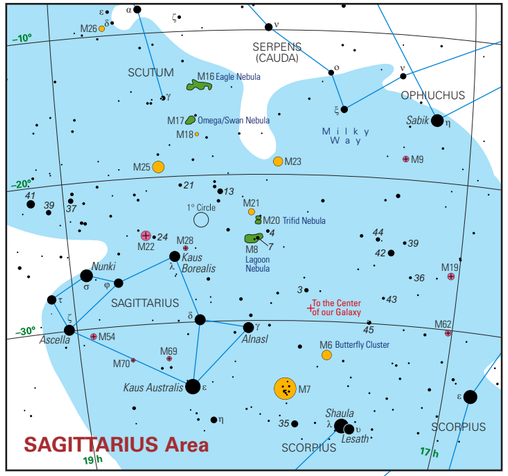
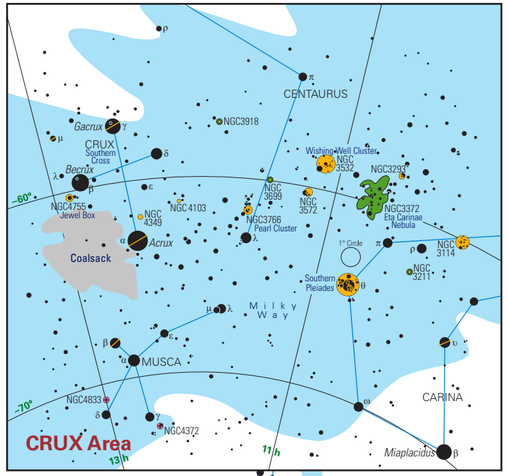
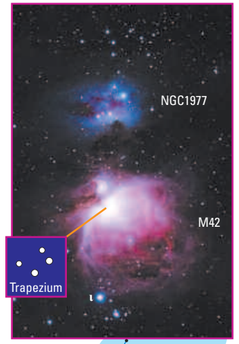
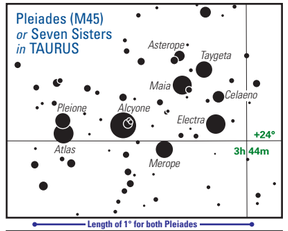


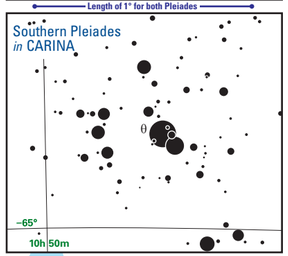


The **Orion Nebula**, M42 is one of the most magnicient objects in the sky. It is 8,000 trillion miles away and stretches across 160 trillion miles. At its center are four young hot stars, known as the Trapezium, that were born from the nebula and stimulate its gas to glow pink. They can be seen in a small telescope at 50x. More stars are forming in this nebula.





Length of 1° for both Pleiades



Charting Terminology & Nomenclature

Celestial Coordinates

Astronomy uses coordinates analogous to latitude and longitude. Declination (Dec or δ) is equivalent to latitude but uses + and – instead of N and S. Right Ascension (RA or α) is equivalent to longitude but has 24 divisions representing hours because the stars "circle" the Earth in a day.

M and NGC Catalogues

Noted in this atlas are many Deep Sky Objects with their catalogue designations. The "M" numbers are from the Messier catalogue of over 100 objects compiled by Charles Messier in the late 1700s and is still used today because it lists the biggest and brightest objects visible from the northern hemisphere. And, NGC refers to the *New General Catalogue* of nearly 13,000 objects compiled by J.L.E. Dreyer in the late 1800s.

Numbers & Greek Letters

Some stars are labeled with a number or Greek letter. The numbers are Flamsteed numbers and the Greek letters are Bayer letters — names of the early astronomers who started these nomenclatures.

Magnitude of Stars

The stars are classified by brightness using a system of magnitudes. For the stars visible to the naked eye, the scale ranges from about −1.4 (negative 1.4) for the brightest star *Sirius* in the constellation CANIS MAJOR to +6 or 6 for the faintest. The planet Venus shines as bright as −4.6 and Jupiter as bright as −2.5.

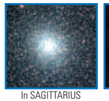
Milky Way Band

The hazy band that stretches across the sky represents the faint glow from the majority of stars in our Milky Way Galaxy — totalling over 200 billion. Our Sun is just one of these stars.

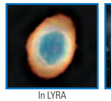
Southern Magellanic Clouds

From the Southern Hemisphere, you can see two milky patches detached from the Milky Way Band. They are called the Large and Small Magellanic Clouds and are two dwarf galaxies that are nearby companions to our Milky Way Galaxy.

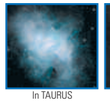
Pleiades, M42 Open Cluster — In TAURUS



Globular Cluster, M22 — In SAGITTARIUS



Planetary Nebula, M57 — In LYRA



Crab Nebula, M1 Supernova — In TAURUS

Andromeda Galaxy, M31 — In ANDROMEDA

Deep Sky Objects & Double Stars

Deep Sky Objects (DSOs) are Open Clusters, Globular Clusters, Planetary Nebulae, Nebulae, Supernova Remnants and Galaxies.

An **Open Cluster** is a group of several to hundreds of stars that were born out of the same nebula cloud. A group often forms a pretty pattern. The Pleiades and Southern Pleiades are great examples. Open clusters reside in our Milky Way Galaxy. Our Sun is no longer in its group.

Globular Clusters look like fuzzy balls because they contain tens of thousands stars held together by their mutual gravity. All of the globulars that can be seen in the sky are part of our Milky Way Galaxy, and there are about 200 of them that surround our galaxy like a halo. M22 in SAGITTARIUS is a northern favorite.

A **Planetary Nebula** is an old term that has nothing to do with the planets. Instead, it is a round or symmetrical nebula that is the shed atmosphere of a dying star. At its center is a white dwarf star. When our Sun dies, it will create a planetary nebula. These objects have diameters of a few light years and are located in our galaxy. The Ring Nebula, M57, in LYRA is a favorite.

A **Supernova Remnant** is the remaining hydrogen gas from a very large star that has exploded at the end of its life. M1, the Crab Nebula, in TAURUS is the easiest to observe.

A **Nebula** is a giant hydrogen gas cloud that is located in our galaxy and can span 60 light years or more. Within these clouds, concentrations of gas can occur and gravitationally condense to form stars and accompanying planets. A set of stars created by a nebula is known as an Open Cluster. The Orion Nebula, M42 is a favorite (center panel).

Galaxies contain billions of stars. All galaxies are beyond our Milky Way Galaxy, where our Sun resides. When you are observing a galaxy, you are looking through our galaxy into the true depths of the universe. The Andromeda Galaxy, M31 can be seen with the naked eye.

A **Double Star** is a star that looks like one star but when magnified sufficiently, it separates into two or more stars. Some are very pretty because of contrasting colors. *Castor* in GEMINI is a favorite and *Albireo* in CYGNUS is well liked for its blue & gold colors.

Observing Tips

Almost every object indicated in this atlas can be seen with a small telescope. Double stars can be observed in light-polluted skies. A few can be "split" with binoculars but others require a telescope with powers up to 200x. DSOs are best observed in dark skies with no Moon using magnifications of 50x–125x. Large objects, like the Pleiades are great in binoculars. The Milky Way Band is best seen in country skies and it is great to scan with binoculars.

Tickle of Mythology

Arcas and his beautiful mother, Callisto were turned into the Little and Big Bears, **URSA MINOR** and **MAJOR** because of jealous Juno, wife of promiscuous Jupiter.

During an early war between the Titans and Olympians, **DRACO**, the Dragon was flung to the North and frozen in place by the cold.

King **CEPHEUS** and Queen **CASSIOPEIA** ruled Ethiopia. Their beautiful daughter **ANDROMEDA** is being rescued by **PERSEUS** from the Sea Monster, **CETUS**.

AURIGA, the Charioteer supervised the royal livestock, including a goat that provided milk for growing Jupiter.

The Pleiades or Seven Sisters rise before **ORION**, out-of-reach of his amorous clutches. Orion is a great Hunter and battles the Bull, **TAURUS**. Below his feet is **LEPUS**, the Hare. At his back is the ultimate prize for any hunter, the Unicorn, **MONOCEROS**. His Big and Little Hunting Dogs, **CANIS MAJOR** and **MINOR** follow. **ERIDANDUS**, the River is before Orion, representing the water of life.

GEMINI is the warlike Twins, Pollux and Castor, protectors of seafarers. Pollux is immortal but Castor is not.

Regulus, the brightest star in **LEO**, the Lion has several meanings including regal, king and mighty. Before him is **CANCER**, the Crab sent to prevent **HERCULES** from killing the nine-headed **HYDRA** as one of his twelve labors toward a virtuous life.

When **VIRGO**, the Virgin is in the night sky, crops grow. The growing season ends when, in the early evening, she sets on the western horizon.

CANES VENATICI are the Hunting Dogs of **BOOTES** who is also seen as a Ploughman. **CORONA BOREALIS** is the crown of Bacchus, the god of wine.

OPHIUCHUS is a Healer handling the Snake, **SERPENS** that has medicinal powers.

AQUILA is Jupiter's Eagle that carries out tasks. **SAGITTARIUS**, the Archer is a warlike centaur. Mother Earth lets the Scorpion, **SCORPIUS** crawl out of the great Milky Way crack to kill Orion, for boasting, but it is kept at bay by Ophiuchus.

LYRA, the Lyre was invented by Mercury and mastered by Apollo's son, Orpheus whose music had magical powers.

CYGNUS, the Swan helped Helios find the pieces of his son, having fallen from the chariot that pulls the Sun across the sky.

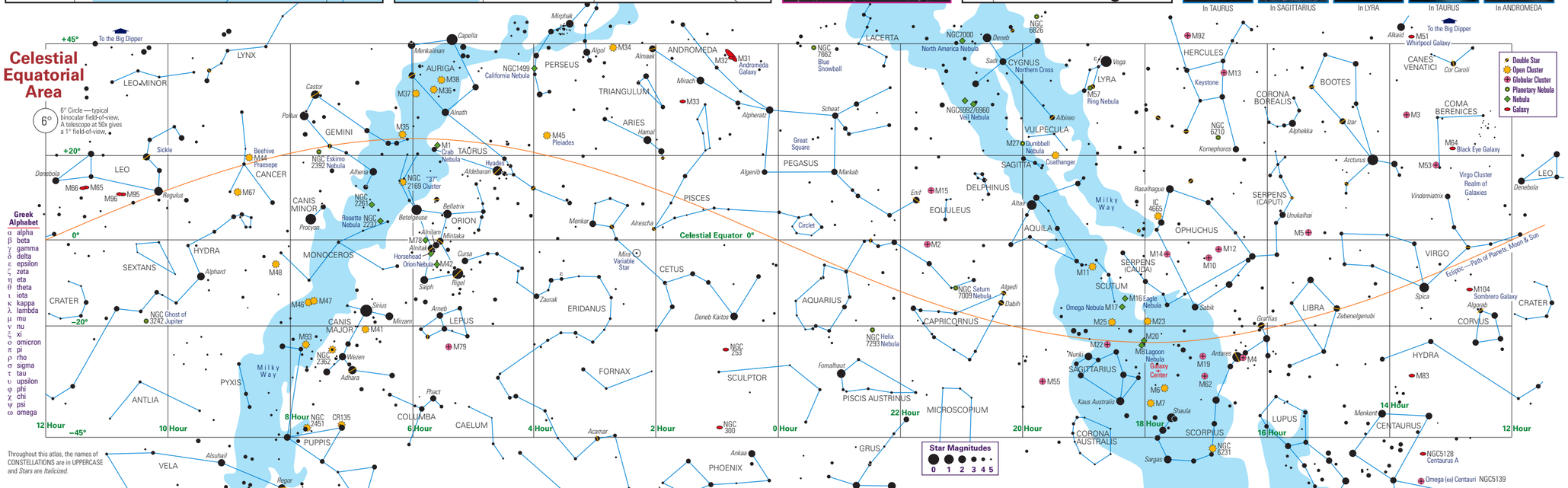
AQUARIUS is the Water and Cup Bearer, a servant of the gods.

CAPRICORNUS is a "Seagoat," the partially transformed, half-goat, half-fish body of the god Pan who got scared and hurriedly escaped the monster Typhoon in order to warn Jupiter. The word panic is derived from Pan.

PEGASUS, the Winged Horse is the deliverer of Jupiter's thunderbolts.

ARIES, the Ram with the golden fleece, could fly and was used by the goddess of the Nebulous Cloud, Nephele to rescue her children.

PISCES represents Venus and Cupid who changed themselves into Fishes tied with a length of string to stay together and escape the monster Typhoon.



Throughout this atlas, the names of CONSTELLATIONS are in UPPERCASE and *Stars* are *Italicized*.

At arm's length...

ORION's height is one hand span

The width of a fist spans the Big Dipper's bowl

One thumb width is 4 Moon diameters

North Celestial Pole Area

PEGASUS · Scheat · Alpheratz · ANDROMEDA · M33 · TRIANGULUM · M31 · M32 · Andromeda Galaxy · Blue Snowball · NGC 7662 · LACERTA · Almaak · M34 · Algol · PERSEUS · NGCs 6960/6992 Veil Nebula · North America Nebula · NGC7000 · M39 · Milky Way · NGC 7789 · Caph · NGC457 · M76 · NGC869/884 Double Cluster · Mirphak · NGC 1499 California Nebula · Albireo · Sadr · Deneb · CYGNUS Northern Cross · M52 · CASSIOPEIA · Alderamin · CEPHEUS · NGC 6826 · LYRA · M57 Ring Nebula · Vega · Capella · AURIGA · M38 · M36 · M37 · Menkalinan · Etamin · NGC 6543 · DRACO · URSA MINOR · North Celestial Pole · Polaris · North Star · Little Dipper · Kochab · CAMELOPARDALIS · M92 · HERCULES · Keystone · M13 · M82 · M81 · Muscida · Thuban · Dubhe · URSA MAJOR · LYNX · Talitha · Alcor · Mizar · Alioth · Megrez · Merak · Big Dipper · Phad · M57 Owl Nebula · Alkaid · M51 Whirlpool Galaxy · CORONA BOREALIS · Alphekka · BOOTES · Tania Australis · CANES VENATICI · Cor Caroli · LEO MINOR

0h · 3h · 6h · 9h · 12h · 15h · 18h · 21h · +70° · +50° · +30°

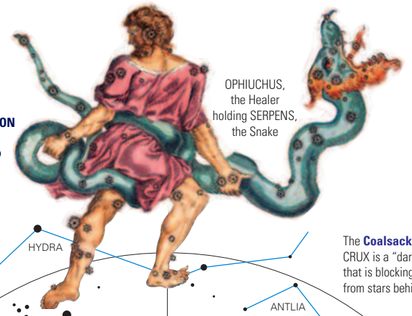
Star Magnitudes
0 1 2 3 4 5

Double Star · Open Cluster · Globular Cluster · Planetary Nebula · Nebula · Galaxy
6° Circle

Winter Triangle

Consists of the 3 bright stars *Procyon, Betelgeuse* and *Sirius*

CANIS MINOR · Procyon · Betelgeuse · Belt · ORION · Points to Sirius · Sirius · CANIS MAJOR



OPHIUCHUS, the Healer holding SERPENS, the Snake

Summer Triangle

Consists of the 3 bright stars *Deneb, Vega* and *Altair*

Deneb · Northern Cross · CYGNUS · Vega · LYRA · Altair · AQUILA

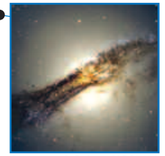
The **Coalsack**, next to CRUX is a "dark" nebula that is blocking light from stars behind it.

HYDRA · ANTLIA · Menkent · NGC5128 Centaurus A · NGC Omega Centauri 5139 · CENTAURUS · VELA · PYXIS · Alsuhail · Milky Way · Gacrux · CRUX Southern Cross · NGC 3532 · NGC Becrux · M55 · NGC3372 · Hadar · Coalsack · Agena · Aspidiske · Regor · LEPUS · Rigil Kent · Proximia · Southern Pleasures · False Cross · Avior · CARINA · M83 · NGC 2808 · NGC 2516 · NORMA · CIRCINUS · CANIS MAJOR · Adhara · PUPPIS · Miaplacidus · CHAMAELEON · VOLANS · GEMINI · Castor · Pollux · M4 · Antares · NGC 6231 · SCORPIUS · Shaula · Sargas · M7 · ARA · TRIANGULUM AUSTRALE · Atria · APUS · Tarantula Nebula · NGC2070 · PICTOR · Canopus · South Celestial Pole · MENSA · Large Magellanic Cloud · DORADO · COLUMBA · Phact · TELESCOPIUM · PAVO · OCTANS · HYDRUS · Small Magellanic Cloud · NGC104 47 Tucanae · RETICULUM · CAELUM · SAGITTARIUS · CORONA AUSTRALIS · Arkab · Rukbat · Nunki · Peacock · INDUS · TUCANA · HOROLOGIUM · Achernar · ERIDANUS · Acamar · MICROSCOPIUM · Alnair · GRUS · PHOENIX · FORNAX · Ankaa · NGC 300 · PISCIS AUSTRINUS · SCULPTOR · Fomalhaut

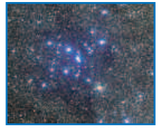
0h · 3h · 6h · 9h · 12h · 15h · 18h · 21h · −70° · −50° · −30°

South Celestial Pole Area

Eta Carinae Nebula, NGC3372



Centaurus A Galaxy, NGC5128

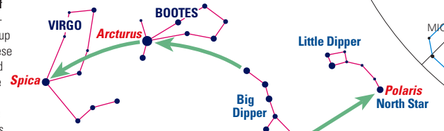


M7 Cluster in SCORPIUS

Sombrero Galaxy in VIRGO, M104

Spring & Summer Pointers

The **Big Dipper** and BOOTES are bright constellations that can be seen in most skies. However, you need dark skies to see the fainter stars in the **Little Dipper** and VIRGO.



*The **Big Dipper** is one of the easiest patterns to identify because its stars are bright.*

Celestial Tidbits

There are a total of 88 constellations in the sky and all of them are shown in this atlas. Each constellation has a boundary. CRUX occupies the least area and HYDRA the most. SERPENS is the only constellation that is split between two parts of the sky, on opposite sides of OPHIUCHUS.

We use the same constellations described by the ancient Greeks. However, most names of stars are from Arabic. Fourteen constellations in the southern hemisphere were charted by the French astronomer Nicolas Louis de Lacaille around 1750.

About 5000 stars can be seen with the naked eye. Most people can see stars as faint as magnitude 6.

Stars twinkle because of turbulence in the atmosphere and twinkle most when low in the sky. **The five planets visible to the naked eye do not normally twinkle** but shine bright and steady.

For a star, our Sun is average in size and middle aged, about 4.6 billion years old.

A falling star or meteor is not a star — it is usually a gain of sand from space slamming into and burning up in our atmosphere. These grains of sand are shed from comets that come close to the Sun and are responsible for the annual meteor showers.

***Thuban*, in DRACO was the North Star around 2800 BC**. *Vega*, in LYRA will be the North Star around 14,000 AD. The Earth's axis wobbles around a great circle in the North and South every 25,800 years and points close to several stars during this time.

A **Light Year** (ly) **is a unit of length** and is equal to the distance light travels in one year. Since light moves at the speed of 186,282 miles a second, one light year is nearly **6 trillion miles** long. Our Milky Way Galaxy is about 100,000 light years in diameter.

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Annual Meteor Showers

Shower (CONSTELLATION)	Peak Date	Hourly Count
Quadrantids (BOOTES)	**Jan 3**	60–200
Lyrids (LYRA)	**Apr 22**	15–20+
Eta Aquarids (AQUARIUS)	**May 5**	60
Delta Aquarids	**Jul 29**	20
Perseids (PERSEUS)	**Aug 12**	120–160
Orionids (ORION)	**Oct 21**	20
Taurids (TAURUS)	**Nov 5–13**	5
Leonids (LEO)	**Nov 17**	10
Geminids (GEMINI)	**Dec 14**	120
Ursids (URSA MINOR)	**Dec 22**	10+

Constellations of the Zodiac

1	PISCES ♓	7	VIRGO ♍
2	ARIES ♈	8	LIBRA ♎
3	TAURUS ♉	9	SCORPIUS ♏
4	GEMINI ♊	10	SAGITTARIUS ♐
5	CANCER ♋	11	CAPRICORNUS ♑
6	LEO ♌	12	AQUARIUS ♒

The constellations are listed in the order that the Sun passes through them and starts with PISCES, where the Sun resides at the start of Spring, about June 21.

60 Brightest Stars

Name	Constellation	Distance Light Years	Magnitude
Sun	—	93 million miles	**−26.8**
Sirius	CANIS MAJOR	8.6	**−1.4**
Canopus	CARINA	313	**−0.6**
Arcturus	BOOTES	37	**−0.1**
Rigil Kent	CENTAURUS	4	**−0.01**
Vega	LYRA	25	**0.0**
Capella	AURIGA	42	**+0.1**
Rigel	ORION	1,400	**+0.2**
Procyon	CANIS MINOR	11	**+0.4**
Achernar	ERIDANUS	144	**0.5**
Betelgeuse	ORION	1,400	**0.5**
Hadar	CENTAURUS	526	**0.6**
Altair	AQUILA	16	**0.8**
Acrux	CRUX	321	**0.8**
Aldebaran	TAURUS	65	**0.9**
Spica	VIRGO	220	**1.0**
Antares	SCORPIUS	522	**1.1**
Pollux	GEMINI	34	**1.2**
Fomalhaut	PISCIS AUSTRINUS	25	**1.2**
Becrux	CRUX	350	**1.3**
Deneb	CYGNUS	1,500	**1.3**
Regulus	LEO	78	**1.4**
Adhara	CANIS MAJOR	400	**1.5**
Castor	GEMINI	52	**1.6**
Gacrux	CRUX	88	**1.6**
Shaula	SCORPIUS	330	**1.6**
Bellatrix	ORION	1,400	**1.6**
Alnath	TAURUS	131	**1.7**
Miaplacidus	CARINA	111	**1.7**
Alnilam	ORION	1,000	**1.7**
Alnair	GRUS	57	**1.7**
Alnitak	ORION	800	**1.7**
Regor	VELA	840	**1.7**
Alioth	URSA MAJOR	81	**1.8**
Mirphak	PERSEUS	630	**1.8**
Kaus Australis	SAGITTARIUS	76	**1.8**
Dubhe	URSA MAJOR	124	**1.8**
Wezen	CANIS MAJOR	2,000	**1.8**
Alkaid	URSA MAJOR	101	**1.9**
Avior	CARINA	600	**1.9**
Sargas	SCORPIUS	270	**1.9**
Menkalinan	AURIGA	82	**1.9**
Atria	TRIANGULUM AUSTRALE	400	**1.9**
Alhena	GEMINI	100	**1.9**
Delta (δ) Velorum	VELA	80	**1.9**
Peacock	PAVO	183	**1.9**
Polaris	URSA MINOR	316	**2.0**
Mirzam	CANIS MAJOR	500	**2.0**
Alphard	HYDRA	177	**2.0**
Nunki	SAGITTARIUS	170	**2.1**
Algol	PERSEUS	93	**2.1**
Denebola	LEO	36	**2.1**
Hamal	ARIES	66	**2.1**
Alpheratz	ANDROMEDA	97	**2.1**
Kochab	URSA MINOR	126	**2.1**
Saiph	ORION	78	**2.1**
Deneb Kaitos	CETUS	96	**2.1**
Alsuhail	VELA	600	**2.2**
Aspidiske	CARINA	700	**2.2**
Alphekka	CORONA BOREALIS	78	**+2.2**

Closest Stars

Our Sun is the closest star at just 93 million miles away. The closest nighttime star visible to the naked eye is ***Alpha (α) Centauri*** in the constellation CENTARUS and it is also known as *Rigel Kent* or *Rigel Kentaurus*. *Alpha Centauri* shines brightly at magnitude −0.01 and is just 4.4 light years away. One light year (ly) is about 6 trillion miles. The very closest star is ***Proxima*** in CENTARUS at just 4.22 ly away (noted on chart). It is too faint to see with the eyes because it shines at magnitude +11. The second closest star visible to the naked eye is ***Sirius*** at 8.6 ly followed by ***Epsilon (ε) Eridani*** at 10.5 ly and ***Procyon*** at 11.4 ly. There are several stars closer than these three but they are too faint to be seen with the naked eye.

The Planets move eastward along the Ecliptic

The position of the planets are not indicated on this atlas because they move through the fixed stars! However, the planets and Moon can always be found on or near the orange, sine-wave curve, which is a path in the sky called the ecliptic. If you could see the stars during the day, **the ecliptic is the path that the Sun takes through the stars over the course of a year** and is a result of Earth's revolution around the Sun. The planets and Moon are always on or very near the ecliptic because they orbit in nearly the same plane as Earth. The five planets, visible to the naked eye, in order of brightness, are: Venus, Jupiter, Saturn, Mars and Mercury. If you see a bright star that is not in this atlas, it will be one of these five planets — usually Venus or Jupiter. Normally, the planets do not twinkle and this is one way to help identify them. Visit www.whatouttonight.com for the location of the planets. The planets are best viewed with a telescope using magnifications from 50x to 250x.

The ecliptic passes through the 12 constellations of the zodiac which are listed to the lower left. The planets move eastward along the ecliptic but sometimes they *appear* to move westward or "retrograde" a bit when the Earth "passes" them in its orbit about the Sun.

Solar Body	Diameter	Rotation	Distance From Sun	Revolution	Magnitude Faintest / Brightest
SUN	865,000 miles	30 days	—	—	**−26.8**
MERCURY	3,032 miles	59 days	36,000,000 miles	88 days	5 / **−1.9**
VENUS	7,521 miles	243 days	67,000,000 miles	225 days	−3.7 / **−4.6**
EARTH	7,926 miles	24 hours	93,000,000 miles	365 days	—
MARS	4,228 miles	24.6 hours	142,000,000 miles	687 days	2.3 / **−2.8**
JUPITER	88,844 miles	9.8 hours	484,000,000 miles	11.8 years	−1.2 / **−2.5**
SATURN	74,900 miles	10.2 hours	887,000,000 miles	29 years	1.1 / **−0.4**
URANUS	31,764 miles	17.9 hours	1,800,000,000 miles	84 years	5.9 / **5.6**
NEPTUNE	30,777 miles	19.2 hours	2,800,000,000 miles	164 years	8.0 / **7.6**
PLUTO	1,433 miles	6.4 days	3,700,000,000 miles	248 years	15.9 / **13.7**

Field Guide

Atlas of the Heavens

With 200 Favorite Binocular & Telescope Objects