= Auriga (constellation) =

Auriga is one of the 48 constellations listed by the 2nd @-@ century astronomer Ptolemy and remains one of the 88 modern constellations . Located north of the celestial equator , its name is the Latin word for " charioteer " , associating it with various mythological charioteers , including Erichthonius and Myrtilus . Auriga is most prominent during winter evenings in the Northern Hemisphere , along with the five other constellations that have stars in the Winter Hexagon asterism . Because of its northern declination , Auriga is only visible in its entirety as far as 34 ° south ; for observers farther south it lies partially or fully below the horizon . A large constellation , with an area of 657 square degrees , it is half the size of the largest constellation , Hydra .

Its brightest star , Capella , is an unusual multiple star system among the brightest stars in the night sky . Beta Aurigae is an interesting variable star in the constellation ; Epsilon Aurigae , a nearby eclipsing binary with an unusually long period , has been studied intensively . Because of its position near the winter Milky Way , Auriga has many bright open clusters in its borders , including M36 , M37 , and M38 , popular targets for amateur astronomers . In addition , it has one prominent nebula , the Flaming Star Nebula , associated with the variable star AE Aurigae .

In Chinese mythology , Auriga 's stars were incorporated into several constellations , including the celestial emperors ' chariots , made up of the modern constellation 's brightest stars . Auriga is home to the radiant for the Aurigids , Zeta Aurigids , Delta Aurigids , and the hypothesized Iota Aurigids .

= = History and mythology = =

The first record of Auriga 's stars was in Mesopotamia as a constellation called GAM , representing a scimitar or crook . However , this may have represented just Capella (Alpha Aurigae) or the modern constellation as a whole ; this figure was alternatively called Gamlum or MUL.GAM in the MUL.APIN. The crook of Auriga stood for a goat @-@ herd or shepherd . It was formed from most of the stars of the modern constellation ; all of the bright stars were included except for Elnath , traditionally assigned to both Taurus and Auriga . Later , Bedouin astronomers created constellations that were groups of animals , where each star represented one animal . The stars of Auriga comprised a herd of goats , an association also present in Greek mythology . The association with goats carried into the Greek astronomical tradition , though it later became associated with a charioteer along with the shepherd .

In Greek mythology , Auriga is often identified as the mythological Greek hero Erichthonius of Athens , the chthonic son of Hephaestus who was raised by the goddess Athena . Erichthonius was generally credited to be the inventor of the quadriga , the four @-@ horse chariot , which he used in the battle against the usurper Amphictyon , the event that made Erichthonius the king of Athens . His chariot was created in the image of the Sun 's chariot , the reason Zeus placed him in the heavens . The Athenian hero then dedicated himself to Athena and soon after , Zeus raised him into the night sky in honor of his ingenuity and heroic deeds .

Auriga , however , is sometimes described as Myrtilus , who was Hermes 's son and the charioteer of Oenomaus . The association of Auriga and Myrtilus is supported by depictions of the constellation , which rarely show a chariot . Myrtilus 's chariot was destroyed in a race intended for suitors to win the heart of Oenomaus 's daughter Hippodamia . Myrtilus earned his position in the sky when Hippodamia 's successful suitor , Pelops , killed him , despite his complicity in helping Pelops win her hand . After his death , Myrtilus 's father Hermes placed him in the sky . Yet another mythological association of Auriga is Theseus 's son Hippolytus . He was ejected from Athens after he refused the romantic advances of his stepmother Phaedra , who committed suicide as a result . He was killed when his chariot was wrecked , but revived by Asclepius . Regardless of Auriga 's specific representation , it is likely that the constellation was created by the ancient Greeks to commemorate the importance of the chariot in their society .

An incidental appearance of Auriga in Greek mythology is as the limbs of Medea 's brother . In the myth of Jason and the Argonauts , as they journeyed home , Medea killed her brother and dismembered him , flinging the parts of his body into the sea , represented by the Milky Way . Each

individual star represents a different limb .

Capella is associated with the mythological she @-@ goat Amalthea , who breast @-@ fed the infant Zeus . It forms an asterism with the stars Epsilon Aurigae , Zeta Aurigae , and Eta Aurigae , the latter two of which are known as the Haedi (the Kids) . Though most often associated with Amalthea , Capella has sometimes been associated with Amalthea 's owner , a nymph . The myth of the nymph says that the goat 's hideous appearance , resembling a Gorgon , was partially responsible for the Titans ' defeat , because Zeus skinned the goat and wore it as his aegis . The asterism containing the three goats had been a separate constellation ; however , Ptolemy merged the Charioteer and the Goats in the 2nd century Almagest . Before that , Capella was sometimes seen as its own constellation ? by Pliny the Elder and Manilius ? called Capra , Caper , or Hircus , all of which relate to its status as the " goat star " . Zeta Aurigae and Eta Aurigae were first called the " Kids " by Cleostratus , an ancient Greek astronomer .

Traditionally , illustrations of Auriga represent it as a chariot and its driver . The charioteer holds a goat over his left shoulder and has two kids under his left arm ; he holds the reins to the chariot in his right hand . However , depictions of Auriga have been inconsistent over the years . The reins in his right hand have also been drawn as a whip , though Capella is almost always over his left shoulder and the Kids under his left arm . The 1488 atlas Hyginus deviated from this typical depiction by showing a four @-@ wheeled cart driven by Auriga , who holds the reins of two oxen , a horse , and a zebra . Jacob Micyllus depicted Auriga in his Hyginus of 1535 as a charioteer with a two @-@ wheeled cart , powered by two horses and two oxen . Arabic and Turkish depictions of Auriga varied wildly from those of the European Renaissance ; one Turkish atlas depicted the stars of Auriga as a mule , called Mulus clitellatus by Johann Bayer . One unusual representation of Auriga , from 17th @-@ century France , showed Auriga as Adam kneeling on the Milky Way , with a goat wrapped around his shoulders .

Occasionally , Auriga is seen not as the Charioteer but as Bellerophon , the mortal rider of Pegasus who dared to approach Mount Olympus . In this version of the tale , Jupiter pitied Bellerophon for his foolishness and placed him in the stars .

Some of the stars of Auriga were incorporated into a now @-@ defunct constellation called Telescopium Herschelii . This constellation was introduced by Maximilian Hell to honor William Herschel 's discovery of Uranus . Originally , it included two constellations , Tubus Hershelii Major [sic] , in Gemini , Lynx , and Auriga , and Tubus Hershelii Minor [sic] in Orion and Taurus ; both represented Herschel 's telescopes . Johann Bode combined Hell 's constellations into Telescopium Herschelii in 1801 , located mostly in Auriga .

Since the time of Ptolemy , Auriga has remained a constellation and is officially recognized by the International Astronomical Union , although like all modern constellations , it is now defined as a specific region of the sky that includes both the ancient pattern and the surrounding stars . In 1922 , the IAU designated its recommended three @-@ letter abbreviation , " Aur " . The official boundaries of Auriga were created in 1930 by Eugène Delporte as a polygon of 21 segments . Its right ascension is between 4h 37.5m and 7h 30.5m and its declination is between 27 @.@ 9 ° and 56 @.@ 2 ° in the equatorial coordinate system .

= = = In non @-@ Western astronomy = = =

The stars of Auriga were incorporated into several Chinese constellations . Wuche , the five chariots of the celestial emperors and the representation of the grain harvest , was a constellation formed by Alpha Aurigae , Beta Aurigae , Beta Tauri , Theta Aurigae , and Iota Aurigae . Sanzhu or Zhu was one of three constellations which represented poles for horses to be tethered . They were formed by the triplets of Epsilon , Zeta , and Eta Aurigae ; Nu , Tau , and Upsilon Aurigae ; and Chi and 26 Aurigae , with one other undetermined star . Xianchi , the pond where the sun set and Tianhuang , a pond , bridge , or pier , were other constellations in Auriga , though the stars that composed them are undetermined . Zuoqi , representing chairs for the emperor and other officials , was made up of nine stars in the east of the constellation . Bagu , a constellation mostly formed from stars in Camelopardalis representing different types of crops , included the northern stars of

Delta and Xi Aurigae .

In ancient Hindu astronomy , Capella represented the heart of Brahma and was important religiously . Ancient Peruvian peoples saw Capella , called Colca , as a star intimately connected to the affairs of shepherds .

In Brazil , the Bororo people incorporate the stars of Auriga into a massive constellation representing a caiman ; its southern stars represent the end of the animal 's tail . The eastern portion of Taurus is the rest of the tail , while Orion is its body and Lepus is the head . This constellation arose because of the prominence of caymans in daily Amazonian life . There is evidence that Capella was significant to the Aztec people , as the Late Classic site Monte Albán has a marker for the star 's heliacal rising . Indigenous peoples of California and Nevada also noticed the bright pattern of Auriga 's stars . To them , the constellation 's bright stars formed a curve that was represented in crescent @-@ shaped petroglyphs . The indigenous Pawnee of North America recognized a constellation with the same major stars as modern Auriga : Alpha , Beta , Gamma (Beta Tauri) , Theta , and Iota Aurigae .

The people of the Marshall Islands featured Auriga in the myth of Dümur , which tells the story of the creation of the sky . Antares in Scorpius represents Dümur , the oldest son of the stars ' mother , and the Pleiades represent her youngest son . The mother of the stars , Ligedaner , is represented by Capella ; she lived on the island of Alinablab . She told her sons that the first to reach an eastern island would become the King of the Stars , and asked Dümur to let her come in his canoe . He refused , as did each of her sons in turn , except for Pleiades . Pleiades won the race with the help of Ligedaner , and became the King of the Stars . Elsewhere in the central Caroline Islands , Capella was called Jefegen uun (variations include efang alul , evang @-@ el @-@ ul , and iefangel uul) , meaning " north of Aldebaran " . Different names were noted for Auriga and Capella in Eastern Pacific societies . On Pukapuka , the figure of modern Auriga was called Te Wale @-@ o @-@ Tutakaiolo (" The house of Tutakaiolo ") ; in the Society Islands , it was called Faa @-@ nui (" Great Valley ") . Capella itself was called Tahi @-@ anii (" Unique Sovereign ") in the Societies . Hoku @-@ lei was the name for Capella but may have been the name for the whole constellation ; the name means " Star @-@ wreath " and refers to one of the wives of the Pleiades , called Makalii .

The stars of Auriga feature in Inuit constellations . Quturjuuk , meaning " collar @-@ bones " , was a constellation that included Capella (Alpha Aurigae) , Menkalinan (Beta Aurigae) , Pollux (Beta Geminorum) , and Castor (Alpha Geminorum) . Its rising signalled that the constellation Aagjuuk , made up of Altair (Alpha Aquilae) , Tarazed (Gamma Aquilae) , and sometimes Alshain (Beta Aquilae) , would rise soon . Aagjuuk , which represented the dawn following the winter solstice , was an incredibly important constellation in the Inuit mythos . It was also used for navigation and time @-@ keeping at night .

= = Notable features = =

= = = Stars = = =

= = = = Bright stars = = = =

Alpha Aurigae (Capella) , the brightest star in Auriga , is a G8III class star (G @-@ type giant) 43 light @-@ years away and the sixth brightest star in the night sky at magnitude 0 @.@ 08 . Its traditional name is a reference to its mythological position as Amalthea ; it is sometimes called the " Goat Star " . Capella 's names all point to this mythology . In Arabic , Capella was called al- ' Ayyuq , meaning " the goat " , and in Sumerian , it was called mul.Á?.KAR , " the goat star " . On Ontong Java , Capella was called ngahalapolu . Capella is a spectroscopic binary with a period of 104 days ; the components are both yellow giants , more specifically , the primary is a G @-@ type star and the secondary is between a G @-@ type and F @-@ type star in its evolution . The secondary is

formally classified as a G0III class star (G @-@ type giant) . The primary has a radius of 11 @.@ 87 solar radii (R ?) and a mass of 2 @.@ 47 solar masses (M ?) ; the secondary has a radius of 8 @.@ 75 R ? and a mass of 2 @.@ 44 M ? . The two components are separated by 110 million kilometers , almost 75 % of the distance between the Earth and the Sun . The star 's status as a binary was discovered in 1899 at the Lick Observatory ; its period was determined in 1919 by J.A. Anderson at the 100 @-@ inch Mt . Wilson Observatory telescope . It appears with a golden @-@ yellow hue , though Ptolemy and Giovanni Battista Riccioli both described its color as red , a phenomenon attributed not to a change in Capella 's color but to the idiosyncrasies of their color sensitivities . Capella has an absolute magnitude of 0 @.@ 3 and a luminosity of 160 times the luminosity of the Sun , or 160 L ? (the primary is 90 L ? and the secondary is 70 L ?) . It may be loosely associated with the Hyades , an open cluster in Taurus , because of their similar proper motion . Capella has one more companion , Capella H , which is a pair of red dwarf stars located 11 @,@ 000 astronomical units (0 @.@ 17 light @-@ years) from the main pair .

Beta Aurigae (Menkalinan , Menkarlina) is a bright A2IV class star (A @-@ type subgiant) . Its Arabic name comes from the phrase mankib dhu al- ' inan , meaning " shoulder of the charioteer " and is a reference to Beta Aurigae 's location in the constellation . Menkalinan is 81 light @-@ years away and has a magnitude of 1 @.@ 90 . Like Epsilon Aurigae , it is an eclipsing binary star that varies in magnitude by 0.1m. The two components are blue @-@ white stars that have a period of 3 @.@ 96 days . Its double nature was revealed spectroscopically in 1890 by Antonia Maury , making it the second spectroscopic binary discovered , and its variable nature was discovered photometrically 20 years later by Joel Stebbins . Menkalinan has an absolute magnitude of 0 @.@ 6 and a luminosity of 50 L ? . The component of its motion in the direction of Earth is 18 kilometres (11 mi) per second . Beta Aurigae may be associated with a stream of about 70 stars including Delta Leonis and Alpha Ophiuchi ; the proper motion of this group is comparable to that of the Ursa Major Moving Group , though the connection is only hypothesized . Besides its close eclipsing companion , Menkalinan has two other stars associated with it . One is an unrelated optical companion , discovered in 1783 by William Herschel ; it has a magnitude of 10 @.@ 5 and has a separation of 184 arcseconds . The other is likely associated gravitationally with the primary , as determined by their common proper motion . This 14th magnitude star was discovered in 1901 by Edward Emerson Barnard . It has a separation of 12 @.@ 6 arcseconds , and is around 350 astronomical units from the primary .

= = = = Other bright stars = = = =

Besides the particularly bright stars of Alpha and Beta Aurigae , the constellation has many dimmer stars . Gamma Aurigae , now Beta Tauri (El Nath , Alnath) is a B7III class star (B @-@ type giant) . It was originally considered to be a part of both Auriga and Taurus , but is now classified only as Beta Tauri . Iota Aurigae , also called Hasseleh and Kabdhilinan , is a K3II class star (K @-@ type bright giant) of magnitude 2 @.@ 69 ; it is 494 light @-@ years away from Earth . It evolved from a B @-@ type star to a K @-@ type star over the estimated 30 ? 45 million years since its birth . Iota Aurigae has an absolute magnitude of ? 2 @.@ 3 and a luminosity of 700 L ? . It is classed as a particularly luminous bright giant , but appears dimmer than it should because dust clouds in the Milky Way block some of its light ; astronomers estimate that it appears 0 @.@ 6 magnitudes fainter . It is also a hybrid star , an x @-@ ray producing giant star that emits x @-@ rays from its corona and has a cool stellar wind . Though its proper motion is just 0 @.@ 02 arcseconds per year , it has a radial velocity of 10 @.@ 5 miles (16 @.@ 9 km) per second in recession . The traditional name Kabdhilinan , sometimes shortened to " Alkab " , comes from the Arabic phrase al @-@ kab dh 'il inan , meaning " shoulder of the rein holder " . Iota Aurigae may end as a supernova , but because it is close to the mass limit for such stars , it may instead become a white dwarf .

Delta Aurigae , the northernmost bright star in Auriga , is a K0III @-@ type star (K @-@ type giant) , 126 light @-@ years from Earth and approximately 1 @.@ 3 billion years old . It has a magnitude of 3 @.@ 72 , an absolute magnitude of 0 @.@ 2 , and a luminosity of 60 L ? . About 12 times the radius of the Sun , Delta Aurigae weighs only two solar masses and rotates with a period of almost

one year . Though it is often listed as a single star , it actually has three very widely spaced optical companions . One is a double star of magnitude 11 , two arcminutes from Delta , and the other is a star of magnitude 10 , three arcminutes from Delta .

Lambda Aurigae (Al Hurr) is a G1.5IV @-@ V @-@ type star (G @-@ type star intermediate between a subgiant and main @-@ sequence star) of magnitude 4 @.@ 71 . It has an absolute magnitude of 4 @.@ 4 and is located 41 light @-@ years from Earth . It has very weak emissions in the infrared spectrum , like Epsilon Aurigae . In photometric observations of Epsilon , an unusual variable , Lambda Aurigae is commonly used as a comparison star . It is reaching the end of its hydrogen @-@ fusing lifespan at an age of 6 @.@ 2 billion years . It also has an unusually high radial velocity at 83 km / second . Though older than the Sun , it is similar in many ways ; its mass is 1 @.@ 07 solar masses , a radius of 1 @.@ 3 solar radii , and a rotational period of 26 days . However , it differs from the Sun in its metallicity ; its iron content is 1 @.@ 15 times that of the Sun and it has relatively less nitrogen and carbon . Like Delta , it has several optical companions and is often categorized as a single star . The brightest companions are of magnitude 10 , separated by 175 and 203 arcseconds . The dimmer companions are of magnitude 13 and 14 , 87 and 310 arcseconds from Lambda , respectively . Nu Aurigae is a G9.5III (G @-@ type giant) star of magnitude 3 @.@ 97 , 230 light @-@ years from Earth . It has a luminosity of 60 L ? and an absolute magnitude of 0 @.@ 2 . Nu Aurigae is a giant star with a radius of 20 ? 21 solar radii and a mass of approximately 3 solar masses . It may technically be a binary star ; its companion , sometimes listed as optical and separated by 56 arcseconds , is a dwarf star of spectral type K6 and magnitude 11 @.@ 4 . Its period is more than 120 @,@ 000 years and it orbits at least 3700 AU from the primary .

= = = = Eclipsing binary stars = = = =

The most prominent variable star in Auriga is Epsilon Aurigae (Al Maz , Almaaz) , an F0 class eclipsing binary star with an unusually long period of 27 years ; its last minima occurred from 1982 ? 1984 and 2009 ? 2011 . The distance to the system is disputed , variously cited as 4600 and 2170 light @-@ years . The primary is a white supergiant , and the secondary may be itself a binary star within a large dusty disk . Its maximum magnitude is 3 @.@ 0 , but it stays at a minimum magnitude of 3 @.@ 8 for around a year ; its most recent eclipse began in 2009 . The primary has an absolute magnitude of ? 8 @.@ 5 and an unusually high luminosity of 200 @,@ 000 L ? , the reason it appears so bright at such a great distance . Epsilon Aurigae is the longest @-@ period eclipsing binary currently known . The first observed eclipse of Epsilon Aurigae occurred in 1821 , though its variable status was not confirmed until the eclipse of 1847 ? 1848 . From that time forward , many theories were put forth as to the nature of the eclipsing component . Epsilon Aurigae has a noneclipsing component , which is visible as a 14th magnitude companion separated from the primary by 28 @.@ 6 arcseconds . It was discovered by Sherburne Wesley Burnham in 1891 at the Dearborn Observatory , and is about 0 @.@ 5 light @-@ years from the primary .

Another eclipsing binary in Auriga , part of the Haedi asterism with Epsilon Aurigae , is Zeta Aurigae (Sadatoni) , an eclipsing binary star at a distance of 776 light @-@ years with a period of 2 years and 8 months . It has an absolute magnitude of ? 2 @.@ 3 . The primary is an orange @-@ hued K5II @-@ type star (K @-@ type bright giant) and the secondary is a smaller blue star similar to Regulus ; its period is 972 days . The secondary is a B7V @-@ type star , a B @-@ type main @-@ sequence star . Zeta Aurigae 's maximum magnitude is 3 @.@ 7 and its minimum magnitude is 4 @.@ 0 . The full eclipse of the small blue star by the orange giant lasts 38 days , with two partial phases of 32 days at the beginning and end . The primary has a diameter of 150 D ? and a luminosity of 700 L ? ; the secondary has a diameter of 4 D ? and a luminosity of 140 L ? . Zeta Aurigae was spectroscopically determined to be a double star by Antonia Maury in 1897 and was confirmed as a binary star in 1908 by William Wallace Campbell . The two stars orbit each other about 500 @,@ 000 @,@ 000 miles (800 @,@ 000 @,@ 000 km) apart . Zeta Aurigae is moving away from Earth at a rate of 8 miles (13 km) per second . The last star in the asterism is Eta Aurigae , a B3 class star located 243 light @-@ years from Earth with a magnitude of 3 @.@ 17 . It

is a B3V class star , meaning that it is a blue @-@ white hued main @-@ sequence star . Eta Aurigae is a part of the Haedi or " Kids " asterism , along with Zeta and Epsilon Aurigae . Eta Aurigae has an absolute magnitude of ? 1 @.@ 7 and a luminosity of 450 L ? . Eta Aurigae is moving away from Earth at a rate of 4 @.@ 5 miles (7 @.@ 2 km) per second .

T Aurigae (Nova Aurigae 1891) was a nova discovered at magnitude 5 @.@ 0 on January 23 , 1892 , by Thomas David Anderson . It became visible to the naked eye by December 10 , 1891 , as shown on photographic plates examined after the nova 's discovery . It then brightened by a factor of 2 @.@ 5 from December 11 to December 20 , when it reached a maximum magnitude of 4 @.@ 4 . T Aurigae faded slowly in January and February 1892 , then faded quickly during March and April , reaching a magnitude of 15 in late April . However , its brightness began to increase in August , reaching magnitude 9 @.@ 5 , where it stayed until 1895 . Over the subsequent two years , its brightness decreased to 11 @.@ 5 , and by 1903 , it was approximately 14th magnitude . By 1925 , it had reached its current magnitude of 15 @.@ 5 . When the nova was discovered , its spectrum showed material moving at a high speed towards Earth . However , when the spectrum was examined again in August 1892 , it appeared to be a planetary nebula . Observations at the Lick Observatory by Edward Emerson Barnard showed it to be disc @-@ shaped , with clear nebulosity in a diameter of 3 arcseconds . The shell had a diameter of 12 arcseconds in 1943 . T Aurigae is classified as a slow nova , similar to DQ Herculis . Like DQ Herculis , WZ Sagittae , Nova Persei 1901 and Nova Aquilae 1918 , it is a very close binary with a very short period . T Aurigae 's period of 4 @.@ 905 hours , comparable to DQ Herculis 's period of 4 @.@ 65 hours , and has a partial eclipse period of 40 minutes .

= = = = Other variable stars = = = =

There are many other variable stars of different types in Auriga. ?1 Aurigae (Dolones) is an orange @-@ hued supergiant , which ranges between magnitudes 4 @.@ 8 and 5 @.@ 7 , though not with a regular period . It has a spectral class of K5Iab , an average magnitude of 4 @.@ 91 , and an absolute magnitude of ? 5 @.@ 7 . Dolones is 3976 light @-@ years from Earth . RT Aurigae is a Cepheid variable which ranges between magnitudes 5 @.@ 0 and 5 @.@ 8 over a period of 3 @.@ 7 days . A yellow @-@ white supergiant , it lies at a distance of 1600 light @-@ years . It was discovered to be variable by English amateur T.H. Astbury in 1905 . It has a spectral class of F81bv , meaning that it is an F @-@ type supergiant star . RX Aurigae is a Cepheid variable as well ; it varies in magnitude from a minimum of 8 @.@ 0 to a maximum of 7 @.@ 3 ; its spectral class is G0Iabv . It has a period of 11 @.@ 62 days . RW Aurigae is the prototype of its class of irregular variable stars . Its variability was discovered in 1906 by Lydia Ceraski at the Moscow Observatory . RW Aurigae 's spectrum indicates a turbulent stellar atmosphere , and has prominent emission lines of calcium and hydrogen . Its spectral type is G5V : e . SS Aurigae is an SS Cygni @-@ type variable star , classified as an explosive dwarf . Discovered by Emil Silbernagel in 1907 , it is almost always at its minimum magnitude of 15 , but brightens to a maximum up to 60 times brighter than the minimum an average of every 55 days , though the period can range from 50 days to more than 100 days . It takes about 24 hours for the star to go from its minimum to maximum magnitude . SS Aurigae is a very close binary star with a period of 4 hours and 20 minutes . Both components are small subdwarf stars ; there has been dispute in the scientific community about which star originates the outbursts . UU Aurigae is a variable red giant star at a distance of 2 @,@ 000 light @-@ years . It has a period of approximately 234 days and ranges between magnitudes 5 @.@ 0 and 7 @.@ 0 .

AE Aurigae is a blue @-@ hued main @-@ sequence variable star . It is normally of magnitude 6 @.@ 0 , but its magnitude varies irregularly . AE Aurigae is associated with the 9 @-@ light @-@ year @-@ wide Flaming Star Nebula (IC 405) , which it illuminates . However , AE Aurigae likely entered the nebula only recently , as determined through the discrepancy between the radial velocities of the star and the nebula , 36 miles (58 km) per second and 13 miles (21 km) per second , respectively . It has been hypothesized that AE Aurigae is a " runaway star " from the young cluster in the Orion Nebula , leaving the cluster approximately 2 @.@ 7 million years ago . It is similar to 53 Arietis and Mu Columbae , other runaway stars from the Orion cluster . Its spectral

class is O9.5Ve , meaning that it is an O @-@ type main @-@ sequence star . The Flaming Star Nebula , is located near IC 410 in the celestial sphere . IC 410 obtained its name from its appearance in long exposure astrophotographs ; it has extensive filaments that make AE Aurigae appear to be on fire .

There are four Mira variable stars in Auriga : R Aurigae , UV Aurigae , U Aurigae , and X Aurigae , all of which are type M stars . More specifically , R Aurigae is of type M7III , UV Aurigae is of type C6 (a carbon star) , U Aurigae is of type M9 , and X Aurigae is of type K2 . R Aurigae , with a period of 457 @.@ 5 days , ranges in magnitude from a minimum of 13 @.@ 9 to a maximum of 6 @.@ 7 . UV Aurigae , with a period of 394 @.@ 4 days , ranges in magnitude from a minimum of 10 @.@ 6 to a maximum of 7 @.@ 4 . U Aurigae , with a period of 408 @.@ 1 days , ranges in magnitude from a minimum of 13 @.@ 5 to a maximum of 7 @.@ 5 . X Aurigae , with a particularly short period of 163 @.@ 8 days , ranges in magnitude from a minimum of 13 @.@ 6 to a maximum of 8 @.@ 0 .

= = = = Binary and double stars = = = =

Auriga is home to several less prominent binary and double stars . Theta Aurigae (Bogardus , Mahasim) is a blue @-@ white A0p class binary star of magnitude 2 @.@ 62 with a luminosity of 75 L ? . It has an absolute magnitude of 0 @.@ 1 and is 165 light @-@ years from Earth . The secondary is a yellow star of magnitude 7 @.@ 1 , which requires a telescope of 100 millimetres (3 @.@ 9 in) in aperture to resolve ; the two stars are separated by 3 @.@ 6 arcseconds . It is the eastern vertex of the constellation 's pentagon . Theta Aurigae is moving away from Earth at a rate of 17 @.@ 5 miles (28 @.@ 2 km) per second . Theta Aurigae additionally has a second optical companion , discovered by Otto Wilhelm von Struve in 1852 . The separation was at 52 arcseconds in 1978 and has been increasing since then because of the proper motion of Theta Aurigae , 0 @.@ 1 arcseconds per year . The separation of this magnitude 9 @.@ 2 component was 2 @.@ 2 arcminutes (130 @.@ 7 arcseconds) in 2007 with an angle of 350 ° . 4 Aurigae is a double star at a distance of 159 light @-@ years . The primary is of magnitude 5 @.@ 0 and the secondary is of magnitude 8 @.@ 1 . 14 Aurigae is a white optical binary star . The primary is of magnitude 5 @.@ 0 and is at a distance of 270 light @-@ years ; the secondary is of magnitude 7 @.@ 9 and is at a distance of 82 light @-@ years . HD 30453 is spectroscopic binary of magnitude 5 @.@ 9 , with a spectral type assessed as either A8m or F0m , and a period of seven days .

= = = = Stars with planetary systems = = = =

There are five stars with confirmed planetary systems in Auriga ; there is also a white dwarf with a suspected planetary system . HD 40979 has one planet , HD 40979 b . It was discovered in 2002 through radial velocity measurements on the parent star . HD 40979 is 33 @.@ 3 parsecs from Earth , a spectral class F8V star of magnitude 6 @.@ 74 ? just past the limit of visibility to the naked eye . It is of similar size to the Sun , at 1 @.@ 1 solar masses and 1 @.@ 21 solar radii . The planet , with a mass of 3 @.@ 83 Jupiter masses , orbits with a semi @-@ major axis of 0 @.@ 83 AU and a period of 263 @.@ 1 days . HD 45350 has one planet as well . HD 45350 b was discovered through radial velocity measurements in 2004 . It has a mass of 1 @.@ 79 Jupiter masses and orbits every 890 @.@ 76 days at a distance of 1 @.@ 92 AU . Its parent star is faint , at an apparent magnitude of 7 @.@ 88 , a G5IV type star 49 parsecs away . It has a mass of 1 @.@ 02 solar masses and a radius of 1 @.@ 27 solar radii . HD 43691 b is a significantly larger planet , with a mass of 2 @.@ 49 Jupiter masses ; it is also far closer to its parent star , HD 43691 . Discovered in 2007 from radial velocity measurements , it orbits at a distance of 0 @.@ 24 AU with a period of 36 @.@ 96 days . HD 43691 has a radius identical to the Sun 's , though it is more dense ? its mass is 1 @.@ 38 solar masses . It is a G0IV type star of magnitude 8 @.@ 03 , 93 @.@ 2 parsecs from Earth .

HD 49674 is a star in Auriga with one planet orbiting it . This G5V type star is faint , at magnitude 8 @.@ 1 , and fairly distant , at 40 @.@ 7 parsecs from Earth . Like the other stars , it is similar in

size to the Sun , with a mass of 1 @.@ 07 solar masses and a radius of 0 @.@ 94 solar radii . Its planet , HD 49674 b , is a smaller planet , at 0 @.@ 115 Jupiter masses . It orbits very close to its star , at 0 @.@ 058 AU , every 4 @.@ 94 days . HD 49674 b was discovered by radial velocity observations in 2002 . HAT @-@ P @-@ 9 b is the most recently confirmed exoplanet in Auriga , orbiting the star HAT @-@ P @-@ 9 . Unlike the other exoplanets in Auriga , detected by radial velocity measurements , HAT @-@ P @-@ 9 b was detected using the transit method in 2008 . It has a mass of 0 @.@ 67 Jupiter masses and orbits just 0 @.@ 053 AU from its parent star , with a period of 3 @.@ 92 days ; its radius is 1 @.@ 4 Jupiter radii , making it a hot Jupiter . Its parent star , HAT @-@ P @-@ 9 , is an F @-@ type star approximately 480 parsecs from Earth . It has a mass of 1 @.@ 28 solar masses and a radius of 1 @.@ 32 solar radii .

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

The galactic anticenter is located about 3 @.@ 5 ° to the east of Beta Aurigae . This marks the point on the celestial sphere opposite the location of the Galactic Center ; hence , this region marks a less extensive and less luminous part of the dust band that forms the spiral arms of the Milky Way . Auriga has many open clusters and other objects because the Milky Way runs through it . The three brightest open clusters are M36 , M37 and M38 , all of which are visible in binoculars or a small telescope in suburban skies . A larger telescope resolves individual stars . Three other open clusters are NGC 2281 , lying close to ?7 Aurigae , NGC 1664 , which is close to ? Aurigae , and IC 410 (surrounding NGC 1893) , a cluster with nebulosity next to IC 405 , the Flaming Star Nebula , found about midway between M38 and ? Aurigae . AE Aurigae , a runaway star , is a bright variable star currently located within the Flaming Star Nebula .

M36 (NGC 1960) is a young galactic open cluster with approximately 60 stars , most of which are relatively bright ; however , only about 40 stars are visible in most amateur instruments . It is at a distance of 3900 light @-@ years and has an overall magnitude of 6 @.@ 0 ; it is 14 light @-@ years wide . Its apparent diameter is 12 @.@ 0 arcminutes . Of the three open clusters in Auriga , M36 is both the smallest and the most concentrated , though its brightest stars are approximately 9th magnitude . It was discovered in 1749 by Guillaume Le Gentil , the first of Auriga 's major open clusters to be discovered . M36 features a 10 @-@ arcminute @-@ wide knot of bright stars in its center , anchored by Struve 737 , a double star with components separated by 10 @.@ 7 arcseconds . Most of the stars in M36 are B type stars with rapid rates of rotation . M36 's Trumpler class is given as both I 3 r and II 3 m . Besides the central knot , most of the cluster 's other stars appear in smaller knots and groups .

M37 (NGC 2099) is an open cluster , larger than M36 and at a distance of 4200 light @-@ years . It has 150 stars , making it the richest cluster in Auriga ; the most prominent member is an orange star that appears at the center . M37 is approximately 25 light @-@ years in diameter . It is the brightest open cluster in Auriga with a magnitude of 5 @.@ 6 ; it has an apparent diameter of 23 @.@ 0 arcminutes . M37 was discovered in 1764 by Charles Messier , the first of many astronomers to laud its beauty . It was described as " a virtual cloud of glittering stars " by Robert Burnham , Jr. and Charles Piazzi Smyth commented that the star field was " strewed [sic] ... with sparkling gold @-@ dust " . The stars of M37 are older than those of M36 ; they are approximately 200 million years old . Most of the constituent stars are A type stars , though there are at least 12 red giants in the cluster as well . M37 's Trumpler class is given as both I 2 r and II 1 r . The stars visible in a telescope range in magnitude from 9 @.@ 0 to 13 @.@ 0 ; there are two 9th magnitude stars in the center of the cluster and an east to west chain of 10th and 11th magnitude stars .

M38 is a diffuse open cluster at a distance of 3900 light @-@ years , the least concentrated of the three main open clusters in Auriga ; it is classified as a Trumpler Class II 2 r or III 2 r cluster because of this . It appears as a cross @-@ shaped or pi @-@ shaped object in a telescope and contains approximately 100 stars ; its overall magnitude is 6 @.@ 4 . M38 , like M36 , was discovered by Guillaume Le Gentil in 1749 . It has an apparent diameter of approximately 20 arcseconds and a true diameter of about 25 light @-@ years . Unlike M36 or M37 , M38 has a varied stellar population . The majority of the population consists of A and B type main sequence stars , the B type stars

being the oldest members , and a number of G type giant stars . One yellow @-@ hued G type star is the brightest star in M38 at a magnitude of 7 @.@ 9 . The brightest stars in M38 are magnitude 9 and 10 . M38 is accompanied by NGC 1907 , a smaller and dimmer cluster that lies half a degree south @-@ southwest of M38 ; it is at a distance of 4200 light @-@ years . The smaller cluster has an overall magnitude of 8 @.@ 2 and a diameter of 6 @.@ 0 arcminutes , making it about a third the size of M38 . However , NGC 1907 is a rich cluster , classified as a Trumpler Class I 1 m n cluster . It has approximately 12 stars of magnitude 9 ? 10 , and at least 25 stars of magnitude 9 ? 12 .

IC 410 , a faint nebula , is accompanied by the bright open cluster NGC 1893 . The cluster is thin , with a diameter of 12 arcminutes and a population of approximately 20 stars . Its accompanying nebula has very low surface brightness , partially because of its diameter of 40 arcminutes . It appears in an amateur telescope with brighter areas in the north and south ; the brighter southern patch shows a pattern of darker and lighter spots in a large instrument . NGC 1893 , of magnitude 7 @.@ 5 , is classified as a Trumpler Class II 3 r n or II 2 m n cluster , meaning that it is not very large and is somewhat bright . The cluster possesses approximately 30 stars of magnitude 9 ? 12 . In an amateur instrument , IC 410 is only visible with an Oxygen @-@ III filter . NGC 2281 is a small open cluster at a distance of 1500 light @-@ years . It contains 30 stars in a crescent shape . It has an overall magnitude of 5 @.@ 4 and a fairly large diameter of 14 @.@ 0 arcseconds , classified as a Trumpler Class I 3 m cluster . The brightest star in the cluster is magnitude 8 ; there are approximately 12 stars of magnitude 9 ? 10 and 20 stars of magnitude 11 ? 13 .

NGC 1931 is a nebula in Auriga , slightly more than one degree to the west of M36 . It is considered to be a difficult target for an amateur telescope . NGC 1931 has an approximate integrated magnitude of 10 @.@ 1 ; it is 3 by 3 arcminutes . However , it appears to be elongated in an amateur telescope . Some observers may note a green hue in the nebula ; a large telescope will easily show the nebula 's " peanut " shape , as well as the quartet of stars that are engulfed by the nebula . The open cluster portion of NGC 1931 is classed as a I 3 p n cluster ; the nebula portion is classed as both an emission and reflection nebula . NGC 1931 is approximately 6000 light @-@ years from Earth and could easily be confused with a comet in the eyepiece of a telescope .

NGC 1664 is a fairly large open cluster , with a diameter of 18 arcminutes , and moderately bright , with a magnitude of 7 @.@ 6 , comparable to several other open clusters in Auriga . One open cluster with a similar magnitude is NGC 1778 , with a magnitude of 7 @.@ 7 . This small cluster has a diameter of 7 arcminutes and contains 25 stars . NGC 1857 , a small cluster , is slightly brighter at magnitude 7 @.@ 0 . It has a diameter of 6 arcminutes and contains 40 stars , making it far more concentrated than the similar @-@ sized NGC 1778 . Far dimmer than the other open clusters is NGC 2126 at magnitude 10 @.@ 2 . Despite its dimness , NGC 2126 is as concentrated as NGC 1857 , having 40 stars in a diameter of 6 arcminutes .

= = = Meteor showers = = =

Auriga is home to two meteor showers . The Aurigids , named for the entire constellation and formerly called the " Alpha Aurigids " , are renowned for their intermittent outbursts , such as those in 1935 , 1986 , 1994 , and 2007 . They are associated with the comet Kiess (C / 1911 N1) , discovered in 1911 by Carl Clarence Kiess . The association was discovered after the outburst in 1935 by Cuno Hoffmeister and Arthur Teichgraeber . The Aurigid outburst on September 1 , 1935 prompted the investigation of a connection with Comet Kiess , though the 24 @-@ year delay between the comet 's return caused doubt in the scientific community . However , the outburst in 1986 erased much of this doubt . Istvan Teplickzky , a Hungarian amateur meteor observer , observed many bright meteors radiating from Auriga in a fashion very similar to the confirmed 1935 outburst . Because the position of Teplickzky 's observed radiant and the 1935 radiant were close to the position of Comet Kiess , the comet was confirmed as the source of the Aurigid meteor stream .

The Aurigids had a spectacular outburst in 1994 , when many grazing meteors ? those that have a shallow angle of entry and seem to rise from the horizon ? were observed in California . The meteors were tinted blue and green , moved slowly , and left trails at least 45 ° long . Because they

had such a shallow angle of entry , some 1994 Aurigids lasted up to 2 seconds . Though there were only a few visual observers for part of the outburst , the 1994 Aurigids peak , which lasted less than two hours , was later confirmed by Finnish amateur radio astronomer Ilkka Yrjölä . The connection with Comet Kiess was finally confirmed in 1994 . The 2007 outburst of the Aurigids was predicted by Peter Jenniskens and was observed by astronomers worldwide . Despite some predictions that there would be no Alpha Aurigid outburst , many bright meteors were observed throughout the shower , which peaked on September 1 as predicted . Much like in the 1994 outburst , the 2007 Aurigids were very bright and often colored blue and green . The maximum zenithal hourly rate was 100 meteors per hour , observed at 4 : 15 am , California time (12 : 15 UTC) by a team of astronomers flying on NASA planes .

The Aurigids are normally a placid Class II meteor shower that peaks in the early morning hours of September 1 , beginning on August 28 every year . Though the maximum zenithal hourly rate is 2 ? 5 meteors per hour , the Aurigids are fast , with an entry velocity of 67 kilometres (42 mi) / sec . The annual Aurigids have a radiant located about two degrees north of Theta Aurigae , a third @-@ magnitude star in the center of the constellation . The Aurigids end on September 4 . Some years , the maximum rate has reached 9 ? 30 meteors per hour .

The other meteor showers radiating from Auriga are far less prominent and capricious than the Alpha Aurigids . The Zeta Aurigids are a weak shower with a northern and southern branch lasting from December 11 to January 21 . The shower peaks on January 1 and has very slow meteors , with a maximum rate of 1 ? 5 meteors per hour . It was discovered by William Denning in 1886 and was discovered to be the source of rare fireballs by Alexander Stewart Herschel . There is another faint stream of meteors called the " Aurigids " , unrelated to the September shower . This shower lasts from January 31 to February 23 , peaking from February 5 through February 10 ; its slow meteors peak at a rate of approximately 2 per hour . The Delta Aurigids are a faint shower radiating from Auriga . It was discovered by a group of researchers at New Mexico State University and has a very low peak rate . The Delta Aurigids last from September 22 through October 23 , peaking between October 6 and October 15 . They may be related to the September Epsilon Perseids , though they are more similar to the Coma Berenicids in that the Delta Aurigids last longer and have a dearth of bright meteors . They too have a hypothesized connection to an unknown short period retrograde comet . The Iota Aurigids are a hypothesized shower occurring in mid @-@ November ; its parent body may be the asteroid 2000 NL10 , but this connection is highly disputed . The hypothesized Iota Aurigids may instead be a faint stream of Taurids .