow-white supergiant that varies between spectral types F7Ib and F8Ib, and has around 6 times the Sun's mass, 2,500 times its luminosity and 45 times its radius. Polaris is the brightest Cepheid variable star visible from Earth. It is a triple star system, the supergiant primary star having two yellow-white main sequence star companions that are 17 and 2,400 astronomical units (AU) distant and take 29.6 and 42,000 years respectively to complete one orbit.

Traditionally called Kochab, Beta Ursae Minoris at apparent magnitude 2.08 is only slightly less bright than Polaris. Located around 131 light years away from Earth, it is an orange giant, an evolved star that has used up the hydrogen in its core and moved off the main sequence of spectral type K4III. Slightly variable over a period of 4.6 days, Kochab has had its mass estimated at 1.3 times that of the Sun via measurement of these oscillations. Kochab is 450 times more luminous than the Sun and has 42 times its diameter, with a surface temperature of approximately 4,130 K. Estimated to be around 2.95 billion years old, give or take 1 billion years, Kochab was announced to have a planetary companion around 6.1 times as massive as Jupiter with an orbit of 522 days.

Traditionally known as Pherkad, Gamma Ursae Minoris has an apparent magnitude that varies between 3.04 and 3.09 roughly every 3.4 hours. It and Kochab have been termed the "guardians of the pole star". A white bright giant of spectral type A3II-III, with around 4.8 times the Sun's mass, 1,050 times its luminosity and 15 times its radius, it is  $487 \pm 8$  light years distant from Earth. Pherkad belongs to a class of stars known as Delta Scuti variables, short period (six hours at most) pulsating stars that have been used as standard candles and as subjects to study asteroseismology. Also possibly a member of this class is Zeta Ursae Minoris, a white star of spectral type A3V, which has begun cooling, expanding and brightening. It is likely to have been a B3 main sequence star and is now slightly variable. At

magnitude 4 @. @ 95 the dimmest of the seven stars of the Little Dipper is Eta Ursae Minoris . A yellow @- @ white main @- @ sequence star of spectral type F5V , it is 97 light @- @ years distant . It is double the Sun 's diameter , 1 @. @ 4 times as massive , and shines with 7 @. @ 4 times its luminosity . Nearby Zeta lies 5 @. @ 00 @- @ magnitude Theta Ursae Minoris . Located  $860 \pm 80$  light @- @ years distant , it is an orange giant of spectral type K5III that has expanded and cooled off the main sequence , and has an estimated diameter around 4 @. @ 8 times that of the Sun .

Making up the handle of the Little Dipper are Delta and Epsilon Ursae Minoris . Just over 3 @. @ 5 degrees from the north celestial pole , Delta is a white main @- @ sequence star of spectral type A1V with an apparent magnitude of 4 @. @ 35 , located  $172 \pm 1$  light @- @ years from Earth . Bearing the proper name of Yildun , it has around 2 @. @ 8 times the diameter and 47 times the luminosity of the Sun . A triple star system , Epsilon Ursae Minoris shines with a combined average light of magnitude 4 @. @ 22 . A yellow giant of spectral type G5III , the primary is an RS Canum Venaticorum variable star . It is a spectroscopic binary , with a companion 0 @. @ 36 AU distant , and a third star ? an orange main @- @ sequence star of spectral type K0 ? 8100 AU distant .

Located close to Polaris is Lambda Ursae Minoris , a red giant of spectral type M1III . It is a semiregular variable varying from magnitudes 6 @. @ 35 to 6 @. @ 45 . The northerly nature of the constellation means that the variable stars can be observed all year : the red giant R Ursae Minoris is a semiregular variable varying from magnitude 8 @. @ 5 to 11 @. @ 5 over 328 days , while S Ursae Minoris is a long period variable that ranges between magnitudes 8 @. @ 0 and 11 over 331 days . Located south of Kochab and Pherkad towards Draco is RR Ursae Minoris , a red giant of spectral type M5III that is also a semiregular variable ranging from magnitude 4 @. @ 44 to 4 @. @ 85 over a period of 43 @. @ 3 days . T Ursae Minoris is another red giant variable star that has undergone a dramatic change in status ? from being a long period ( Mira ) variable ranging from magnitude 7 @. @ 8 to 15 over 310 ? 315 days to a semiregular variable . The star is thought to have undergone a shell helium flash ? a point where the shell of helium around the star 's core reaches a critical mass and ignites ? marked by its abrupt change in variability in 1979 . Z Ursae Minoris is a faint variable star that suddenly dropped 6 magnitudes in 1992 and was identified as one of a rare class of stars ? R Coronae Borealis variables .

Eclipsing variables are star systems that vary in brightness because of one star passing in front of the other rather than from any intrinsic change in luminosity . W Ursae Minoris is one such system , its magnitude ranging from 8 @. @ 51 to 9 @. @ 59 over 1 @. @ 7 days . The combined spectrum of the system is A2V , but the masses of the two component stars are unknown . A slight change in the orbital period in 1973 suggests there is a third component of the multiple star system ? most likely a red dwarf ? with an orbital period of  $62 @. @ 2 \pm 3 @. @ 9$  years . RU Ursae Minoris is another example , ranging from 10 to 10 @. @ 66 over 0 @. @ 52 days . It is a semidetached system , as the secondary star is filling its Roche lobe and transferring matter to the primary .

RW Ursae Minoris is a cataclysmic variable star system that flared up as a nova in 1956 , reaching magnitude 6 . In 2003 , it was still two magnitudes brighter than its baseline , and dimming at a rate of 0 @. @ 02 magnitude a year . Its distance has been calculated as  $5 @, @ 000 \pm 800$  parsecs (  $16 @, @ 300$  light @- @ years ) , which puts its location in the galactic halo .

Taken from the villain in The Magnificent Seven , Calvera is the nickname given to an X @- @ ray source known as 1RXS J141256.0 + 792204 in the ROSAT All @- @ Sky Survey Bright Source Catalog ( RASS / BSC ) . It has been identified as an isolated neutron star , one of the closest of its kind to Earth . Ursa Minor has two enigmatic white dwarfs . H1504 + 65 is a faint ( magnitude 15 @. @ 9 ) star that with the hottest surface temperature ? 200 @, @ 000 K ? yet discovered for a white dwarf . Its atmosphere , composed of roughly half carbon , half oxygen and 2 % neon , is devoid of hydrogen and helium ? its composition unexplainable by current models of stellar evolution . WD 1337 + 705 is a cooler white dwarf that has magnesium and silicon in its spectrum , suggesting a companion or circumstellar disk , though no evidence for either has come to light . WISE 1506 + 7027 is a brown dwarf of spectral type T6 that is a mere 11 @. @ 1 + 2 @. @ 3

? 1 @. @ 3 light @- @ years away from Earth . A faint object of magnitude 14 , it was discovered by the Wide @- @ field Infrared Survey Explorer ( WISE ) in 2011 .

Kochab aside , three more stellar systems have been discovered to contain planets . 11 Ursae

Minoris is an orange giant of spectral type K4III around 1 @. @ 8 times as massive as the Sun . Around 1 @. @ 5 billion years old , it has cooled and expanded since it was an A @- @ type main sequence star . Around 390 light @- @ years distant , it shines with an apparent magnitude of 5 @. @ 04 . A planet around 11 times the mass of Jupiter was discovered orbiting the star with a period of 516 days in 2009 . HD 120084 is another evolved star , this time a yellow giant of spectral type G7III , around 2 @. @ 4 times the mass of the Sun . It has a planet 4 @. @ 5 times the mass of Jupiter with one of the most eccentric planetary orbits ( with an eccentricity of 0 @. @ 66 ) , discovered by precisely measuring the radial velocity of the star in 2013 . HD 150706 is a sunlike star of spectral type G0V some 89 light @- @ years distant from the Solar System . It was thought to have a planet as massive as Jupiter at a distance of 0 @. @ 6 AU , but this was discounted in 2007 . A further study published in 2012 showed that it has a companion around 2 @. @ 7 times as massive as Jupiter that takes around 16 years to complete an orbit and is 6 @. @ 8 AU distant from its Sun .

= = = Deep @- @ sky objects = = =

Ursa Minor is rather devoid of deep @- @ sky objects . The Ursa Minor Dwarf , a dwarf spheroidal galaxy , was discovered by Albert George Wilson of the Lowell Observatory in the Palomar Sky Survey in 1955 . Its centre is around 225000 light @- @ years distant from Earth . In 1999 , Kenneth Mighell and Christopher Burke used the Hubble Space Telescope to confirm that it had a single burst of star formation that lasted around 2 billion years that took place around 14 billion years ago , and that the galaxy was probably as old as the Milky Way itself .

NGC 6217 is a barred spiral galaxy located some 67 million light @- @ years away , which can be located with a 10 cm ( 4 in ) or larger telescope as an 11th magnitude object about 2 @. @ 5 ° east @- @ northeast of Zeta Ursae Minoris . It has been characterized as a starburst galaxy , which means it is undergoing a high rate of star formation compared to a typical galaxy .

NGC 6251 is an active supergiant elliptical radio galaxy more than 340 million light @- @ years away from Earth . It has a Seyfert 2 active galactic nucleus , and is one of the most extreme examples of a Seyfert galaxy . This galaxy may be associated with gamma @- @ ray source 3EG J1621 + 8203 , which has high @- @ energy gamma @- @ ray emission . It is also noted for its one @- @ sided radio jet ? one of the brightest known ? discovered in 1977 .

= = = Meteor showers = = =

The Ursids , a prominent meteor shower that occurs in Ursa Minor , peaks between December 18 and 25 . Its parent body is the comet 8P / Tuttle .

= = = Chinese constellation = = =

The map of Ursa Minor in the Chinese constellation :