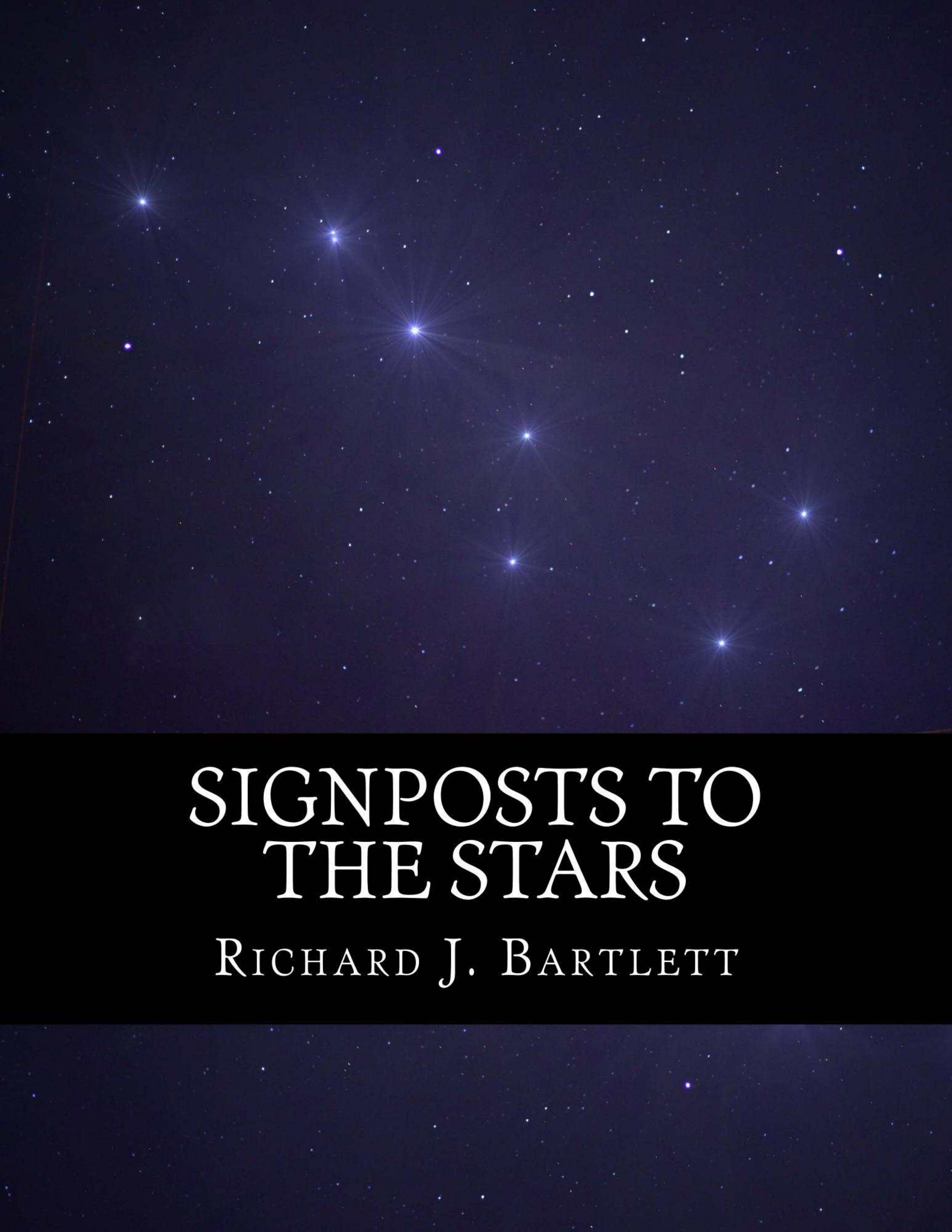

Signposts to the Stars

Richard J. Bartlett

Signposts to the Stars

An Absolute Beginner's Guide to Learning the Night Sky and Exploring the Constellations

Cover Image: The seven brightest stars of Ursa Major, commonly known as the Big Dipper or the Plough, can be used to locate a number of other stars and constellations in the night sky.

Credit: Faheem Aslam, used with permission.

First Edition, August 2016

Contents

Introduction

About this Book

This book is one of three I've wanted to write for about ten years. One, a guide to easy objects to see with a small telescope, was published in December 2015 while the third has yet to be fully developed. (It'll be written and published eventually!)

Signposts is aimed at the absolute beginner, the person who has often stopped and stared at the stars but has never learnt to identify them. It was really born from a couple of pages I'd included in previous books that showed the brightest stars of Ursa Major and Orion and how you can use them to find other stars and constellations.

So that was my starting point. You can't use these constellations to find *every* other constellation, but in many cases you can use them as the first stepping stone along the path that will lead you to your destination.

Beyond that, I've written this book so you can also learn more about some of the fascinating objects you can find in the constellations. Not just the stars themselves, but also star clusters, galaxies and nebulae.

Many of these *deep sky objects* can be seen with just your eyes or a regular set of binoculars and I highly recommend you seek them out.

The book is divided up as follows:

(Incidentally, you'll find a lot of images, in particular star charts throughout the book. As this is the Kindle edition, if you double-tap the image, you'll be able to see an expanded view that will allow you to see more detail.)

As with most of my other books, I've tried to keep the technical words and phrases to a minimum. However, there are some things you'll need to know otherwise you might get a little lost on your journey.

Hence, I wrote the *Before You Begin* section to explain some of the key terms and concepts you'll find throughout the book. It's nothing too technical and although, arguably, it's not absolutely essential to learn this before you try finding the stars, you'll get more from the experience if you read this section anyway.

Lastly, you'll find a few pages at the end of the section that discuss the Moon and its phases. If you plan on observing some of the deep sky objects described in the book, you'll need to learn more about the lunar cycle.

The *Star Charts & Visible Constellations* section is where the fun begins. I'll start with a few words about how to use the charts and how to get started.

Following that you'll find a table; simply look for the current time of year (for example, early November) and then look for the current time of night (for example, 10 p.m.) The table will then tell you which star chart to use. (In this example, that would be Chart 1.)

The chart will show you the night sky as it appears at that time and also includes a list of visible constellations. The list is alphabetical but it's not all-inclusive. Rather, I've focused on the constellations that are discussed in this book and that are visible at that time.

The next section, *Seasonal Signposts & Stars* shows you the most prominent stars and patterns that can be seen through each season. For example, the stars of the Summer Triangle can be used to find several neighboring constellations.

Next you'll find the biggest section – *The Constellations.* I've focused on the constellations that can be easiest found and have provided two charts: one shows how to find it while the other shows you the location of the highlighted objects within it.

The text for each constellation typically details any associated myths, its brightest star and, for many of the constellations, highlights several objects of interest. The majority of these are visible with either just your eyes or binoculars but a few may require a small telescope.

Lastly, there's an *Appendix* that contains some useful supplemental information; for example, the greek alphabet, information on when the planets are best seen and recommended resources such as books, software and Facebook groups.

Before we move on, there are two people I want to thank. Firstly, Faheem Aslam was very kind in allowing me to use his image for the cover. Faheem says he's just beginning to learn astrophotography and was very modest about the image, but I found it hard to find anything else that could come close to what I wanted.

Having said that, one other person came very close. Steve Peters is a photographer whose work concentrates on the natural world. He has some stunning photographs of the night sky but, unfortunately, he didn't have quite what I was looking for.

With that in mind, I want to give a shout-out to Steve, to thank him for offering his imagery and to recommend you take a look at – and follow – Steve's work on Flickr:

https://www.flickr.com/photos/tierracosmos/with/28060792442/

About the Author

Photo by my son, James Bartlett

I’ve had an interest in astronomy since I was six and although my interest has waxed and waned like the Moon, I’ve always felt compelled to stop and stare at the stars.

In the late 90’s, I discovered the booming frontier of the internet, and like a settler in the Midwest, I quickly staked my claim on it. I started to build a (now-defunct) website called *StarLore.* It was designed to be an online resource for amateur astronomers who wanted to know more about the constellations - and all the stars and deep sky objects to be found within them. It was quite an undertaking.

After the website was featured in the February 2001 edition of *Sky & Telescope* magazine, I began reviewing astronomical websites and software for their rival, *Astronomy*. This was something of a dream come true; I'd been reading the magazine since I was a kid and now my name was regularly appearing in it.

Unfortunately, a financial downturn forced my monthly column to be cut after a few years but I'll always be grateful for the chance to write for the world's best-selling astronomy magazine.

I emigrated from England to the United States in 2004 and spent three years under relatively clear, dark skies in Oklahoma. I then relocated to Kentucky in 2008 and then California in 2013. I now live in the suburbs of Los Angeles; not the most ideal location for astronomy, but there are still a number of naked eye events that are easily visible on any given night.

Also by the Author…

All these titles can be found on the author's page on Amazon.com and Amazon UK.

2016 An Astronomical Year is written for everyone with an interest in astronomy and contains information on hundreds of night sky events throughout the year. It was designed for astronomers of all levels and includes details of the lunar phases and eclipses, as well as conjunctions, oppositions, magnitude and apparent diameter changes for the planets and major asteroids.

To date, the 2015 edition has been downloaded nearly 3,000 times, was ranked #1 in Free Kindle Astronomy books, within the Top 10 Paid Kindle Astronomy books and within the Top 50 Free Kindle Non-Fiction books.

It is available in paperback and Kindle editions in the United States, Canada and the United Kingdom. (Please be aware that due to the cost of printing in color, the paperback does not contain images and is purely text only.)

2016 The Night Sky Sights is specifically designed for absolute beginners and casual stargazers without a telescope. The guide highlights over 125 astronomical events in 2016 - all of them visible with just your eyes - and showcases events visible in both the evening and pre-dawn sky as well as those you can see throughout the night.

It is currently available in paperback and Kindle editions in the United States, Canada and the United Kingdom.

The Astronomical Almanac (2016-2020): A Comprehensive Guide to Night Sky Events provides details of thousands of astronomical events from 2016 to the end of 2020. Designed for more experience astronomers, this the guide includes almost daily data and information on the Moon and planets, as well as Pluto, Ceres, Pallas, Juno and Vesta.

To date, the 2015-2019 edition has been downloaded nearly 6,000 times, was ranked #1 in the Free Kindle Astronomy book category, #3 in the Paid

Kindle Astronomy book category and within the Top 50 of *all* Free Kindle books in October 2014.

It is available in paperback and Kindle editions worldwide, including the United States, Canada, the United Kingdom and Australia.

The Amateur Astronomer's Notebook: A Journal for Recording and Sketching Astronomical Observations is the perfect way to log your observations of the Moon, stars, planets and deep sky objects. It is available as both a full-size 8.5" by 11" journal and also as a 5" by 8" pocket notebook. The larger edition has room for 150 observing sessions while the pocket edition allows you to record 100 observations.

It is available as a paperback in selected areas. (Full Size Edition: United States, Canada and the United Kingdom. Pocket Edition: United States, Canada and the United Kingdom.)

The Deep Sky Observer's Guide offers you the night sky at your fingertips. As an amateur astronomer, you want to know what's up tonight and you don't always have the time to plan ahead. Maybe the clouds have suddenly parted. Maybe you're at a star party. Maybe you want to challenge yourself with something new but don't know where to start.

The guide can solve these problems in a conveniently sized paperback that easily fits in your back pocket. Take it outside and let the guide suggest any one of over 1,300 deep sky objects, all visible with a small telescope and many accessible via binoculars.

It is currently available as a paperback throughout the world.

The Easy Guide to the Night Sky: Discovering the Constellations with Your Eyes and Binoculars is aimed at the relative newcomer who might already be familiar with the constellations but is looking to learn more. It includes the myths and legends associated with the stars, highlights the best objects and includes star charts and depictions of binocular views.

It is available in paperback and Kindle editions worldwide, including the United States, Canada, the United Kingdom and Australia.

An Easy Introduction to the Constellations: A Reference Guide to Exploring the Night Sky with Your Eyes, Binoculars and Small Telescopes combines *The Easy Guide to the Night Sky* and *Easy Things to See With a Small Telescope* into a single convenient low-cost volume.

It is available in paperback and Kindle editions worldwide, including the United States, Canada, the United Kingdom and Australia.

Easy Things to See With a Small Telescope: A Beginner's Guide to Over 60 Easy-to-Find Night Sky Sights – the #1 best-selling telescope book in the UK Amazon store, January 2016, it is specifically written with the beginner in mind and highlights stunning multiple stars, star clusters, nebulae and the Andromeda Galaxy.

Each object has its own page which includes a map, a view of the area through your finderscope and a depiction of the object through the eyepiece. There’s also a realistic description of every object based upon the author’s own notes written over years of observations. Additionally, there are useful tips and tricks designed to make your start in astronomy easier and pages to record your observations.

If you’re new to astronomy and own a small telescope, this book is an invaluable introduction to the night sky.

It is currently available in paperback and Kindle editions in the United States, Canada and the United Kingdom.

Echoes of Earth – a collection of science fiction, mythological and philosophical short stories that I wrote many, many moons ago. (i.e., in the mid 1990’s.)

It is available as a Kindle edition in selected areas. (United States, Canada, the United Kingdom and Australia.)

The Wonder of It All: Your Unique Place Amongst the Sun, Moon, Planets and Stars of the Universe is a book for children and young astronomers everywhere. From our home here on Earth, past the Sun, Moon and planets, this is a journey out to the stars and beyond. A journey of discovery that shows us the beauty and wonder of the cosmos and our special and unique place within it. *The Wonder of It All* will open your child's eyes to the universe and includes notes for parents to help develop an interest in astronomy.

It is currently available in paperback and Kindle editions in the United States, Canada and the United Kingdom.

The Author Online

Amazon US: http://tinyurl.com/rjbamazon-us	Amazon UK: http://tinyurl.com/rjbamazon-uk
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Blog: http://tinyurl.com/theastroyear AstroNews: http://tinyurl.com/astronewsus	Email: astronomywriter@gmail.com

Clear skies,

Richard J. Bartlett

August 3rd, 2016

Before You Begin

About this Section

We begin this section with a few words about binoculars and telescopes and which of these might be “best” for astronomy.

Next is an explanation of what some of the most common words and phrases mean. While I don’t want this to be too technical, it’s important to have a basic understanding of these terms as they’re almost unavoidable when discussing astronomy!

At the end of this section you’ll also find some notes regarding the Moon and why it can be a hindrance to our hobby.

Binoculars or a Telescope?

So you’re getting into astronomy and you want to learn more. You’re keen to explore the night sky and discover the mysteries of the cosmos. The big question is: should you buy binoculars or a telescope?

Neither. Or at least, not to begin with. Ask any amateur astronomer, whether it be online or through a local group, and they’ll tell you the same thing: you should learn to navigate the night sky first.

Fortunately, you have this book to help you, but it’s worth emphasizing the point. It won’t matter what car you drive, you’re not going to find Disneyland by jumping on the nearest road and driving off in the general direction. (But you’ll probably still see some interesting sights along the way!)

Once you’ve familiarized yourself with the basic constellations of the night sky it’s worth investing in binoculars before paying out for a telescope.

Why? For starters, using binoculars is good practice for locating objects with a telescope. Sure, you can buy a computerized GoTo scope that will literally point you in the right direction, but a) there’s no real fun in that and b) you still need to know if your scope is pointing at the right object.

There’s a lot to be said for tracking down and finding a deep sky object for yourself. Binoculars will provide you an excellent opportunity to do this and then you’ll be ready to invest in a scope.

There’s also a couple of other factors: availability and cost. A lot of homes have a set of binoculars already and, if not, good quality binoculars are inexpensive.

Orion UltraView 10x50 Binoculars. Reprinted with permission from Orion Telescopes & Binoculars, [www.OrionTelescopes.com.](http://www.OrionTelescopes.com) (Double-tap image to enlarge.)

Regular 10x50's are a good choice for astronomy. These will provide you with a magnification of 10x and, with a lens diameter of 50mm (hence, 10x50) they'll have enough light gathering power to reveal many of the fainter objects under a good, dark sky.

Besides discussing the constellations in this book, I've also tried to provide details on some of the best binocular objects that can also be easily found.

Two of the world's largest telescope manufacturers, Orion and Celestron, both offer excellent binocular choices and are easily available online.

Smaller binoculars, such as 8x30's, have a lower magnification (8x) and with smaller lenses (30mm) you may not see as much. (But they're still better than nothing!)

Once you've had some experience with binoculars you can move up to a scope. Telescopes will show you more and will give you a higher magnification but, of course, they cost more and aren’t as portable.

There are a lot of different types of telescope but I recommend starting with something small and then working your way up.

(Telescopes are often described as being either refractors or reflectors but as this is meant to be a basic introduction to the subject, I won’t go into the differences here.)

For example, both Orion and Celestron offer small, portable telescopes (with lenses or mirrors of 70mm) that can provide some great views of the night sky. These are typically inexpensive and can be easily taken outside or relocated for family trips and vacations.

If you really get bitten by the bug and want something larger, a scope of about 130mm or 150mm should do the trick for a beginner or someone of intermediate experience. They obviously cost more but the views they provide will more than make up for the extra expense.

Again, you’ll find plenty of objects that can be easily seen and observed with a small telescope and, if you have one, I strongly advise you check them out!

Realistic Expectations

Everyone has seen images taken by the Hubble Space Telescope and we've all been wowed by them. Maybe you've been inspired to learn more about astronomy as a result.

But without wishing to sound negative, it's important for new astronomers to know that the amazing images you see online and in magazines aren't an accurate representation of what you'll see with your own eyes.

For one thing, the equipment used to take those images is very sensitive to light and can pick up on colors that your eyes cannot.

For example, you'll typically see a nebula, globular cluster (see the pages that follow) or a galaxy as a faint, grey misty patch whereas a photograph may show stunning colors and hundreds or thousands of stars.

So what's the point? Imagine if you saw your singer somewhere but you couldn't get close to them?

I liken it to seeing your favorite singer or group in concert. You can't get close to them, but to see them "in real life" can be almost surreal. You'll still be pleased that you had the chance to see them and, to me, it's a similar experience with the objects in the night sky.

(Your first look at Saturn through a telescope will probably demonstrate this pretty well. You've seen the pictures in the media, but when you first see it, you might very well have an "oh, it's real!" moment. Many folks talk about how it looks three dimensional and appears to be simply hanging there in space.)

Another important point is that what you see will greatly depend upon your own eyes, your level of experience, your equipment and – to a large extent – your location and weather.

Having the best telescope you can buy is almost completely wasted on a night sky filled with light pollution from the nearest town or city.

A lot of the objects (I'd dare to say *most*) can be seen from suburban skies but some might require the dark skies of the country to be seen. Either way, *all* the objects will appear better from a dark sky.

For example, simply standing under the light of our own Milky Way galaxy from a truly dark location can be an awe-inspiring sight. If you’re truly lucky and can stand under black skies (and also have good eyesight) it’s possible to see your own shadow cast by starlight. It’s rare, but it’s been done!

Asterisms

An asterism is a group of unrelated stars that appears to form a familiar shape. Perhaps the most famous example are the seven brightest stars of Ursa Major, the Great Bear.

To observers in North America, these stars are known as the Big Dipper, but to observers in the United Kingdom they're commonly known as the Plough.

Other famous asterisms include the Teapot of Sagittarius and the Coathanger, an apparent cluster of stars that are easily observed with binoculars in the constellation of Vulpecula, the Fox.

Light Year

A light year, as many people know, is a measure of distance in the universe. Put simply, light travels at a speed of roughly 186,000 miles per second.

So, for example, at a distance of (on average) 239,000 miles, the Moon's light takes about one and a quarter seconds to reach us.

The Sun is, again, on average, almost 93 million miles away – its light therefore takes about 8 minutes and 19 seconds to reach us.

Jupiter, the largest planet in our solar system, is about forty-three light minutes away. Light from Neptune, the furthest planet, takes about four hours and ten minutes to reach us.

The nearest star, Proxima Centauri, is just slightly under 4 ¼ light years away. Our solar system is thought to be about 27,000 light years away from the center of the Milky Way galaxy while the Andromeda Galaxy – the furthest object you can see with just your eyes – is about 2¼ million light years away.

In fact, using advanced instruments like the Hubble Space Telescope, astronomers have been able to observe objects that are *billions* of light years away.

It's a staggering thought, made all the more amazing when you realize that you're actually seeing those objects as they were *in the past.* Light from the Sun takes 8 minutes to reach us – so that light is already 8 minutes old. You're seeing the Sun as it was 8 minutes ago.

When you look up at the night sky, you're seeing the stars as they were tens, hundreds or even thousands of years ago. When you observe the Andromeda Galaxy, you're seeing a memory of it from *millions* of years ago.

No matter which way you turn, you're looking into the past. Astronomy has its heart in history.

Magnitude

In short, astronomers use a scale called *magnitude* to determine an object's brightness. The scale originates from ancient Greece (possibly by the astronomer Hipparchus) and was initially applied to only the stars themselves.

The scale ranged from 1 to 6, with the brightest stars being of first magnitude while the faintest – at the very edge of naked eye visibility – ranked as being of sixth magnitude.

Over time the system has been adjusted and refined with the brightest objects having a negative magnitude.

For example, the full Moon shines at about magnitude -12. Venus, the brightest planet, shines at a maximum magnitude of -4.9 while Sirius, the brightest star in the sky, has a magnitude of -1.5. (The Sun shines at a blinding magnitude -26.7)

Nowadays, the faintest stars are really determined by how much light pollution your observing location suffers. If you live at the center of a large city you may only see the brightest stars, probably no brighter than magnitude 2. This means that, at most, you'd probably see no more than 50 stars in the sky.

But go out to the darkness of a rural location and, with good eyesight, you may be able to see stars as faint as magnitude 6. The number of visible stars now increases exponentially. It's no longer tens of stars, or even hundreds, but may be more like 4,000 stars.

Unfortunately, this is a sight that fewer and fewer people are able to witness. With about a third of the world's population no longer able to see our own Milky Way galaxy, the stars our ancestors observed are truly fading from view and becoming lost to us.

Nebulae

Messier 42, the Orion Nebula in the constellation of Orion. Image credit: Sylvain Billot (Double-tap image to enlarge.)

The best way to think of a nebula (nebul*ae* being plural) is as a huge cloud of gas and dust in space. In short, a nebula is the birthplace of stars.

Over time, the nebula grows larger more massive until it’s no longer able to support itself and it undergoes a gravitational collapse. The fragments of the cloud continue to collapse until the central mass ignites into a young star.

Planets will often form from the disc of gas and dust that orbits the star with asteroids and comets forming from the remaining rubble.

There are a number of nebulae visible in the night sky, but only a few are bright enough to be easily seen. The most famous (and best example for northern hemisphere observers) is the Orion Nebula (see the previous image.)

Visible throughout the winter months below the three stars of Orion’s belt, this nebula is clearly seen as a tiny misty patch with nothing but your eyes. (You can even see it from light polluted suburban skies.)

The Orion Nebula is thought to be roughly 1,300 light years away and is about 12 light years in diameter. It’s also thought that the Orion Nebula may be the birthplace of our own solar system and that, over the course of billions of years, we have left our cradle behind and ventured out into the surrounding stellar neighborhood.

If you look at the nebula with binoculars or a small telescope, you can see the next generation of young stars within it. At the heart of the nebula are four tiny, bright white stars collectively known as the Trapezium. In time, these stars will also leave the cloud behind.

Star Clusters

Messier 6, the Butterfly Cluster, is an open star cluster in the constellation of Scorpius. Image credit: Ole Nielsen (Double-tap image to enlarge.)

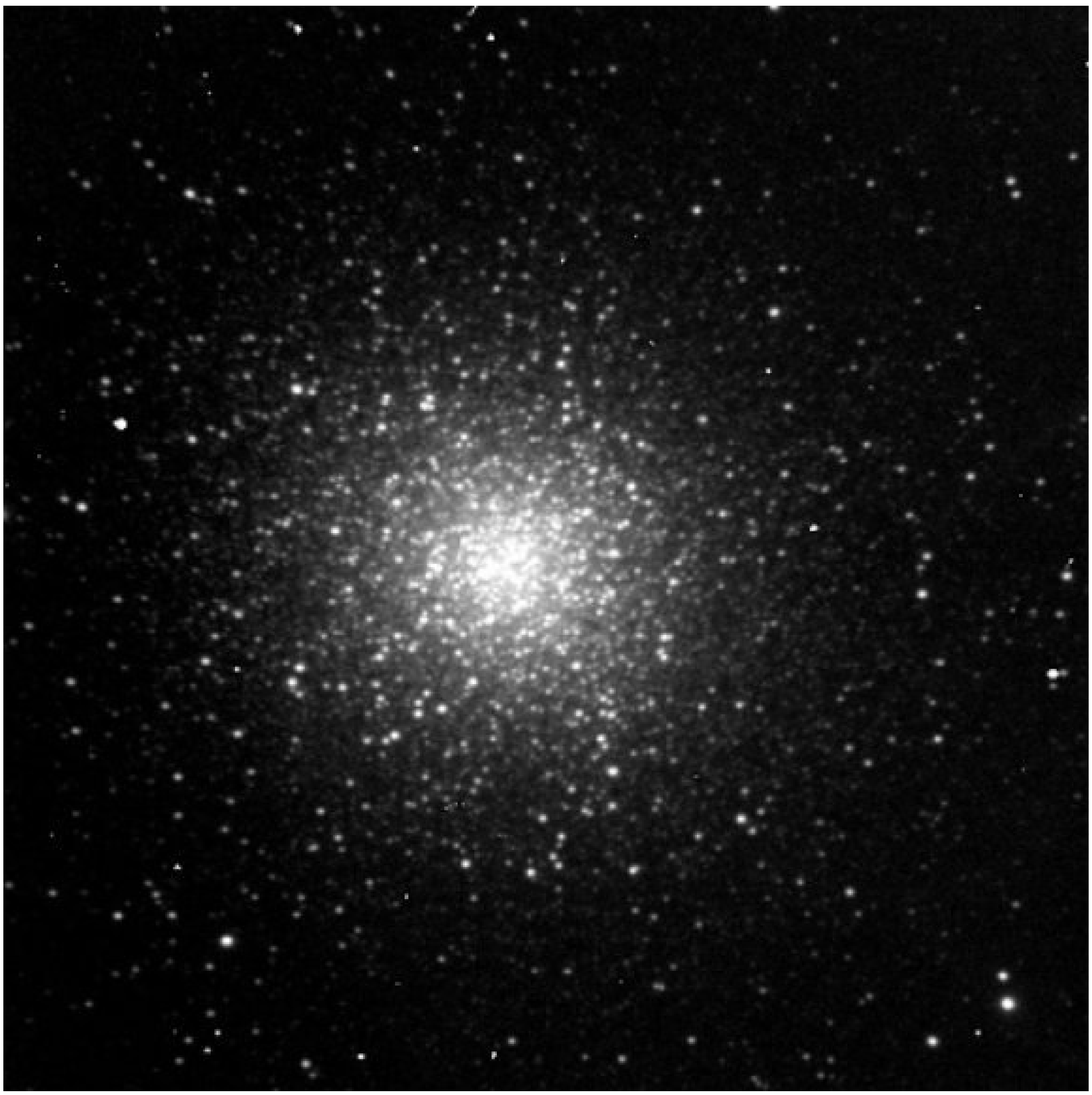
There are two types of star cluster in the night sky: open (or "galactic") clusters and globular star clusters.

An open cluster is a group of stars that have formed from the same nebula. (In some cases the remaining nebula may still be seen swaddling the stars.)

These stars, born together, have remained gravitationally bound together and there are many that can be observed with binoculars or a small telescope.

Perhaps most famously, the Pleaides open star cluster in Taurus is plainly visible to the naked eye while the V-shaped Hyades (also in Taurus) is also an easy target nearby. Both these clusters are beautiful in binoculars and the Pleaides can be particularly stunning in a small telescope at low power.

If you have binoculars or a small telescope, the Praesepe in Cancer, Messier 41 in Canis Major or Messiers 6 and 7 in Scorpius are also excellent examples.



Messier 13, the Keystone Cluster, a globular cluster in the constellation of Hercules. Image credit: Peter Linde (Double-tap image to enlarge.)

Globular clusters are, in short, huge spheres of stars, often containing hundreds of thousands of suns, all gravitationally bound to one another. Their formation is not fully understood but the clusters typically contain older stars with some clusters being nearly as old as the universe itself (ie, ten or twelve billion years old!)

Globulars are typically gathered in a halo around the galactic core. Our own Milky Way may have as many as 200 globulars while our nearby neighbor, the Andromeda Galaxy, may have 500.

There are no globulars that are easily visible with just your eyes from the northern hemisphere but the Keystone Cluster in Hercules may be glimpsed under clear dark skies.

That being said, it can be seen with binoculars (even from the city) and a small telescope can provide a detailed view with chains of stars giving the impression of a tentacled creature at the bottom of the ocean!

To many, globulars can appear as nothing much more than small, hazy blobs through binoculars or a small telescope. But every one is a little different with some globulars having slightly different shapes while others have brighter or larger cores.

Multiple Stars

Mizar and Alcor in the constellation of Ursa Major. Image credit: Sebastien Lebrigand (Double-tap image to enlarge.)

Just as pretty as open star clusters are multiple stars. It may surprise a lot of folks to know that there are more multiple stars in the sky than single stars and many of these are within easy reach of binoculars or small telescopes.

There are basically two types of multiple stars: optical doubles and true multiple star systems.

An optical double is merely the chance alignment of two stars in the sky, giving the impression of a double star system. In reality, these stars may be tens or hundreds of light years apart.

The pairing of Mizar and Alcor in Ursa Major is a good example of an optical double that's easily split with your unaided eye.

Conversely, a true multiple star system is exactly that: two or more stars that are the same distance from Earth and therefore form a true star system in space.

These stars are gravitationally bound and actually orbit one another around a common center of gravity, somewhere between the two stars.

Sometimes these stars are too close to be split visually and may only take a few days to orbit one another. Others typically take years, or even thousands of years, to complete their cosmic dance.

Many multiple star systems contain more than two stars with some systems containing more than three individual stars. Castor, in the constellation of Gemini the Twins, is a famous example. There are thought to be six stars in this system with the two largest components being visible in small telescope.

In situations where two stars are visible, it's common practice to describe the brighter star as the primary and the fainter star as the secondary. This helps to identify which star is being discussed and you'll find I make mention of this in the text.

Planetary Nebulae and Supernovae Remnants

Messier 57, the Ring Nebula, a planetary nebula in the constellation of Lyra, the Lyre. Image credit: NASA, ESA and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration. (Double-tap image to enlarge.)

Depending upon the mass of the star, there are many ways in which a star can die. Two of these ways may be visible to an amateur astronomer.

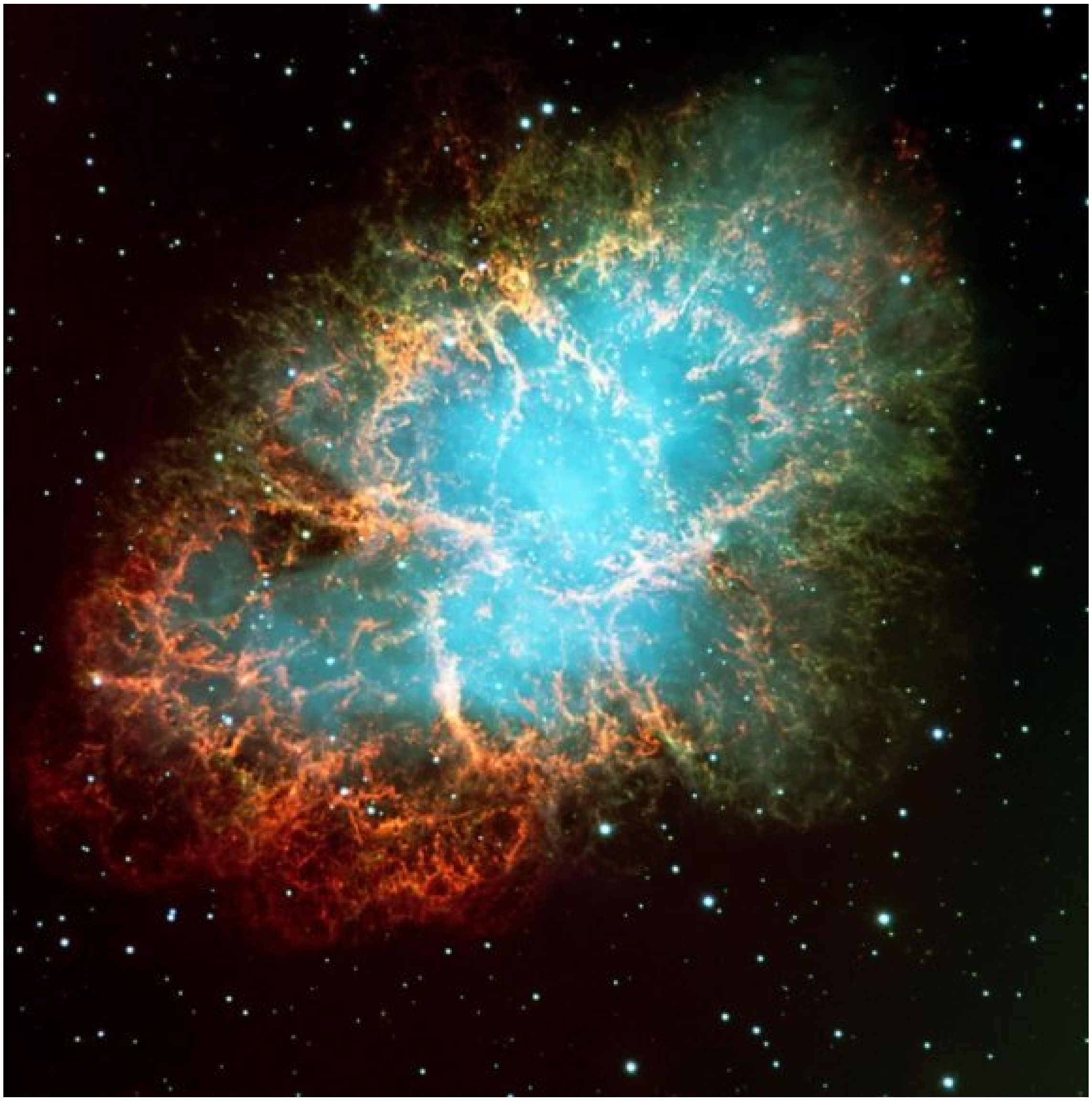
The first happens when the star swells to a red giant and then sheds its outer layers, like the skin of an onion. This shell of gas and dust then expands as the star itself shrinks to a white dwarf.

The shells, called planetary nebulae (because they look like the disc of a planet), can sometimes be seen in a telescope but they're often small, faint and require dark skies (and some experience) to locate.

One famous example is the Ring Nebula in the constellation of Lyra, the Lyre. It's relatively bright, easy to locate and through a telescope with medium to high power its shape becomes apparent as it looks like a smoke ring in space.

(I haven't mentioned this in the text for Lyra as it can be tricky to see with binoculars and I chose to focus on easier targets instead.)

Other, more massive stars, will no longer be able to support themselves and will rapidly collapse, causing the star to explode. This phenomenon is called a nova (or a supernova, if the star is massive enough.)



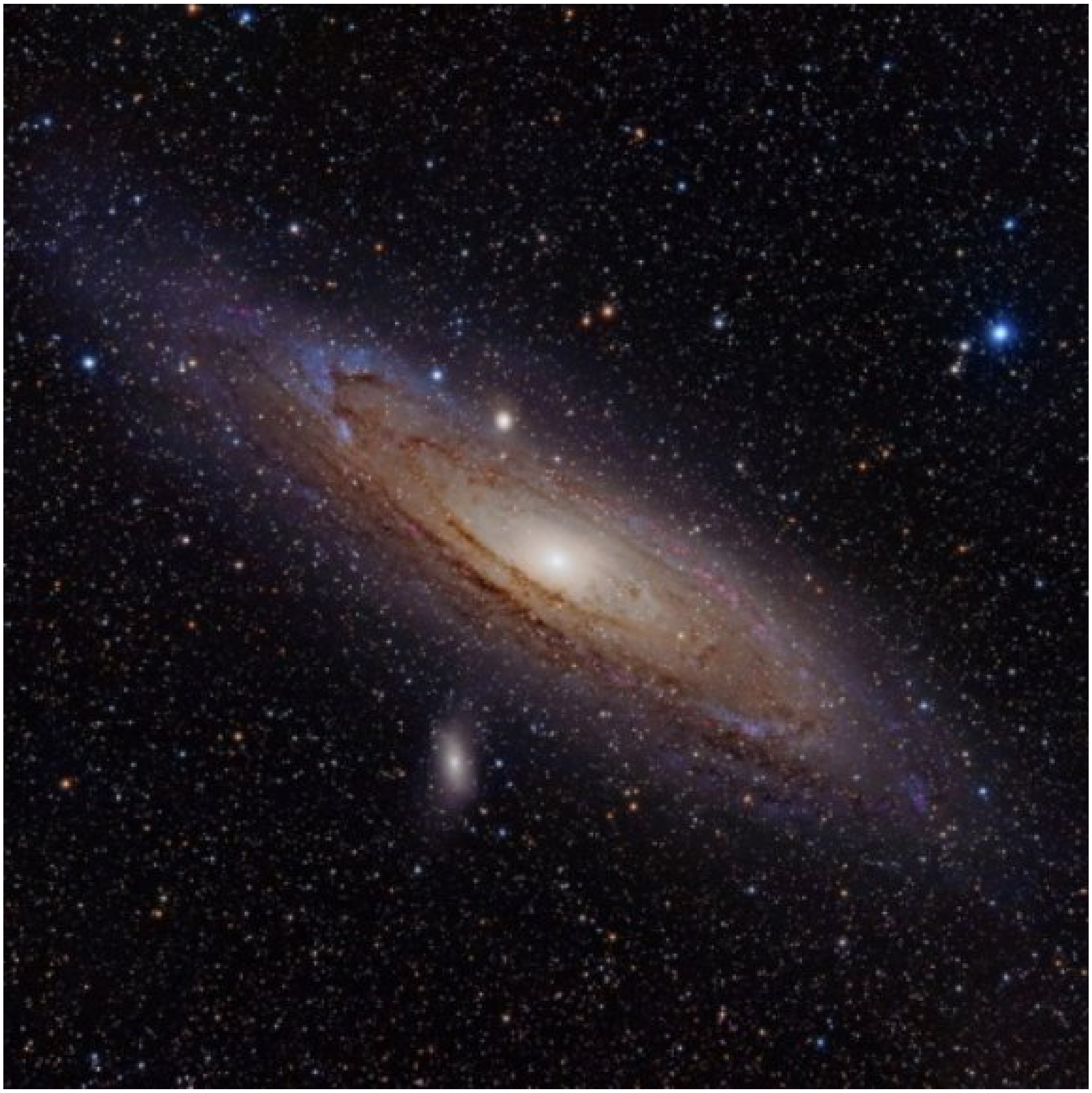
Messier 1, the Crab Nebula, a supernova remnant in the constellation of [Taurus,](#) the Bull. Image credit: ESO. (Double-tap image to enlarge.)

Novae are very rare with supernovae being rarer still. Very occasionally a truly bright nova, visible with just your eyes, may appear but these are few and far between.

We can, however, see a few remnants of these explosions in the night sky. For example, the Crab Nebula in Taurus, the Bull, is the remnants of a star that exploded in July 1054. It shone so brightly that it was visible during the daylight for weeks and was visible during the night with the unaided eye for several years.

This nebula, like the Ring Nebula, is a tricky object for binoculars and may be challenging for an inexperienced observer. Consequently, the text for Taurus discusses the two bright open star clusters of the Hyades and Pleiades instead.

Galaxies



Messier 31, the Andromeda Galaxy, in the constellation of Andromeda the Princess. Image credit: Adam Evans (Double-tap image to enlarge.)

Galaxies are the islands of stars that float upon the ocean of the universe. If that sounds poetic, then that's fine because it's meant to be.

The fact of the matter is that few people really give them much thought but I feel there's nothing else that can truly give you a sense of scale in the universe.

And yet, until the 20th century, nobody knew they existed. Throughout most of history, astronomers believed these faint, misty patches were simply nebulae. Some, like the famous Whirlpool Galaxy, had a spiral structure and were consequently known as spiral nebulae.

It wasn't until the early 20th century that studies indicated that novae observed within these nebulae were much further than those within our own Milky Way galaxy.

Nowadays we know the truth: galaxies are millions of light years away. In all, there are thought to be at least one hundred billion galaxies in the observable universe and each of these contains hundreds of billions of stars.

If you live under moderately dark skies you can see one of these galaxies with just your eyes. The Andromeda Galaxy (in the constellation it is named after) is the most distant object that can be easily seen without optical aid and is one of the closest galaxies to our own.

That galaxy, along with our Milky Way, is a member of the Local Group of galaxies that comprises of more than 50 galaxies across ten million light years of space.

Other galaxies may be visible with binoculars or a small telescope but many are small, faint and require dark skies and some experience to locate. However, the Andromeda Galaxy, being visible to the naked eye, is an easy target and can be well worth a look – especially when you consider the hundreds of billions of stars that are shining back at you!

What are Messier Objects?

Charles Messier, circa 1770. Image credit: public domain. (Double-tap image to enlarge.)

There's a famous group of objects that are known and studied throughout the astronomical world by both amateur and professional astronomers alike: the Messier objects.

This is a catalogue of deep sky objects (ie, nebulae, star clusters and galaxies but not double stars) that was compiled over a number of years by the French astronomer Charles Messier.

Messier was born in 1730 and became a renowned comet-hunter later in life. In all, he discovered thirteen comets but he’s best known today for his catalogue.

Since deep sky objects can often look small, faint and nebulous, he compiled his catalogue to avoid confusing them with any potential cometary discoveries.

The first version of his catalogue was published in 1774 and only contained 45 objects, but over the next seven years he added 68 more. Since then, 7 other objects have been added, making for a total of 110 in all.

Once you become familiar with the objects (and maybe observe a comet or two) you’ll soon understand why Messier would want to set these objects apart. But, equally, there are objects that clearly look nothing like comets, even with the basic equipment that Messier had available at the time.

One such example is Messier 45, the Pleiades open cluster, which is clearly visible as a small group of stars to even the naked eye.

Other objects, such as the Double Cluster in Perseus or the Owl Cluster in Cassiopeia, are not listed at all, leading some astronomical historians to wonder about Messier’s selection criteria and methods!

Of course none of this detracts from the wonder of the objects themselves and every year, in the spring, amateur astronomers come together under clear dark skies to try and spot them all in a single night.

These “Messier Marathons” can be fun, challenging and, most of all, very rewarding. It’s well worth taking the time to meet up with a group of similarly minded observers, through a local club or society, who’ll help you to track down these celestial sights from sundown to sunrise.

Look Out for La Luna

As I’ve said in another book, the Moon is not your friend and, hopefully, by the end of this section you‘ll have an understanding why.

The Moon takes slightly more than 27 days to orbit the Earth. It also takes the same amount of time to revolve, which is why the same side of the Moon is always visible to us.

This is not a coincidence, *per se*, but rather the result of the Moon’s rotation gradually slowing as it also slowly drifts further away from the Earth. We just happen to be alive at a time when its orbital period and the length of its day is the same. (Technically, the Moon is *tidally locked* with the Earth and it occurs with other moons and planets in our solar system too.)

As the Moon orbits the Earth it goes through a number of recognizable phases. When the Moon is between the Earth and the Sun the sunlit portion of its surface is turned away from us and the Moon is invisible. This is the New Moon. The Moon first becomes easily visible a few days later, as it moves away from the Sun in the sky.

Waxing crescent Moon. Photo by the author. (Double-tap image to enlarge.)

So about midway between New Moon and half Moon is the Waxing Crescent phase. This is when the Moon typically sets a few hours after the Sun and is often seen in the evening twilight sky. A bright star or planet can sometimes be visible nearby, making for a picturesque sight.

At this point, it appears to be getting fuller and we say the Moon is waxing. A waxing Moon will typically appear in the evening sky but you might see it in the daylight, usually in the afternoon. A waxing Moon will always set before sunrise.

First Quarter Moon. Photo by the author. (Double-tap image to enlarge.)

Roughly a week after New Moon is the First Quarter phase, so-called because it’s moved a quarter of the way around the Earth in its orbit. At this point the Moon is half illuminated and will rise around midday, be roughly due south at sunset and will then set around midnight.

Waxing Gibbous Moon. Photo by the author. (Double-tap image to enlarge.)

Midway between the half Moon and the Full Moon is the gibbous Moon. The word gibbous itself is used to describe an object that has convex or humped sides.

Full Moon. Photo by the author. (Double-tap image to enlarge.)

Next, about two weeks after the New Moon, we come to the Full Moon. This is when the Earth is between the Moon and the Sun and we see the whole of the Moon’s lit surface. Because the Moon appears opposite the Sun in the sky, it rises at sunset, is roughly due south around midnight and then sets at sunrise. It’s therefore visible all night.

Once the Moon passes through the full phase, it’s said to be waning because it now appears to be growing thinner.

At this point the Moon predominantly belongs to the morning sky and can often be seen during daylight hours, usually during the morning. A waning Moon always sets before the Sun.

Waning Gibbous Moon. Photo by Thomas Bresson (Double-tap image to enlarge.)

Now we cycle through the phases in reverse; so first after Full is the Waning Gibbous phase. Depending on the time of year, this can sometimes be seen rising late in the evening and is an easy sight in the daylight before midday.

Last Quarter Moon. Photo by the author. (Double-tap image to enlarge.)

About a week after Full Moon is the Last Quarter phase. Like its counterpart, First Quarter, the Moon is half illuminated at this point and has completed three quarters of its orbit about the Earth. The last quarter Moon usually rises around midnight, is roughly due south at sunrise and then sets around midday.

Waning Crescent Moon. Photo by Art Lupinacci (Double-tap image to enlarge.)

The last phase comes between the Last Quarter and New Moon and is the Waning Crescent. This is when the Moon rises a few hours before sunrise and appears in the pre-dawn sky. Again, like the waxing crescent, it can make for an attractive sight, especially if a bright star or planet is nearby.

New Moon. Image credit: Mobile Observatory. (Double-tap image to enlarge.)

All too soon, just a few days later, the Moon is gone as it turns new again and the cycle begins over. But how soon after New Moon can you first catch sight of it?

You'll typically need to wait until a few days after New Moon to see it clearly again. When seen as a thin, curved sliver against the golden sky of the evening twilight, the expression "the young Moon in the old Moon's arms" takes on a new significance!

Unfortunately, the Moon, like the Sun, brightens the sky and makes it harder to see faint stars and deep sky objects. Just as the Sun lightens the sky and makes it appears bright blue, so the Moon brightens it a little and makes it appear *dark* blue.

This is most apparent at Full Moon but it can also be a nuisance between First Quarter and Waning Gibbous. That’s about ten days out of nearly four weeks when observing faint, deep sky objects like nebulae, galaxies and globular clusters can be difficult, to say the least.

A waxing crescent Moon isn’t too much of a problem; it’s not nearly as bright as a Full Moon and it will set relatively early in the evening. Once the Moon reaches First Quarter it starts to brighten the sky, sets later in the evening and intrudes upon more of your observing time.

Try it for yourself. Look at the number of stars visible during a moonless night and compare it to a night with a Full Moon.

Hence, the Moon is not your friend. Unless, of course, you’re looking to observe the Moon too. To be honest, I’m not a big lunar observer (so I don’t discuss it much here) but if you have binoculars or a telescope the views leading up to and after Full Moon can be quite spectacular – especially when the Moon is a crescent.

During these times you’ll see shadows stretching across craters and mountain ranges as the Sun very slowly rises and sets over the lunar surface. It’s best observed as a crescent because the shadows are at their longest and the light is not so bright.

(The Moon can be dazzling. If you’re using a telescope, a lunar filter is essential as it will block the vast majority of the Moon’s bright light and will make it much easier to observe.)

Observing the Full Moon can be (almost) a waste of time because the Sun’s light is striking the Moon’s surface from directly overhead (as seen from the Moon.) Hence, there are no shadows to be seen.

All this goes to prove that even on a clear night there might not be much to observe!

Star Charts & Visible Constellations

Getting Started

Before you do anything, there's one thing you need to know: which way's north? Fortunately, this mystery is easily solved, there are a number of ways to solve it and the solution doesn't have to be accurate.

You could, for example, go outside on a bright day at around noon (1pm, if your area is observing summer time) and look for the Sun. **Please don't stare at it** as this can lead to eyesight loss! The Sun at this time will be roughly over the southern horizon, so you only need to look in the opposite direction to be facing north.

Alternately, going outside at sunset will give you (again, roughly) an idea of which way is west. Just make a quarter turn to your right and you'll be approximately looking toward the north. You can also do the same at sunrise; the Sun rises (roughly!) in the east so turn to your left to face north.

You could also go online and simply search for your location through Google or Bing. Both those search engines have maps that will show you which way is north. Similarly, there are a number of free compass apps, available for both Apple and Android devices, that can give you the same information.

Find north and remember which way you're facing. Why? Because you need to find the seven brightest stars of Ursa Major and they'll always be over the northern horizon.

About the Star Charts

Over the next few pages you'll find star charts that'll help you to identify many of the constellations visible throughout the year. You can use the table to look up the appropriate star chart for the current time of year and time of night. If your area is currently observing summer time, remember to deduct an hour first.

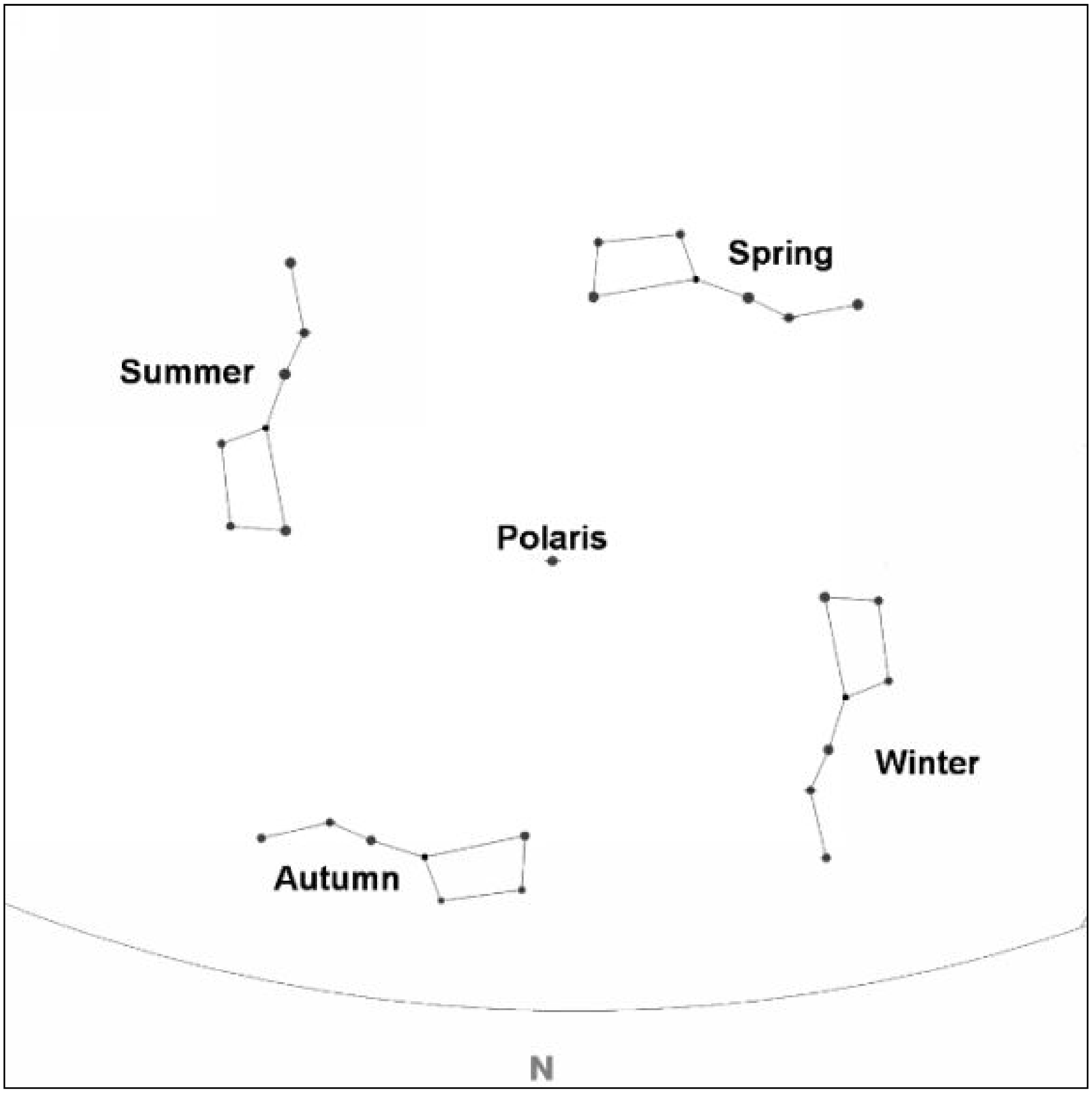
For example, if it's early August, your area is using summer time and you're observing at 11pm, you'll need to refer to chart 19 to see which constellations will be visible.

The charts depict a view of the entire night sky with the perimeter circle representing the horizon. Orient yourself so the N at the top is at the bottom and this will show you a view of the northern horizon.

Locating a Signpost

As mentioned, you’re looking for the brightest stars in Ursa Major. These seven stars are well known throughout the world and have different names, depending upon your location. Perhaps most famously, the seven are known as the Big Dipper in North America or the Plough in the United Kingdom.

These stars are *circumpolar* throughout much of the northern hemisphere. This means they never set and appear to circle Polaris, the north pole star, during the course of the night.



This image depicts the approximate position of Ursa Major throughout the year. Image courtesy: Mobile Observatory (Double-tap image to enlarge.)

You'll also notice that the stars appear to circle Polaris over the course of the year. For example, at 10pm on April 1st, the stars appear high overhead. Three months later, they've begun to drop lower and appear to the west of Polaris.

In the autumn, at 10pm on October 1st, they're low over the northern horizon and may be a little tricky to see from the southern United States.

Lastly, in mid-winter, at 10pm on January 1st, the stars have begun to rise again and now appear to the east of Polaris.

In essence, it's as though you're looking at the hands of a vast celestial clock, but one that runs backwards!

This continuous visibility, plus their brightness, make these stars the perfect starting point for your astronomical journey.

By always knowing how to find this signpost, you're almost guaranteed to be able to navigate your way across the night sky and encounter other constellations – no matter what time of night or year! (See Ursa Major for more information how you can use these stars to locate others.)

As you work through the book, you'll also find notes for each constellation that might mention using Ursa Major as a signpost to find those stars.

If you're observing during the winter, there's one other major signpost that can help you and, arguably, it's even easier to find than Ursa Major: Orion.

Like the seven brightest stars of Ursa Major, this famous constellation has also been known for thousands of years and across many different civilizations. It's a prominent and easy sight over the southern horizon throughout the winter and can be used to find other seasonal constellations, such as Taurus, Gemini and Auriga. (See Orion for more information.)

There's one last thing to bear in mind as you're looking for these constellations. The sky is a big place and so are the constellations themselves. Their depictions on the star charts can seem deceptively small, but their true size in the sky can be surprisingly large.

For that reason, you might find yourself unable to see the constellations for the stars, especially if you live under dark skies. Take your time, look carefully, join the dots and, with patience, a constellation will suddenly reveal itself.

Like completing a jigsaw puzzle, there's nothing quite like that moment when you see the whole picture!

See a Bright Star That’s Not on a Chart?

It’s probably a planet! Five of the planets are easily seen by the naked eye. These wandering stars have hypnotized observers since the dawn of time and more often than not, at least one is visible on any clear night.

As these worlds are not stationary, you’ll need to refer to a magazine (such as *Astronomy* or *Sky & Telescope*), a smartphone app or computer software to confirm your observation, but can you can also find more basic information here.

Star Chart Tables

If observing during daylight savings time, first deduct one hour and then refer to the corresponding chart number. For example, 11pm summer time in early August would be 10pm standard time so you'd need to use chart 19.

Early January

Time	Chart #
6pm	Chart 1
7pm	Chart 2
8pm	Chart 3
9pm	Chart 4
10pm	Chart 5
11pm	Chart 6
12am	Chart 7
1am	Chart 8
2am	Chart 9
3am	Chart 10
4am	Chart 11
5am	Chart 12
6am	Chart 13

Late January

Time	Chart #
6pm	Chart 2
7pm	Chart 3
8pm	Chart 4
9pm	Chart 5
10pm	Chart 6
11pm	Chart 7
12am	Chart 8
1am	Chart 9

2am	Chart 10
3am	Chart 11
4am	Chart 12
5am	Chart 13
6am	Chart 14

Early February

Time	**Chart #**
6pm	Chart 3
7pm	Chart 4
8pm	Chart 5
9pm	Chart 6
10pm	Chart 7
11pm	Chart 8
12am	Chart 9
1am	Chart 10
2am	Chart 11
3am	Chart 12
4am	Chart 13
5am	Chart 14
6am	Chart 15

Late February

Time	**Chart #**
6pm	Chart 4
7pm	Chart 5
8pm	Chart 6
9pm	Chart 7
10pm	Chart 8
11pm	Chart 9
12am	Chart 10
1am	Chart 11

2am	Chart 12
3am	Chart 13
4am	Chart 14
5am	Chart 15
6am	Chart 16

Early March

Time	**Chart #**
6pm	Chart 5
7pm	Chart 6
8pm	Chart 7
9pm	Chart 8
10pm	Chart 9
11pm	Chart 10
12am	Chart 11
1am	Chart 12
2am	Chart 13
3am	Chart 14
4am	Chart 15
5am	Chart 16
6am	Chart 17

Late March

Time	**Chart #**
6pm	Chart 6
7pm	Chart 7
8pm	Chart 8
9pm	Chart 9
10pm	Chart 10
11pm	Chart 11
12am	Chart 12
1am	Chart 13

2am	Chart 14
3am	Chart 15
4am	Chart 16
5am	Chart 17
6am	Chart 18

Early April

Time	**Chart #**
6pm	Chart 7
7pm	Chart 8
8pm	Chart 9
9pm	Chart 10
10pm	Chart 11
11pm	Chart 12
12am	Chart 13
1am	Chart 14
2am	Chart 15
3am	Chart 16
4am	Chart 17
5am	Chart 18
6am	Chart 19

Late April

Time	**Chart #**
6pm	Chart 8
7pm	Chart 9
8pm	Chart 10
9pm	Chart 11
10pm	Chart 12
11pm	Chart 13
12am	Chart 14
1am	Chart 15

2am	Chart 16
3am	Chart 17
4am	Chart 18
5am	Chart 19
6am	Chart 20

Early May

Time	**Chart #**
6pm	Chart 9
7pm	Chart 10
8pm	Chart 11
9pm	Chart 12
10pm	Chart 13
11pm	Chart 14
12am	Chart 15
1am	Chart 16
2am	Chart 17
3am	Chart 18
4am	Chart 19
5am	Chart 20
6am	Chart 21

Late May

Time	**Chart #**
6pm	Chart 10
7pm	Chart 11
8pm	Chart 12
9pm	Chart 13
10pm	Chart 14
11pm	Chart 15
12am	Chart 16
1am	Chart 17

2am	Chart 18
3am	Chart 19
4am	Chart 20
5am	Chart 21
6am	Chart 22

Early June

Time	**Chart #**
6pm	Chart 11
7pm	Chart 12
8pm	Chart 13
9pm	Chart 14
10pm	Chart 15
11pm	Chart 16
12am	Chart 17
1am	Chart 18
2am	Chart 19
3am	Chart 20
4am	Chart 21
5am	Chart 22
6am	Chart 23

Late June

Time	**Chart #**
6pm	Chart 12
7pm	Chart 13
8pm	Chart 14
9pm	Chart 15
10pm	Chart 16
11pm	Chart 17
12am	Chart 18
1am	Chart 19

2am	Chart 20
3am	Chart 21
4am	Chart 22
5am	Chart 23
6am	Chart 24

Early July

Time	**Chart #**
6pm	Chart 13
7pm	Chart 14
8pm	Chart 15
9pm	Chart 16
10pm	Chart 17
11pm	Chart 18
12am	Chart 19
1am	Chart 20
2am	Chart 21
3am	Chart 22
4am	Chart 23
5am	Chart 24
6am	Chart 1

Late July

Time	**Chart #**
6pm	Chart 14
7pm	Chart 15
8pm	Chart 16
9pm	Chart 17
10pm	Chart 18
11pm	Chart 19
12am	Chart 20
1am	Chart 21

2am	Chart 22
3am	Chart 23
4am	Chart 24
5am	Chart 1
6am	Chart 2

Early August

Time	**Chart #**
6pm	Chart 15
7pm	Chart 16
8pm	Chart 17
9pm	Chart 18
10pm	Chart 19
11pm	Chart 20
12am	Chart 21
1am	Chart 22
2am	Chart 23
3am	Chart 24
4am	Chart 1
5am	Chart 2
6am	Chart 3

Late August

Time	**Chart #**
6pm	Chart 16
7pm	Chart 17
8pm	Chart 18
9pm	Chart 19
10pm	Chart 20
11pm	Chart 21
12am	Chart 22
1am	Chart 23

2am	Chart 24
3am	Chart 1
4am	Chart 2
5am	Chart 3
6am	Chart 4

Early September

Time	**Chart #**
6pm	Chart 17
7pm	Chart 18
8pm	Chart 19
9pm	Chart 20
10pm	Chart 21
11pm	Chart 22
12am	Chart 23
1am	Chart 24
2am	Chart 1
3am	Chart 2
4am	Chart 3
5am	Chart 4
6am	Chart 5

Late September

Time	**Chart #**
6pm	Chart 18
7pm	Chart 19
8pm	Chart 20
9pm	Chart 21
10pm	Chart 22
11pm	Chart 23
12am	Chart 24
1am	Chart 1

2am	Chart 2
3am	Chart 3
4am	Chart 4
5am	Chart 5
6am	Chart 6

Early October

Time	**Chart #**
6pm	Chart 19
7pm	Chart 20
8pm	Chart 21
9pm	Chart 22
10pm	Chart 23
11pm	Chart 24
12am	Chart 1
1am	Chart 2
2am	Chart 3
3am	Chart 4
4am	Chart 5
5am	Chart 6
6am	Chart 7

Late October

Time	**Chart #**
6pm	Chart 20
7pm	Chart 21
8pm	Chart 22
9pm	Chart 23
10pm	Chart 24
11pm	Chart 1
12am	Chart 2
1am	Chart 3

2am	Chart 4
3am	Chart 5
4am	Chart 6
5am	Chart 7
6am	Chart 8

Early November

Time	Chart #
6pm	Chart 21
7pm	Chart 22
8pm	Chart 23
9pm	Chart 24
10pm	Chart 1
11pm	Chart 2
12am	Chart 3
1am	Chart 4
2am	Chart 5
3am	Chart 6
4am	Chart 7
5am	Chart 8
6am	Chart 9

Late November

Time	Chart #
6pm	Chart 22
7pm	Chart 23
8pm	Chart 24
9pm	Chart 1
10pm	Chart 2
11pm	Chart 3
12am	Chart 4
1am	Chart 5

2am	Chart 6
3am	Chart 7
4am	Chart 8
5am	Chart 9
6am	Chart 10

Early December

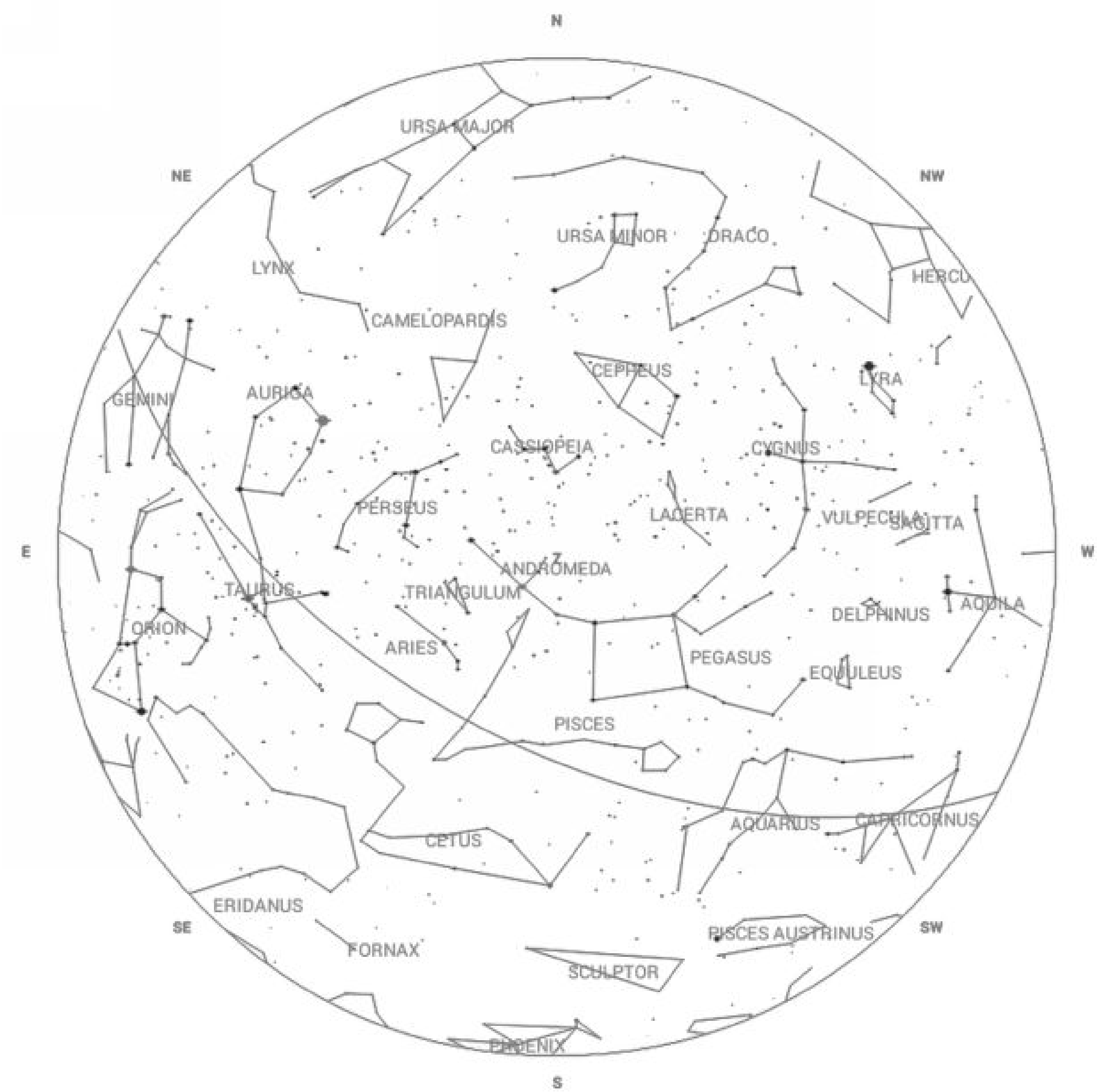
Time	**Chart #**
6pm	Chart 23
7pm	Chart 24
8pm	Chart 1
9pm	Chart 2
10pm	Chart 3
11pm	Chart 4
12am	Chart 5
1am	Chart 6
2am	Chart 7
3am	Chart 8
4am	Chart 9
5am	Chart 10
6am	Chart 11

Late December

Time	**Chart #**
6pm	Chart 24
7pm	Chart 1
8pm	Chart 2
9pm	Chart 3
10pm	Chart 4
11pm	Chart 5
12am	Chart 6
1am	Chart 7

2am	Chart 8
3am	Chart 9
4am	Chart 10
5am	Chart 11
6am	Chart 12

Chart 1

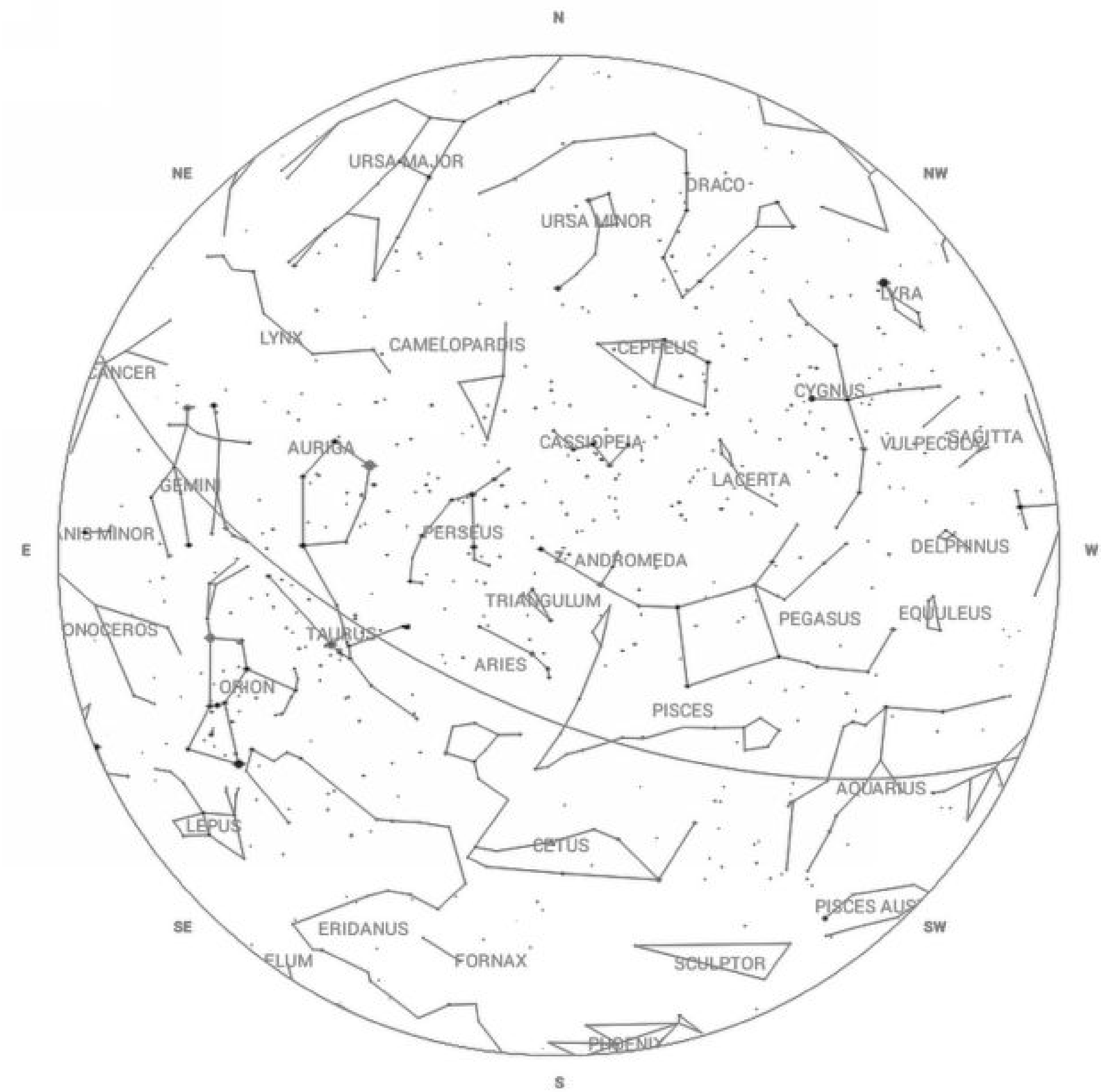


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Lyra, Pegasus, Perseus, Taurus, Ursa Minor and Vulpecula.

Chart 2



(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Gemini, Orion, Pegasus, Perseus, Taurus and Ursa Minor.

Chart 3

(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cassiopeia, Gemini, Orion, Pegasus, Perseus, Taurus and Ursa Minor.

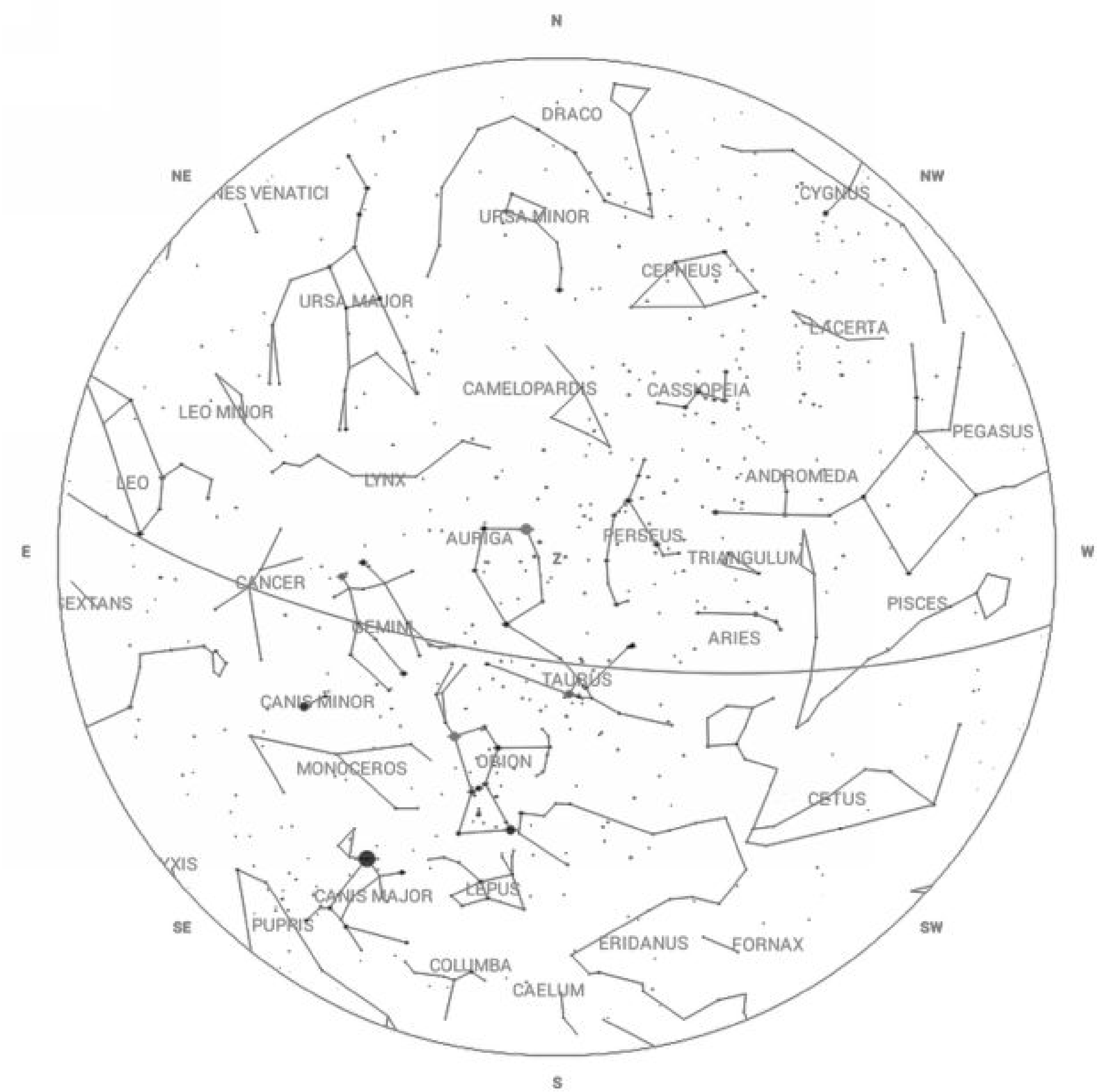
Chart 4

(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cancer, Canis Minor, Cassiopeia, Gemini, Orion, Perseus, Taurus and Ursa Minor.

Chart 5



(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cancer, Canis Major, Canis Minor, Cassiopeia, Gemini, Orion, Perseus, Taurus and Ursa Minor.

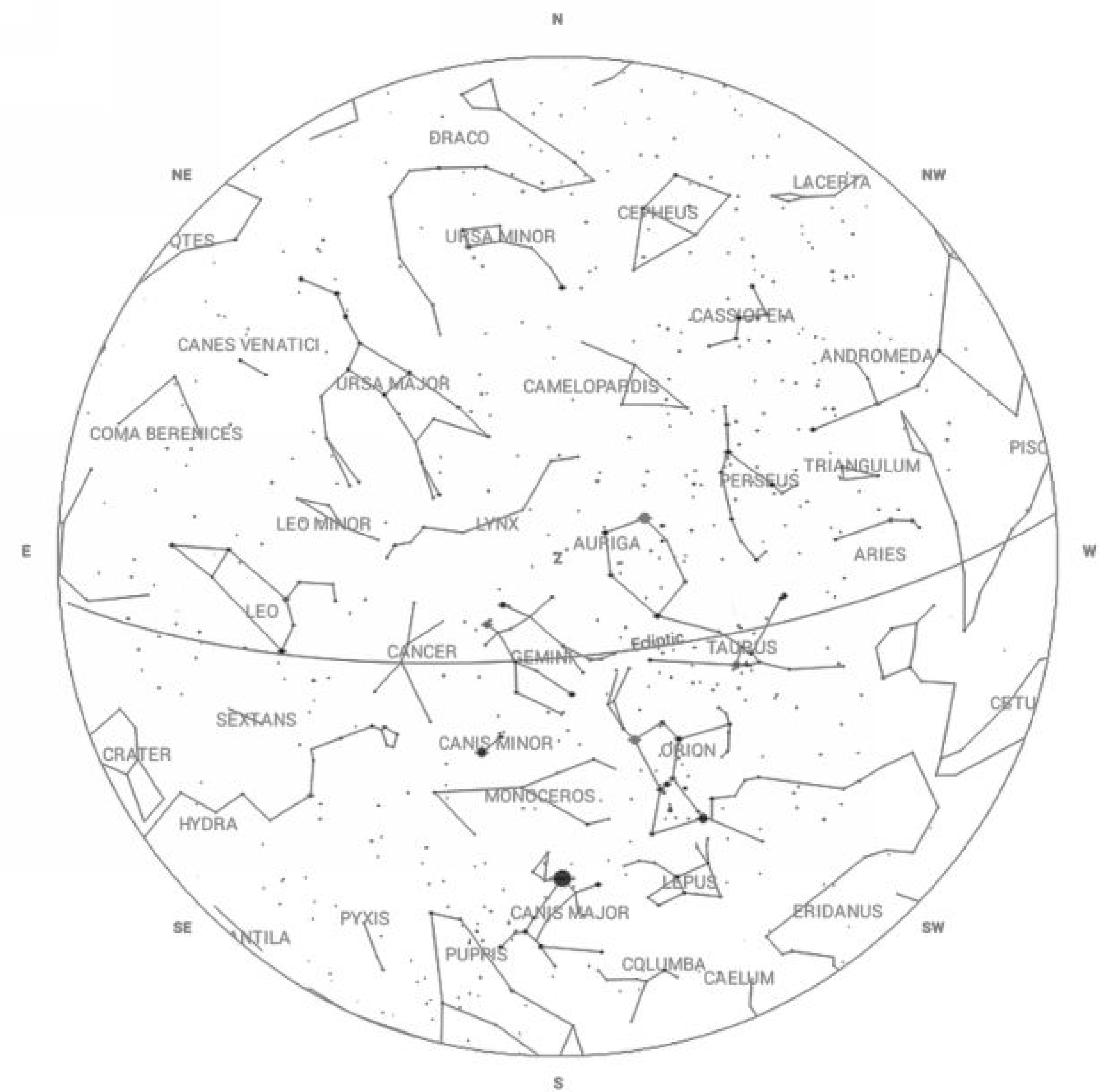
Chart 6

(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aries, Auriga, Cancer, Canis Major, Canis Minor, Cassiopeia, Gemini, Leo, Orion, Perseus, Taurus and Ursa Minor.

Chart 7

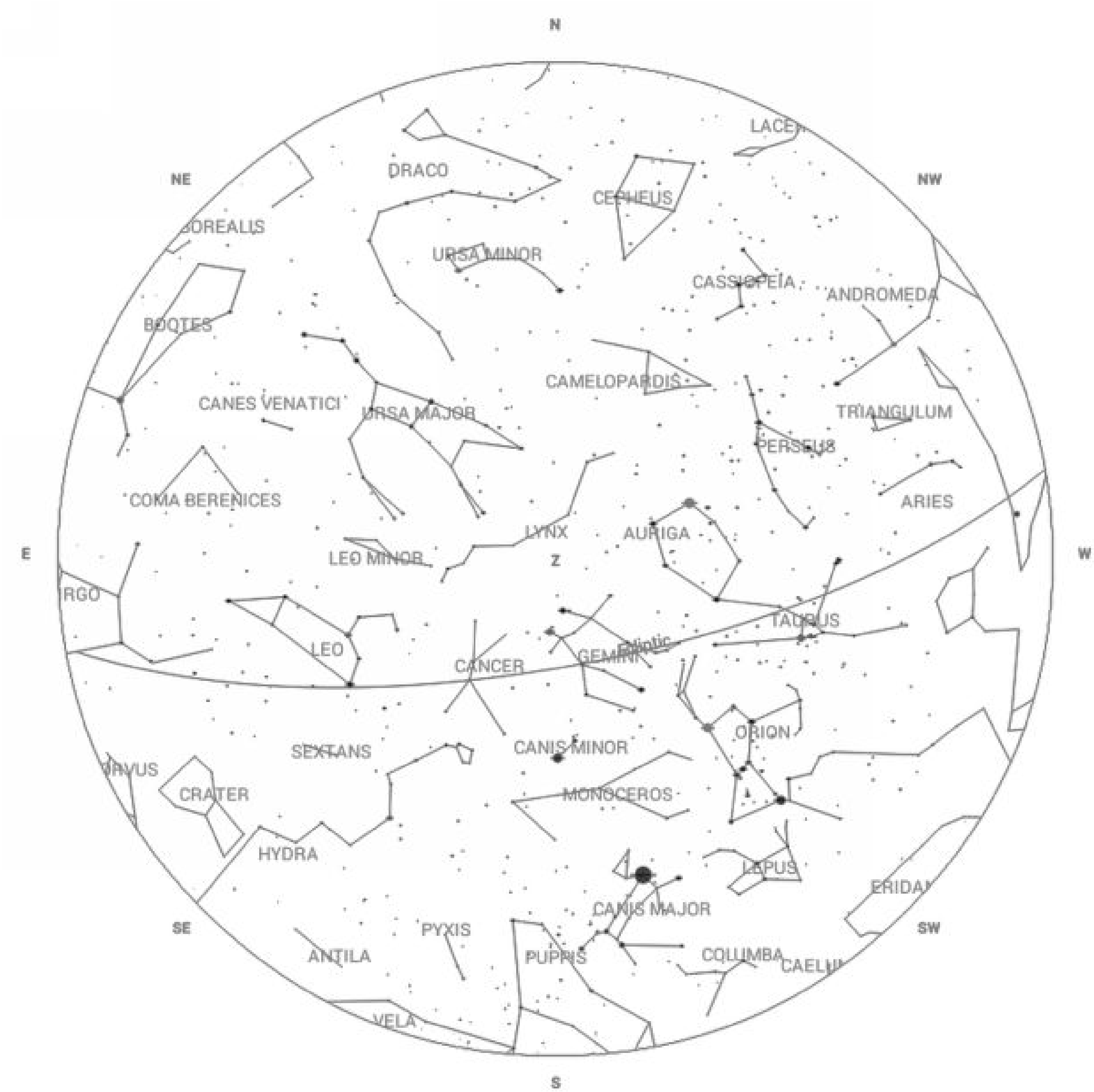


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Aries, Auriga, Cancer, Canis Major, Canis Minor, Cassiopeia, Gemini, Leo, Orion, Perseus, Taurus, Ursa Major and Ursa Minor.

Chart 8

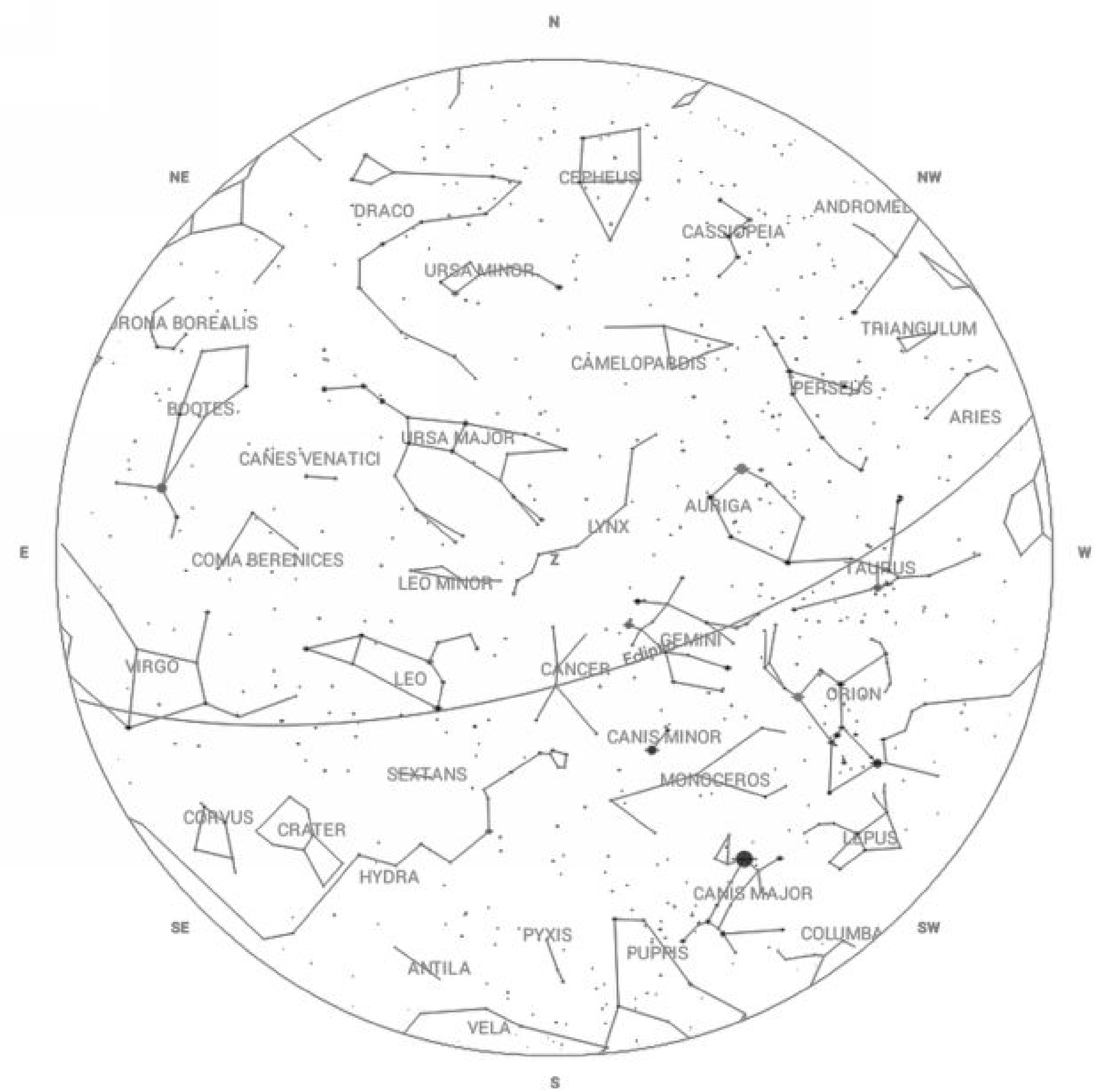


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Auriga, Cancer, Canis Major, Canis Minor, Cassiopeia, Gemini, Leo, Orion, Perseus, Taurus, Ursa Major and Ursa Minor.

Chart 9

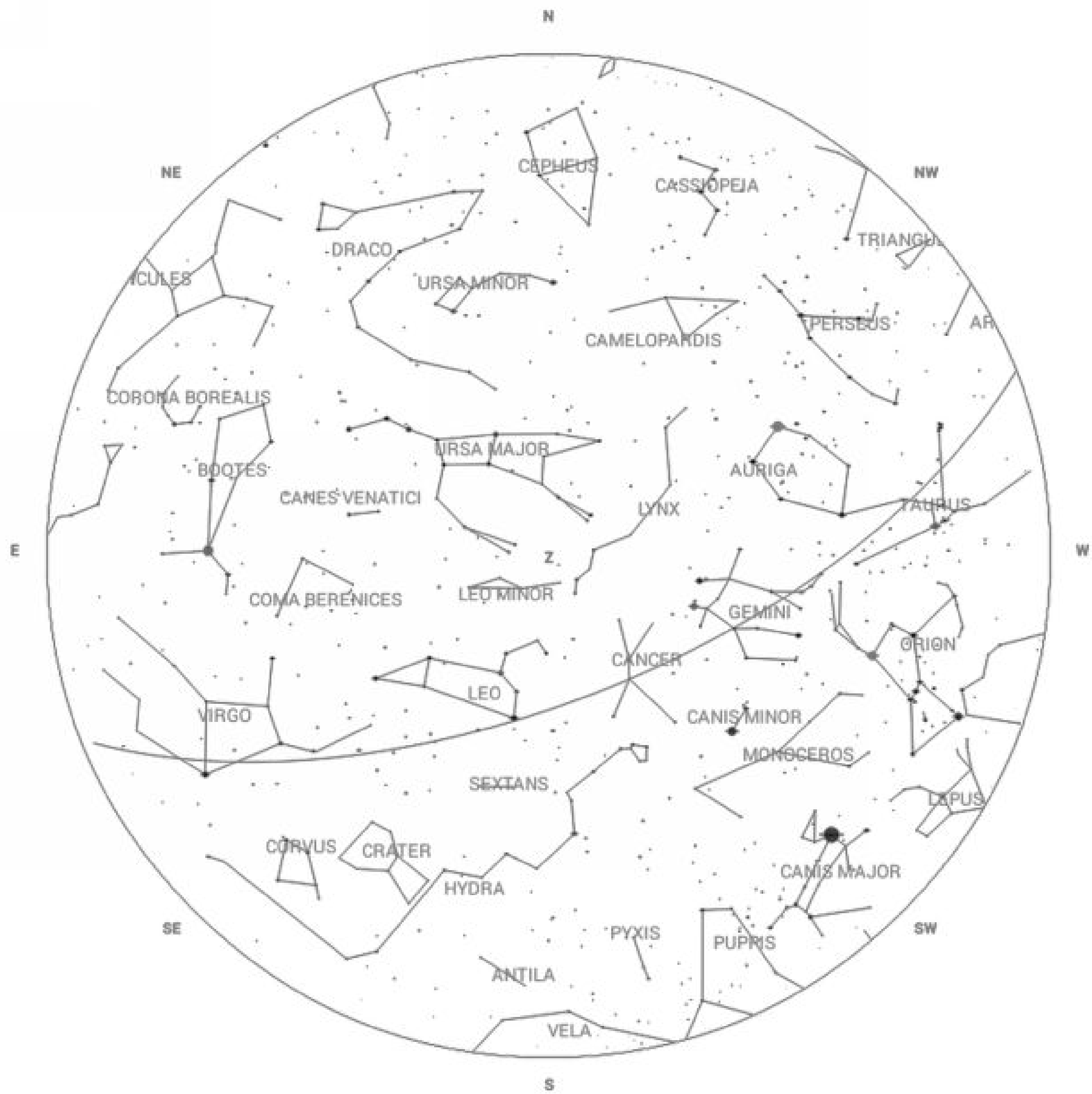


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Auriga, Boötes, Cancer, Canis Major, Canis Minor, Cassiopeia, Coma Berenices, Gemini, Leo, Orion, Perseus, Taurus, Ursa Major and Ursa Minor.

Chart 10

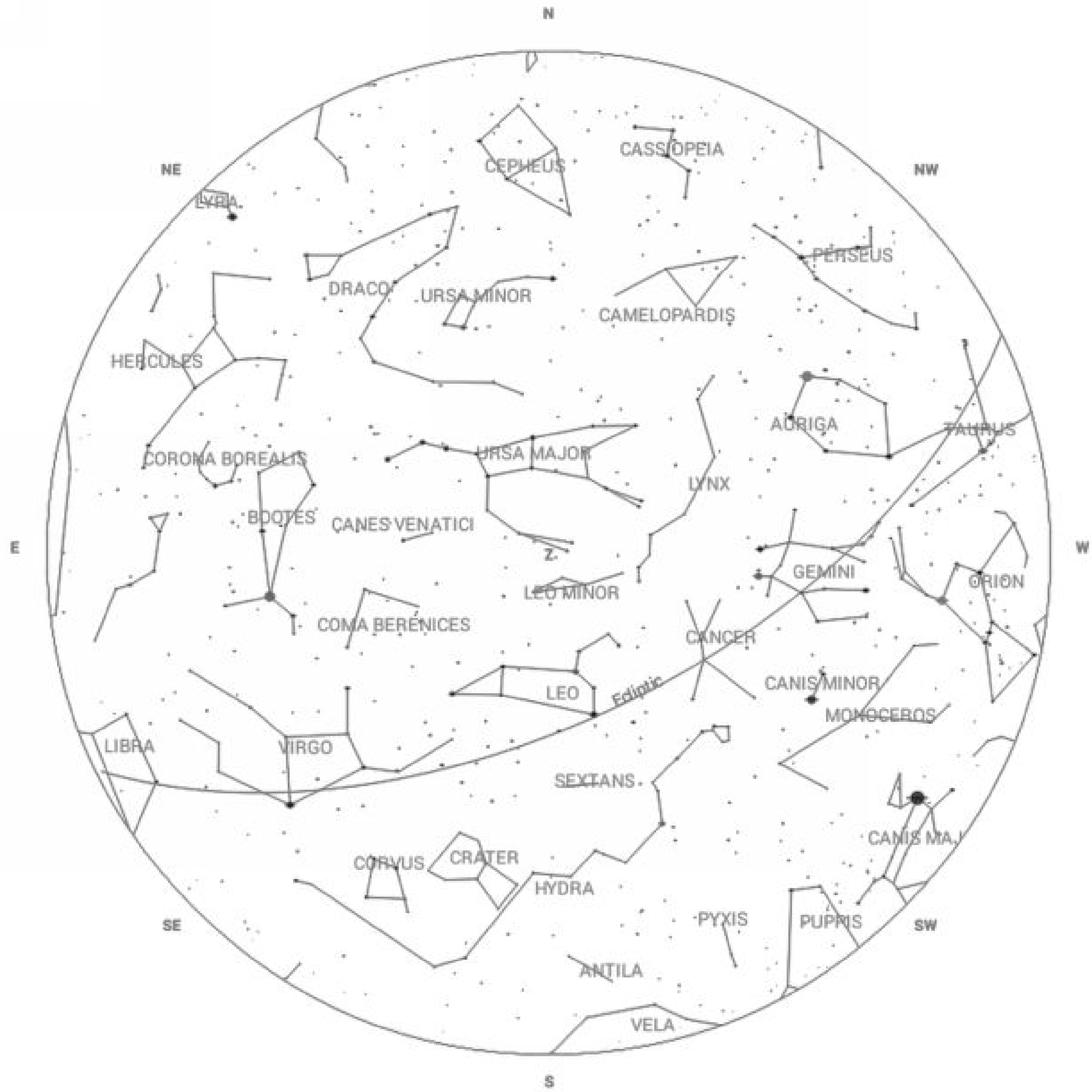


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Auriga, Boötes, Cancer, Canis Minor, Coma Berenices, Corvus, Crater, Gemini, Leo, Ursa Major and Ursa Minor.

Chart 11

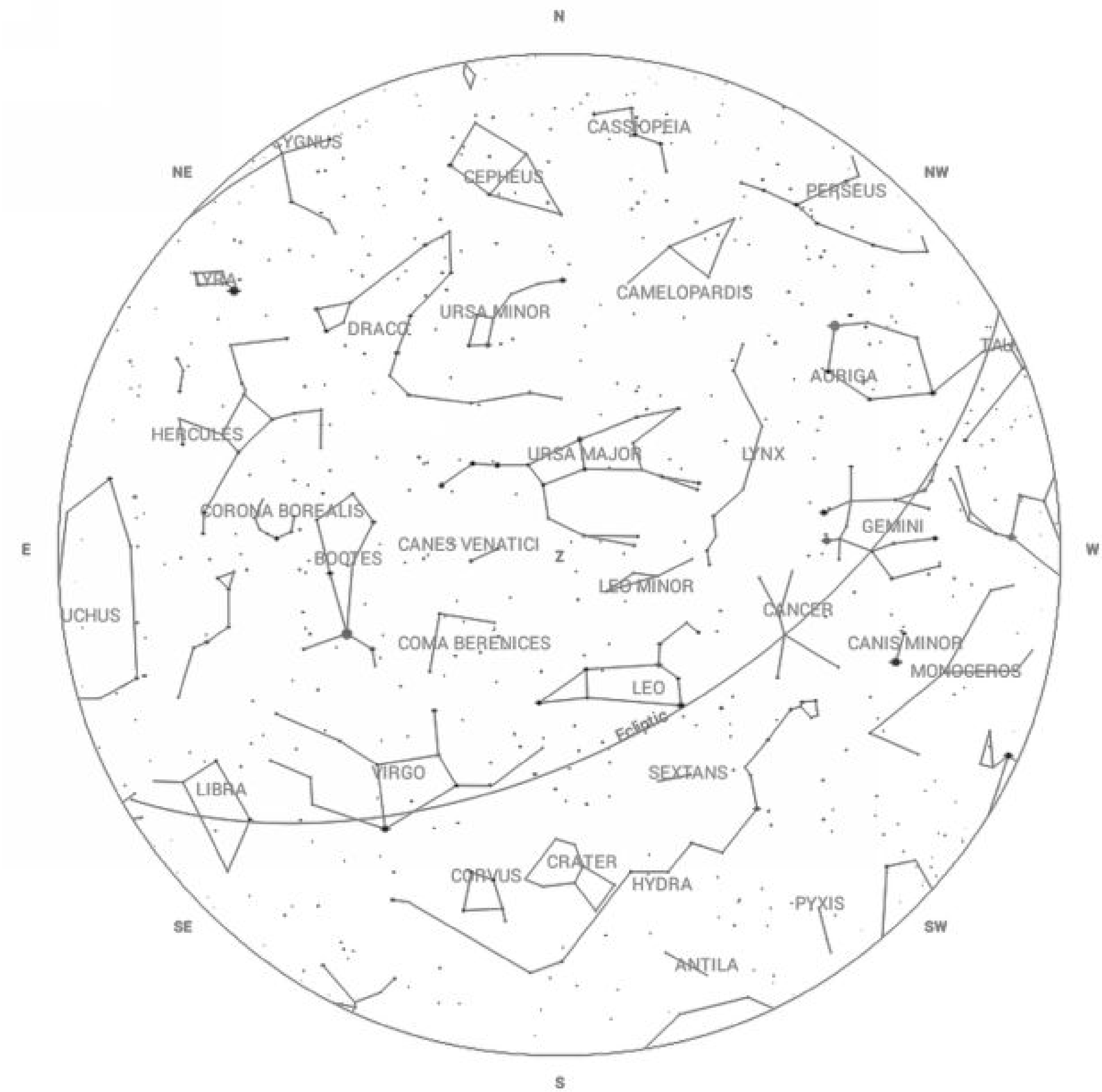


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Auriga, Boötes, Cancer, Canis Minor, Coma Berenices, Corvus, Crater, Draco, Gemini, Leo, Ursa Major, Ursa Minor and Virgo.

Chart 12



(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Auriga, Boötes, Cancer, Canis Minor, Coma Berenices, Corvus, Crater, Draco, Gemini, Hercules, Leo, Ursa Major, Ursa Minor and Virgo.

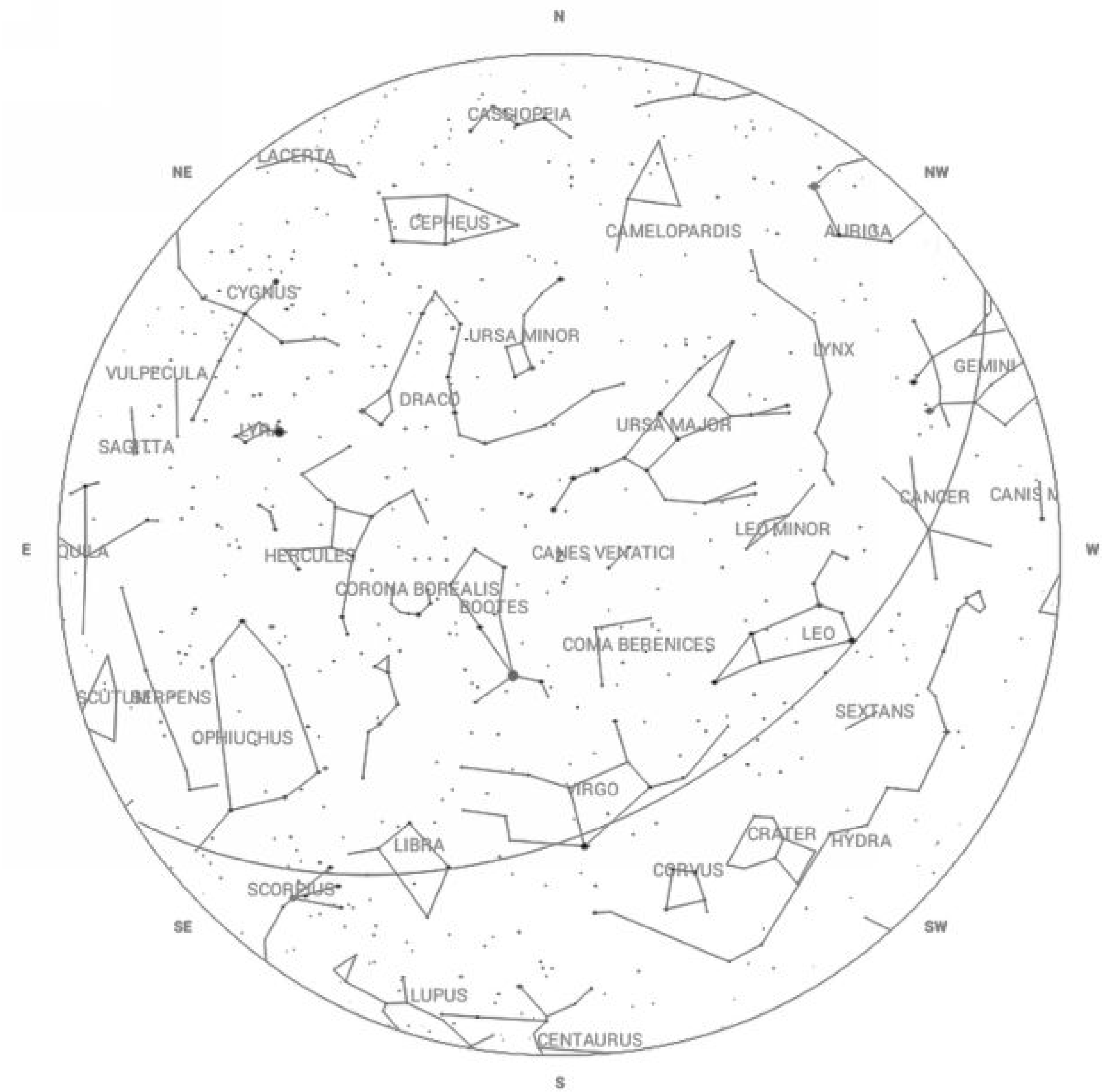
Chart 13

(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Boötes, Cancer, Coma Berenices, Corvus, Crater, Draco, Hercules, Leo, Lyra, Ursa Major, Ursa Minor and Virgo.

Chart 14

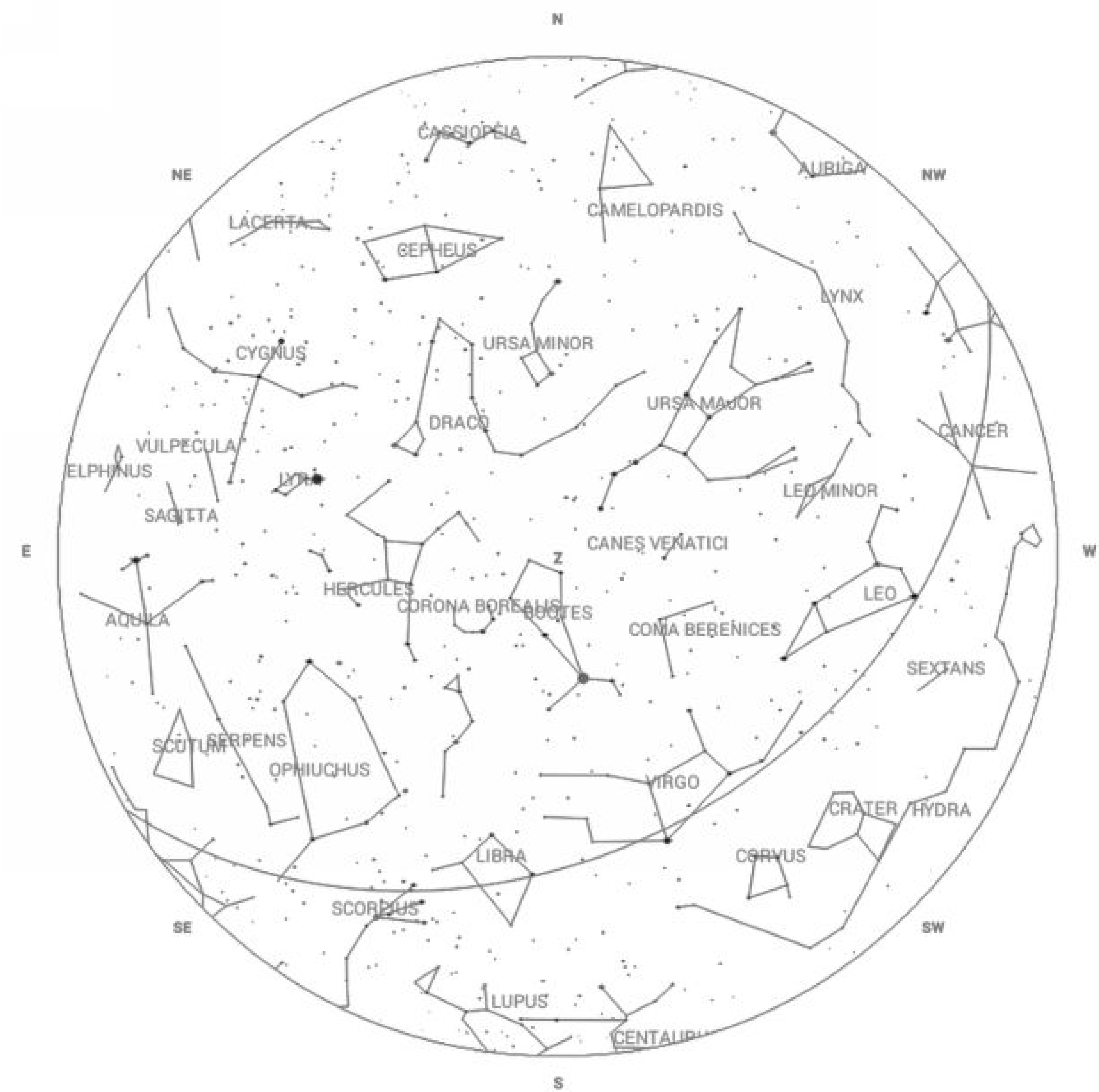


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Boötes, Coma Berenices, Corvus, Crater, Draco, Hercules, Leo, Libra, Lyra, Ursa Major, Ursa Minor and Virgo.

Chart 15

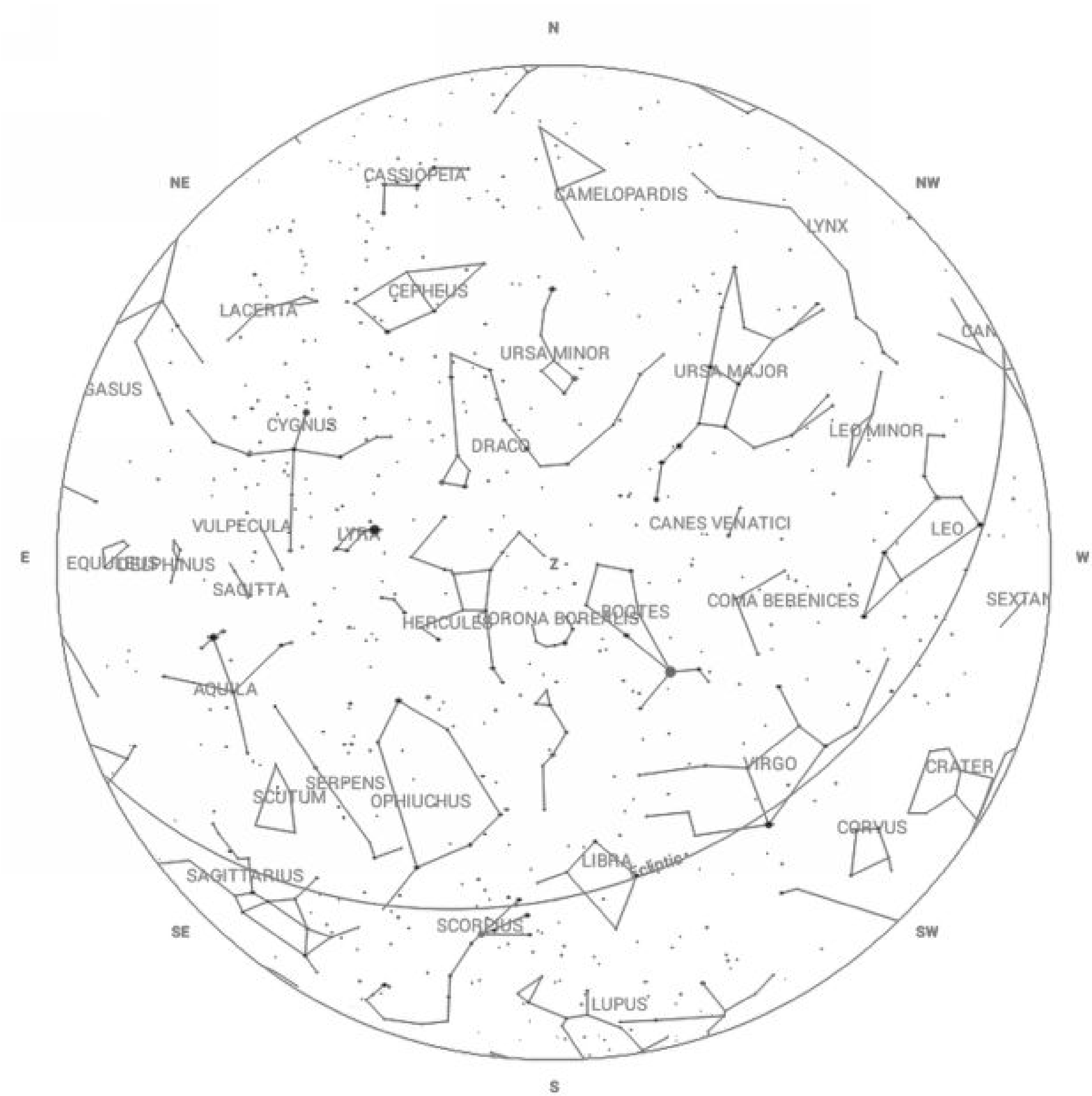


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Boötes, Coma Berenices, Corvus, Cygnus, Draco, Hercules, Leo, Libra, Lyra, Ursa Major, Ursa Minor, Virgo and Vulpecula.

Chart 16

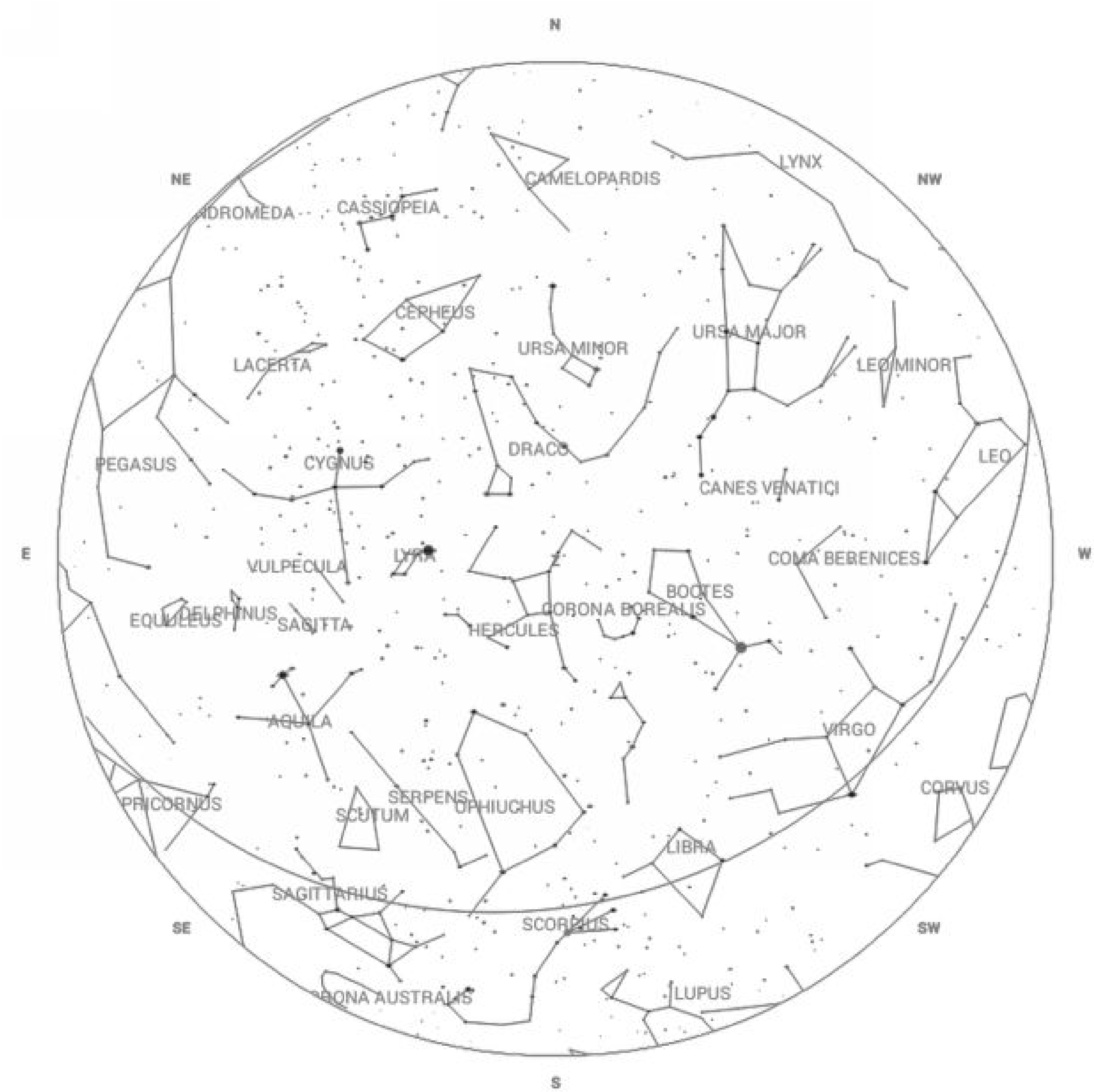


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Boötes, Coma Berenices, Cygnus, Delphinus, Draco, Hercules, Leo, Libra, Lyra, Scorpius, Ursa Major, Ursa Minor, Virgo and Vulpecula.

Chart 17

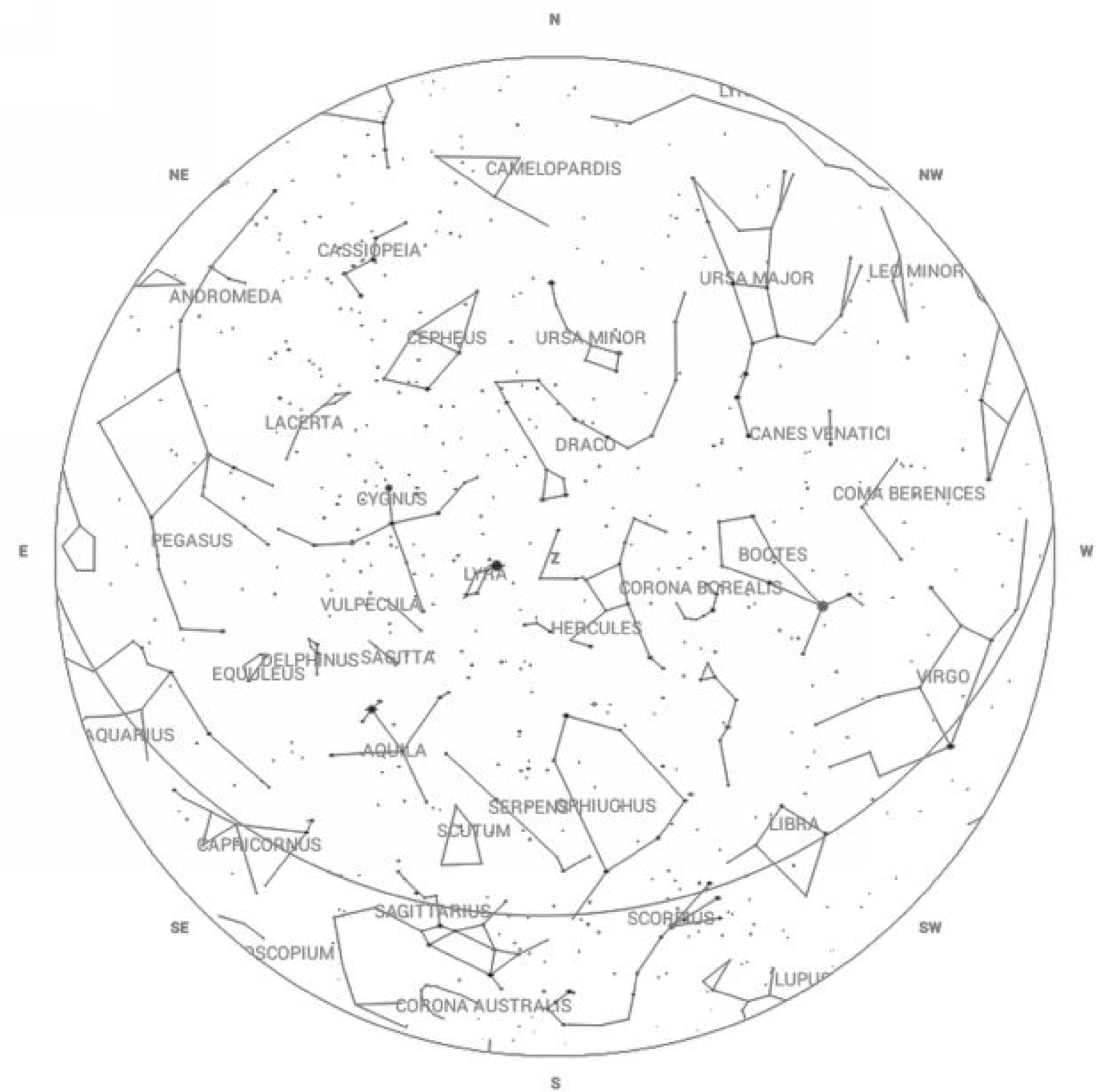


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Aquila, Boötes, Coma Berenices, Cygnus, Delphinus, Draco, Hercules, Libra, Lyra, Sagittarius, Scorpius, Ursa Major, Ursa Minor, Virgo and Vulpecula.

Chart 18

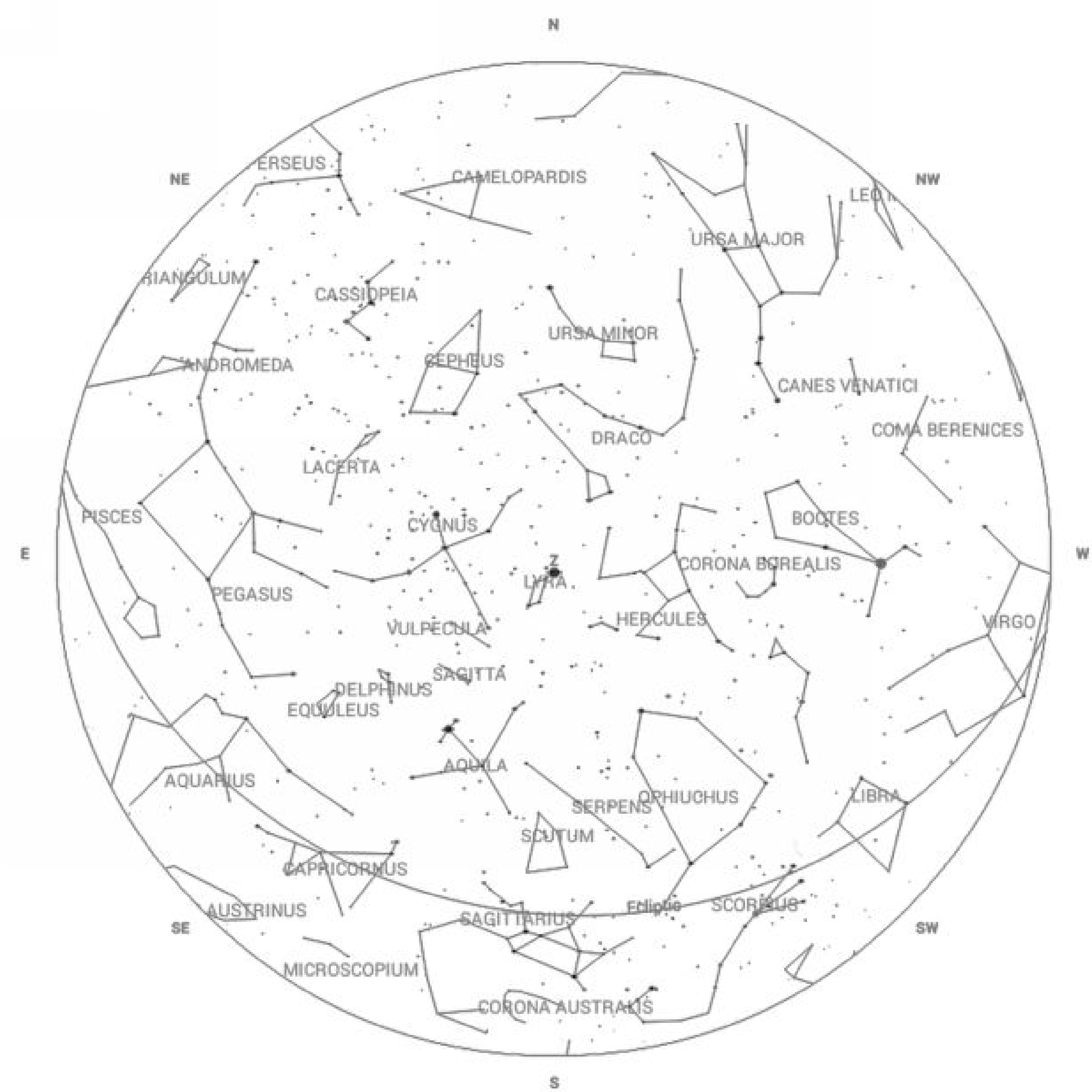


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Aquila, Boötes, Cassiopeia, Coma Berenices, Cygnus, Delphinus, Draco, Equuleus, Hercules, Libra, Lyra, Sagittarius, Scorpius, Ursa Major, Ursa Minor, Virgo and Vulpecula.

Chart 19



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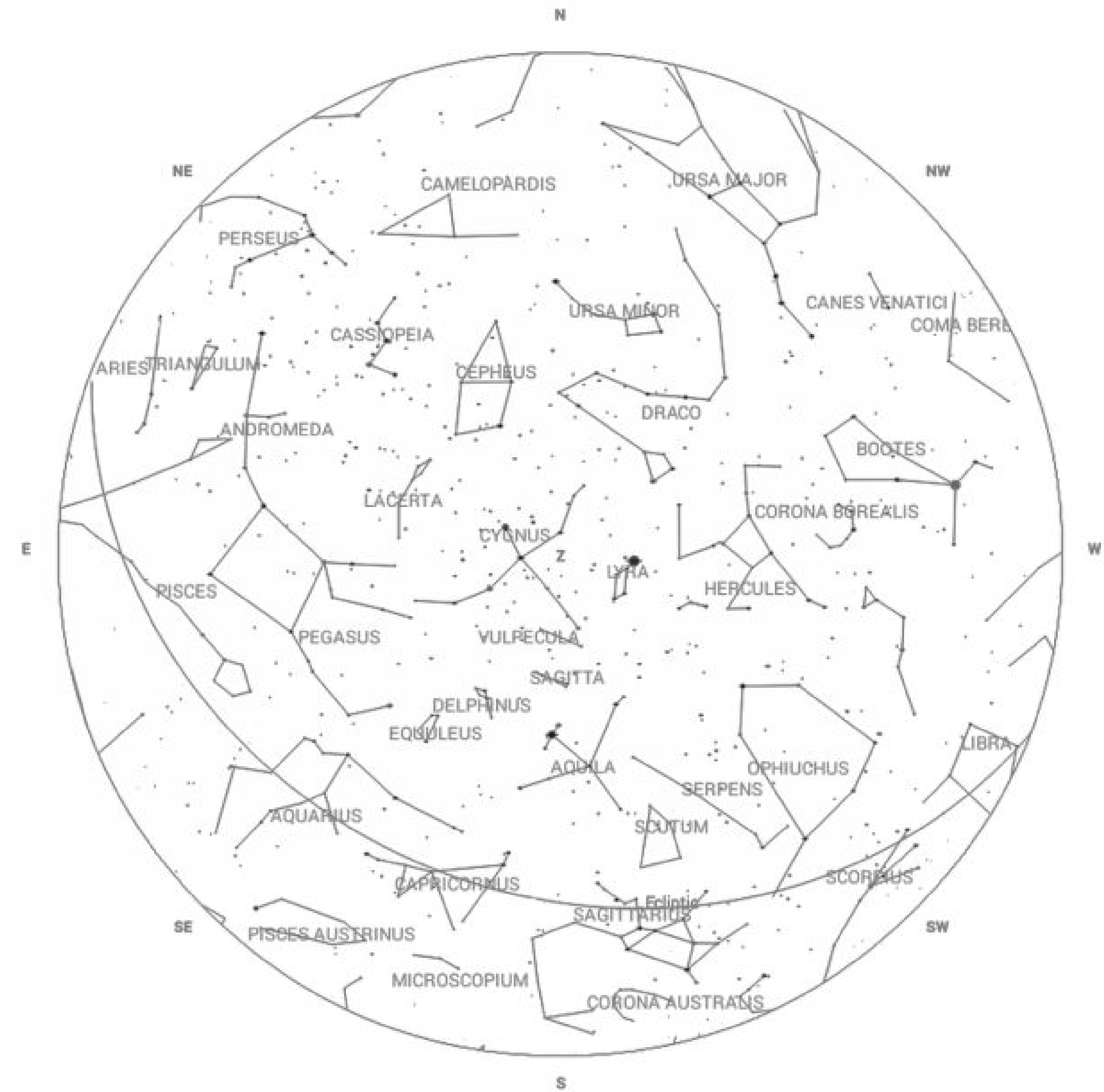
The following constellations are well placed for observation at this time:

Andromeda, Aquila, Boötes, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Hercules, Lyra, Pegasus, Sagittarius, Scorpius, Ursa Major, Ursa Minor and Vulpecula.

Chart 20

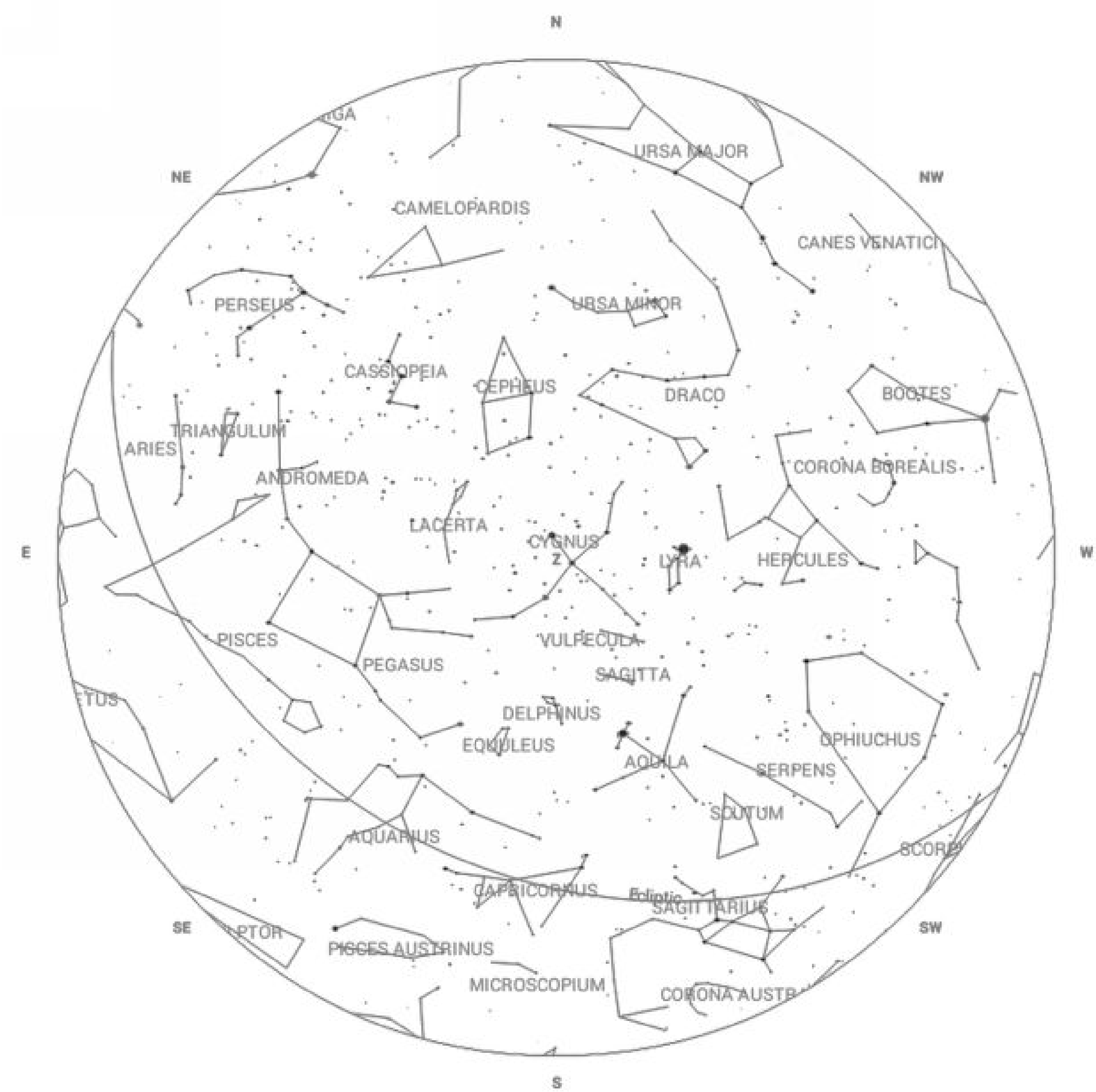


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aquila, Boötes, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Hercules, Lyra, Pegasus, Sagittarius, Ursa Major, Ursa Minor and Vulpecula.

Chart 21



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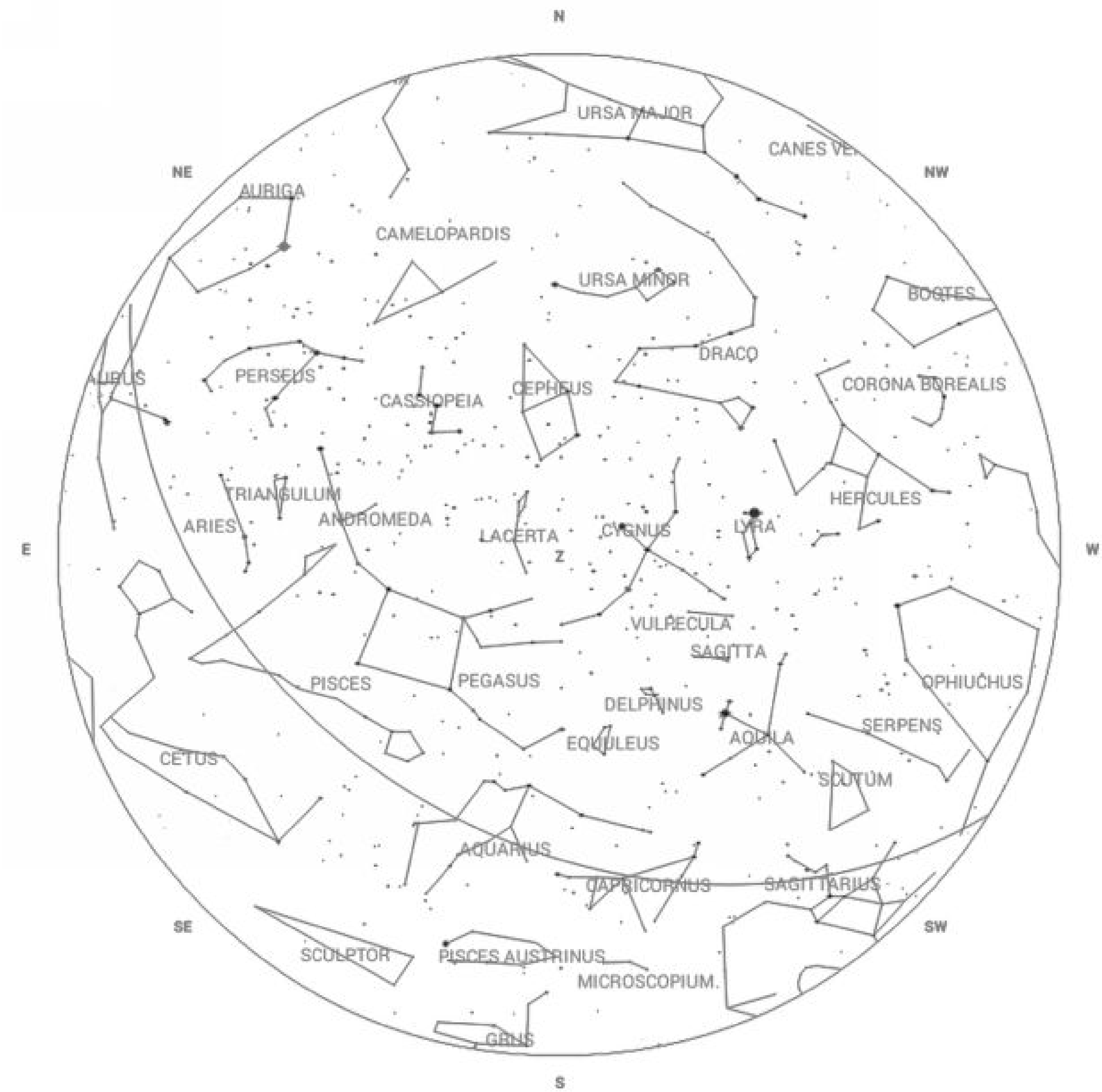
The following constellations are well placed for observation at this time:

Andromeda, Aquila, Aries, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Hercules, Lyra, Pegasus, Perseus, Sagittarius, Ursa Major, Ursa Minor and Vulpecula.

Chart 22

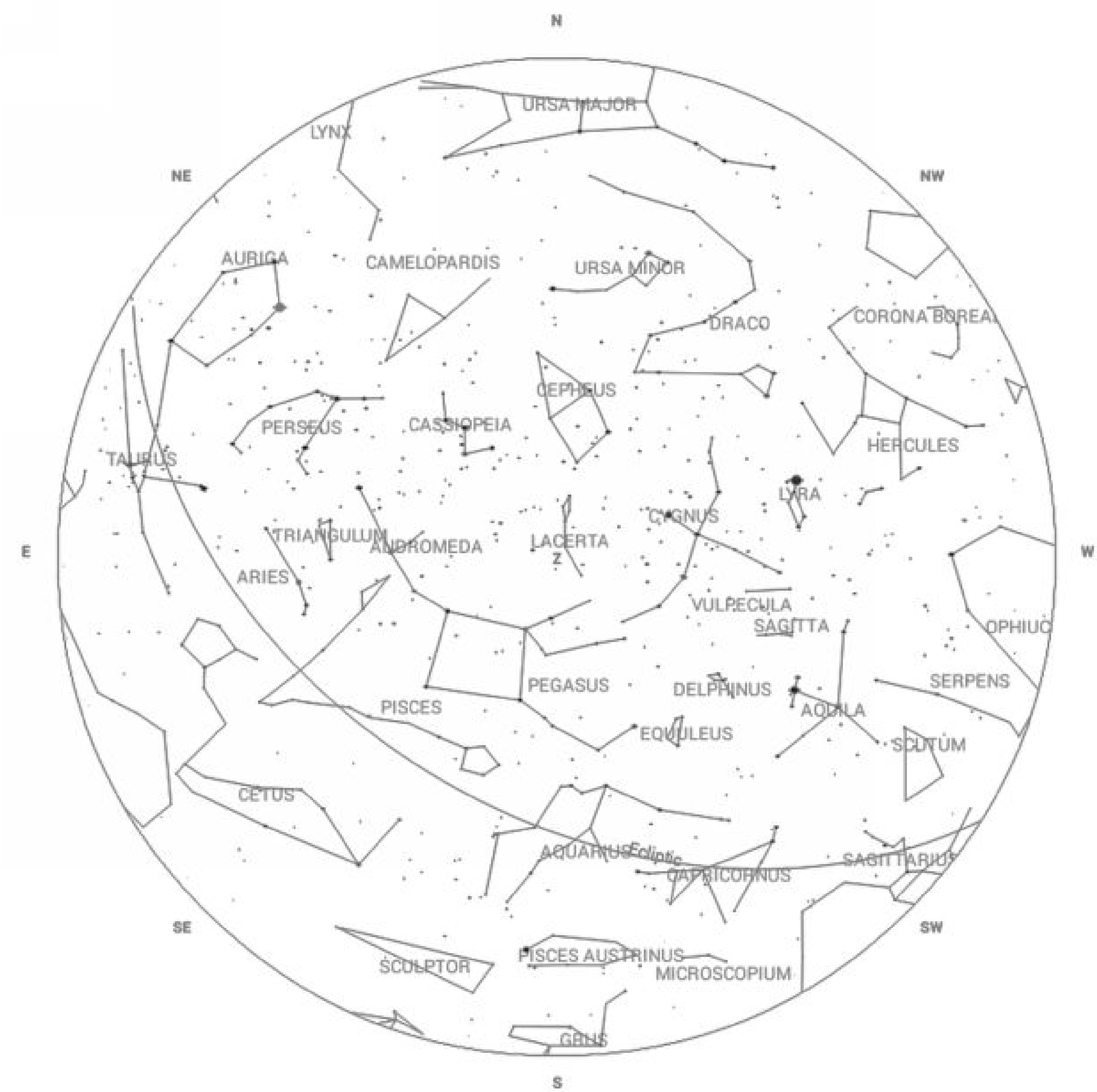


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aquila, Aries, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Hercules, Lyra, Pegasus, Perseus, Ursa Minor and Vulpecula.

Chart 23

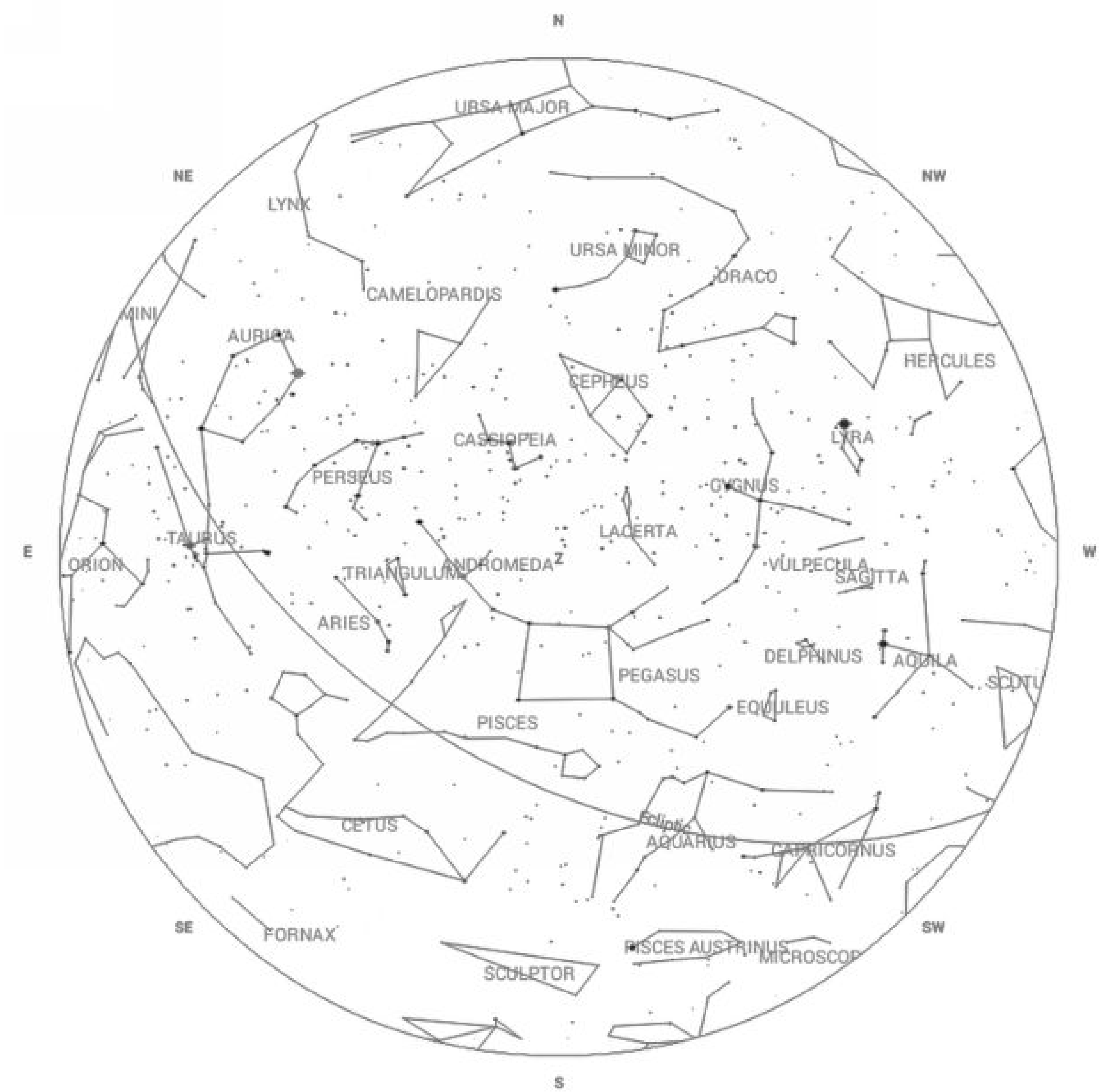


(Double-tap image to enlarge.)

The following constellations are well placed for observation at this time:

Andromeda, Aquila, Aries, Auriga, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Hercules, Lyra, Pegasus, Perseus, Ursa Minor and Vulpecula.

Chart 24



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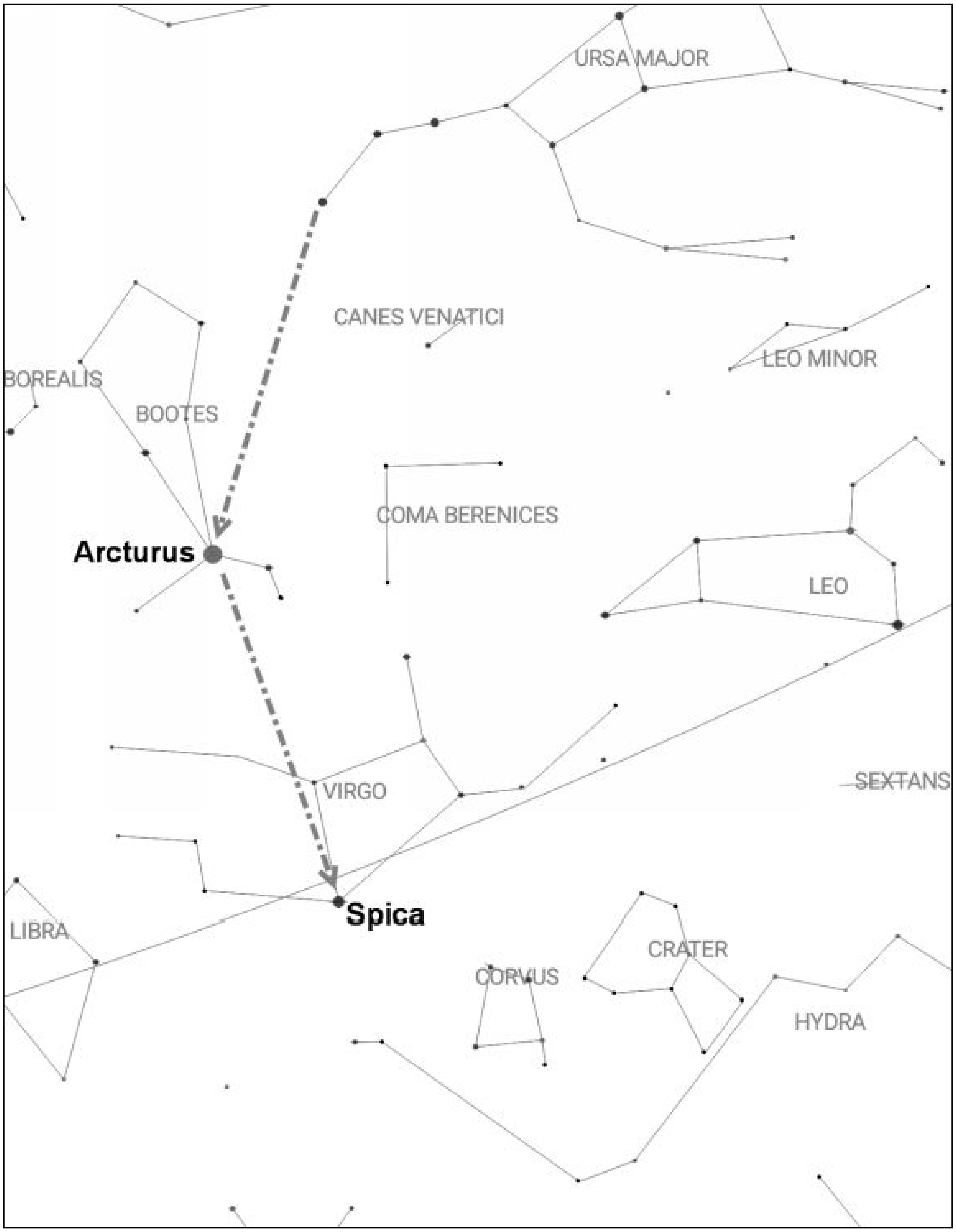
The following constellations are well placed for observation at this time:

Andromeda, Aquila, Aries, Auriga, Cassiopeia, Cygnus, Delphinus, Draco, Equuleus, Lyra, Pegasus, Perseus, Taurus, Ursa Minor and Vulpecula.

Seasonal Signposts & Stars

Spring – Arc Down to Arcturus and Speed on to Spica!

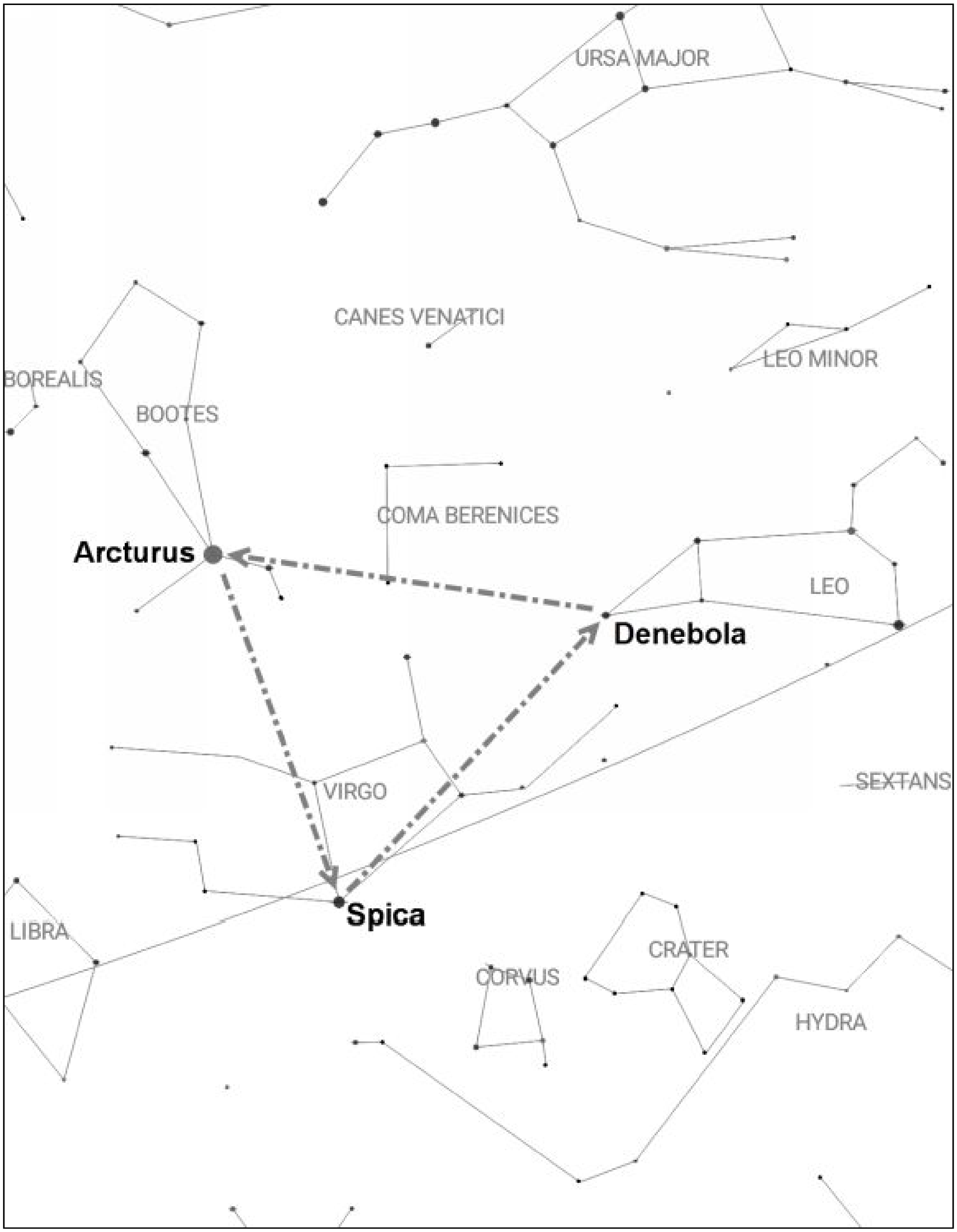


(Double-tap image to enlarge.)

Ursa Major is high overhead throughout the spring and can be used to find two of the season's brightest stars, Arcturus and Spica.

Simply follow the arc of the bear's tail down to orange Arcturus and then continue the curve until you reach white Spica to the south.

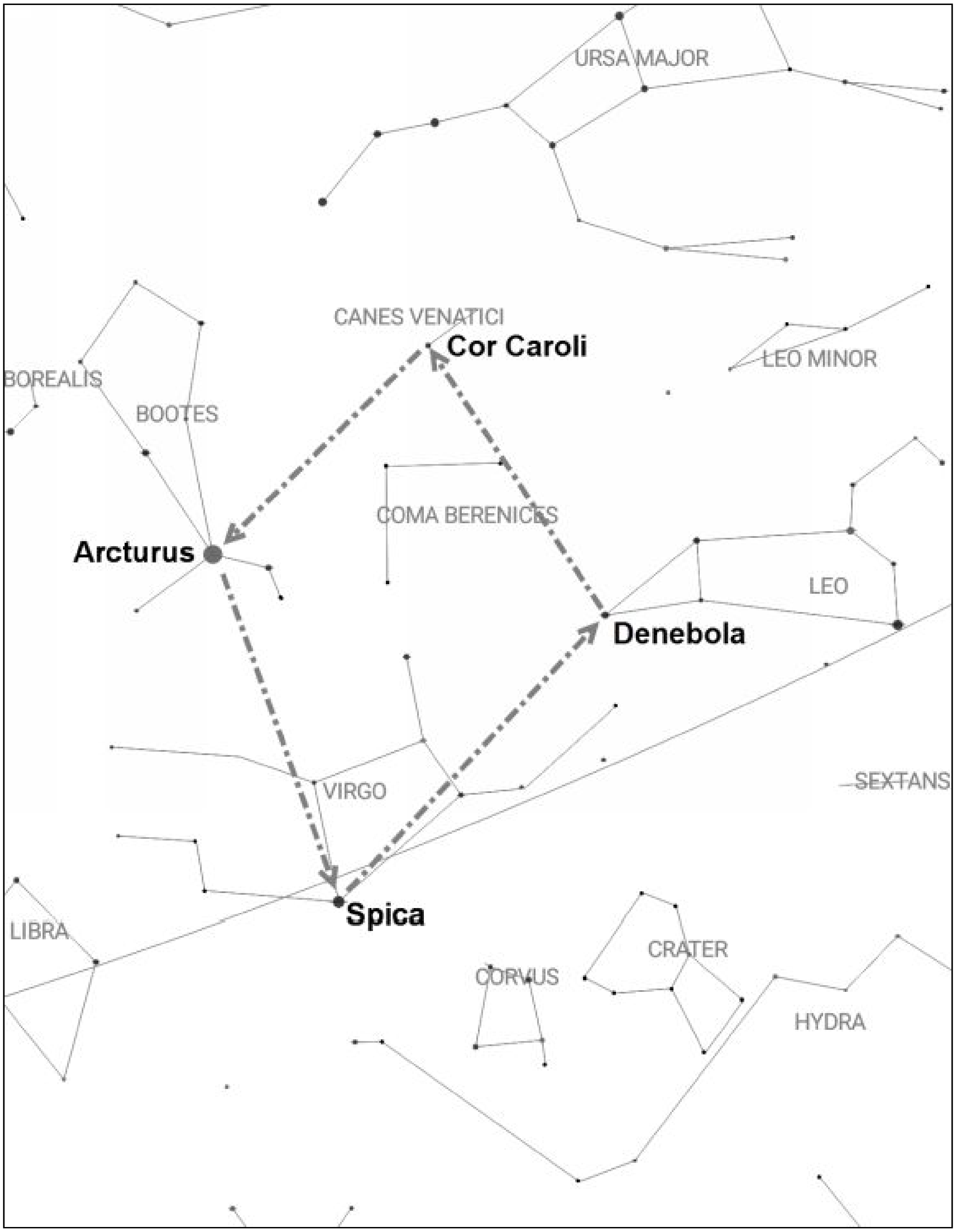
Spring – The Spring Triangle



(Double-tap image to enlarge.)

Once you've found Arcturus and Spica you've found two points of the Spring Triangle. Look to the west for Leo (you can use Ursa Major to help you) and look for Denebola, which marks the lion's tail. This is the third point of the triangle.

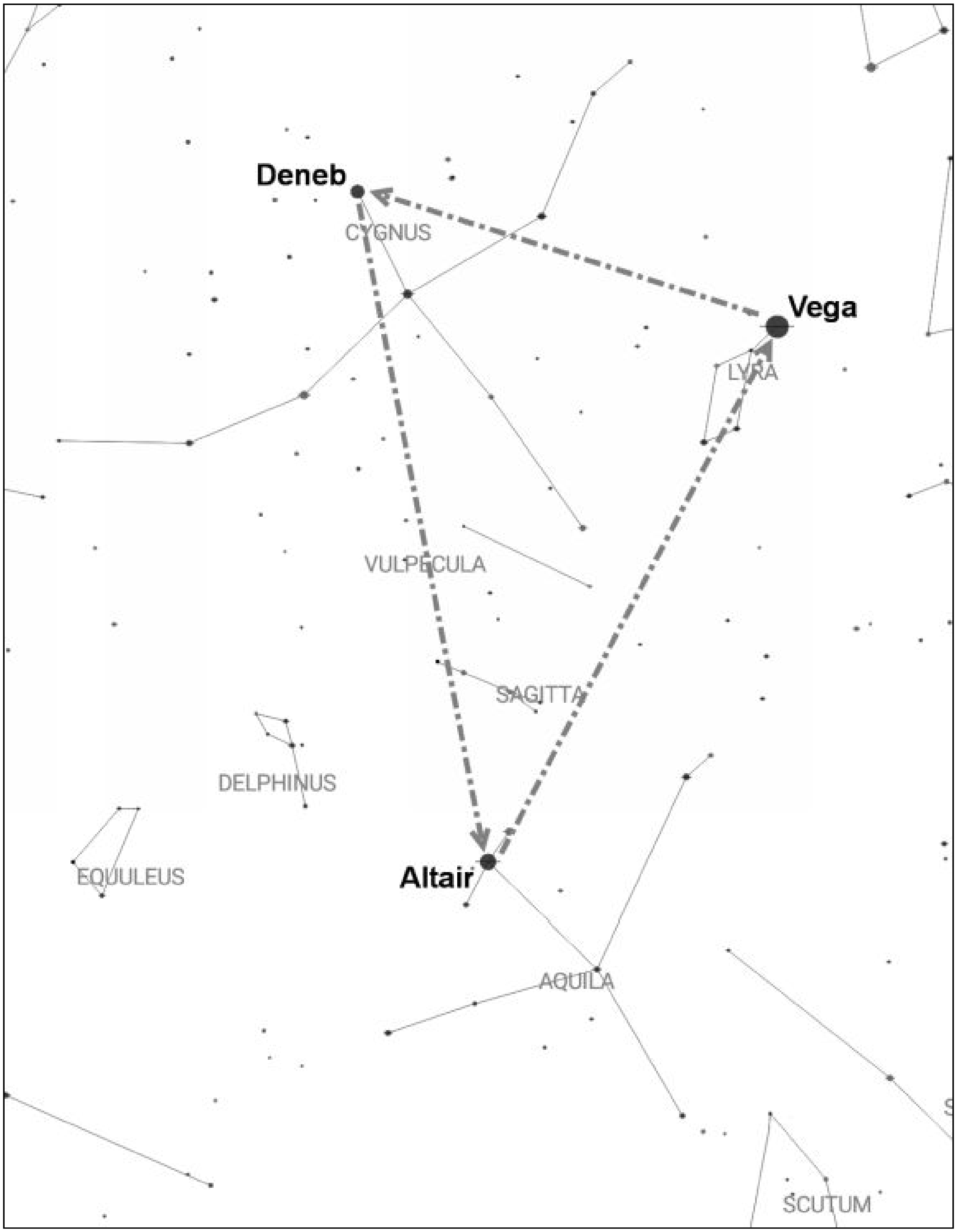
Spring – The Great Diamond



(Double-tap image to enlarge.)

Now we have a triangle, we can expand the view to include Cor Caroli. This is the brightest star in the small constellation of Canes Venatici, which appears close to Ursa Major. This asterism is known as the Great Diamond or, alternatively, the Virgin’s Diamond.

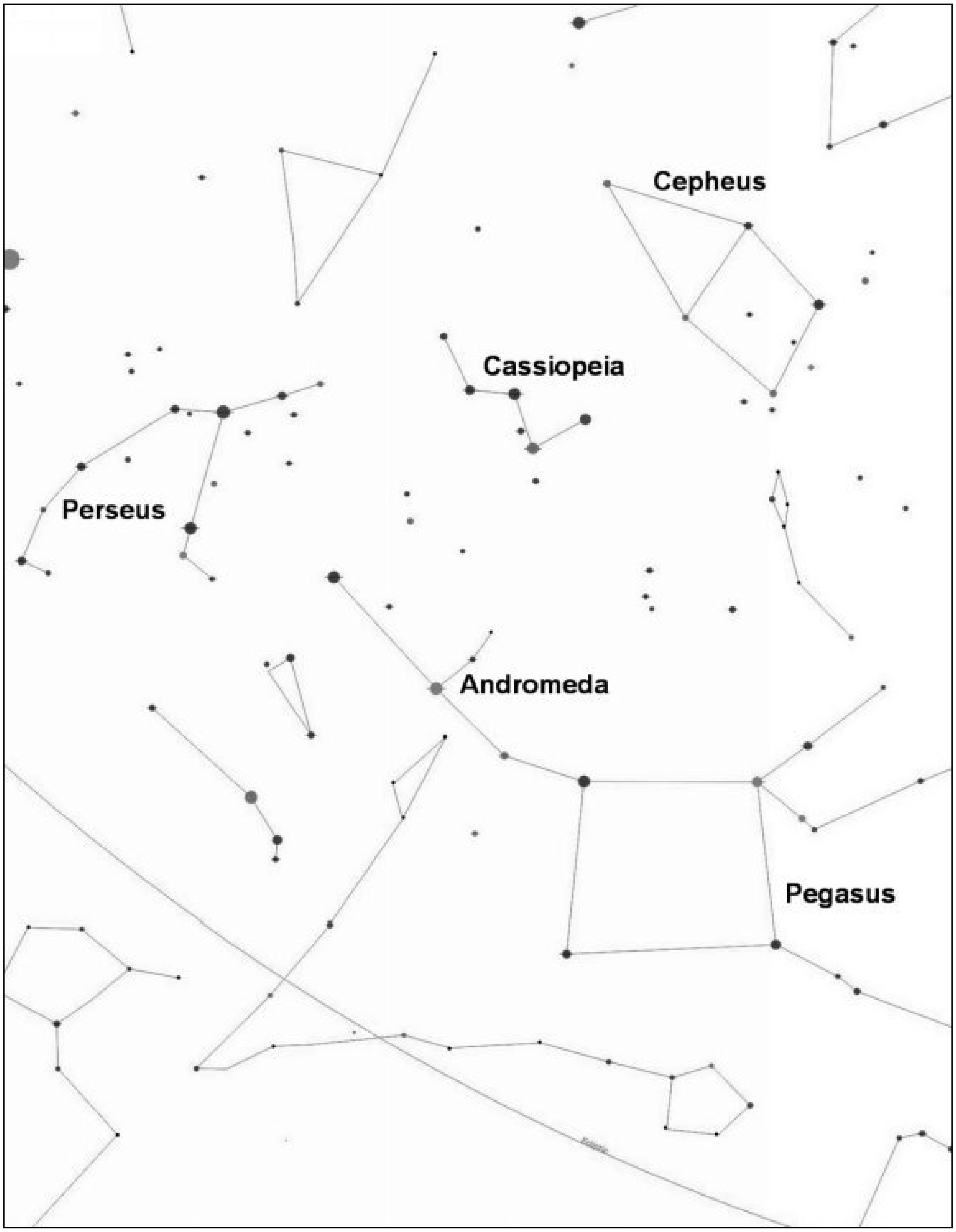
Summer – The Summer Triangle



(Double-tap image to enlarge.)

The Summer Triangle is actually a prominent feature of the evening sky for nearly half the year and can be easily seen from late June to late November. Its three points are made up of three bright stars – start by using Ursa Major to locate brilliant Vega in Lyra and then look nearby for Deneb in Cygnus and Altair in Aquila.

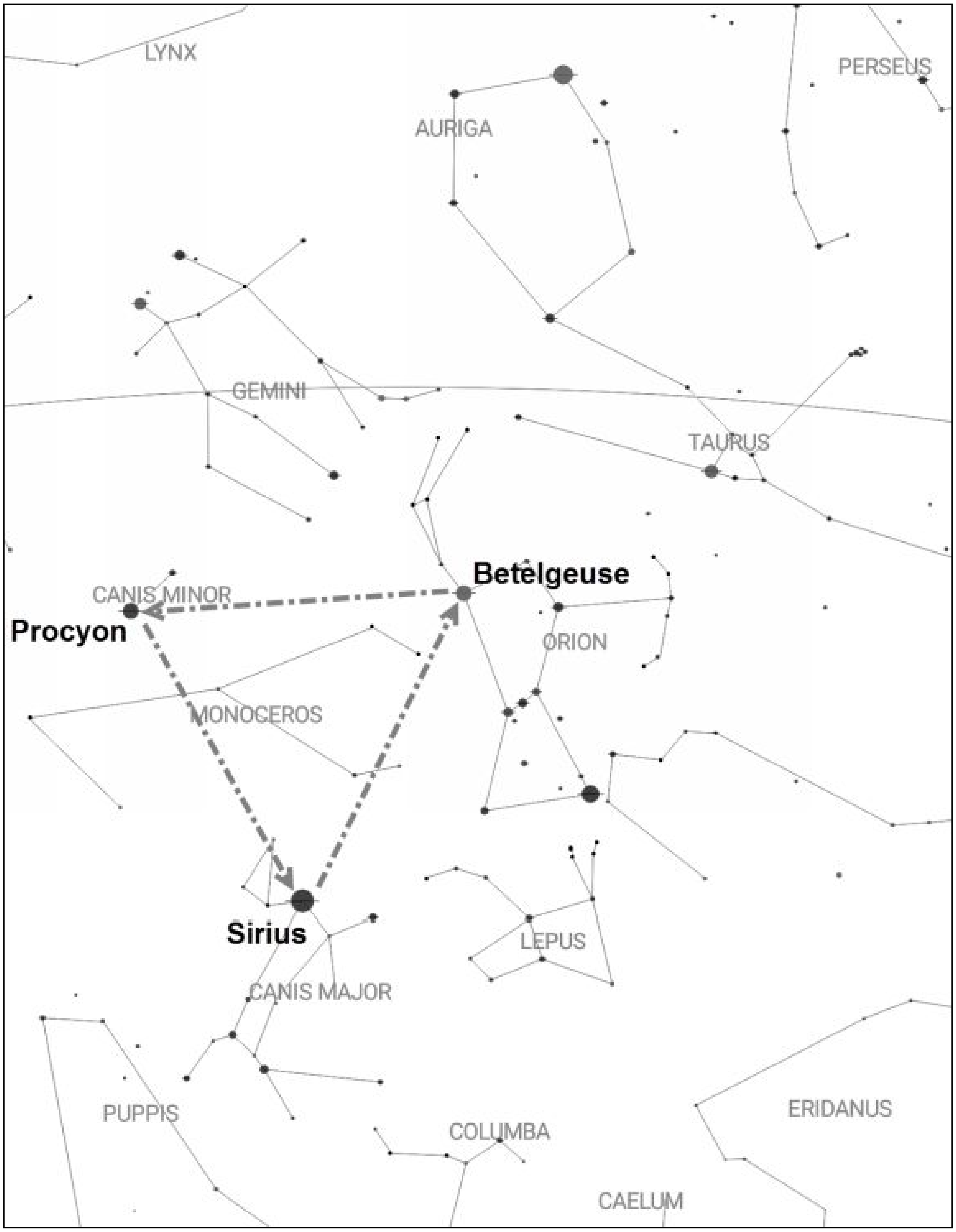
Autumn – The Myth of Andromeda



(Double-tap image to enlarge.)

Autumn stars tend to be on the fainter side but if you use Ursa Major to find Cassiopeia, the Queen, you can find the constellations associated with the myth of Andromeda. Andromeda herself, the Princess, can be found to the south, pulled along by Pegasus the Flying Horse. To the east is Perseus, her Hero, while to the north-west is her father, King Cepheus.

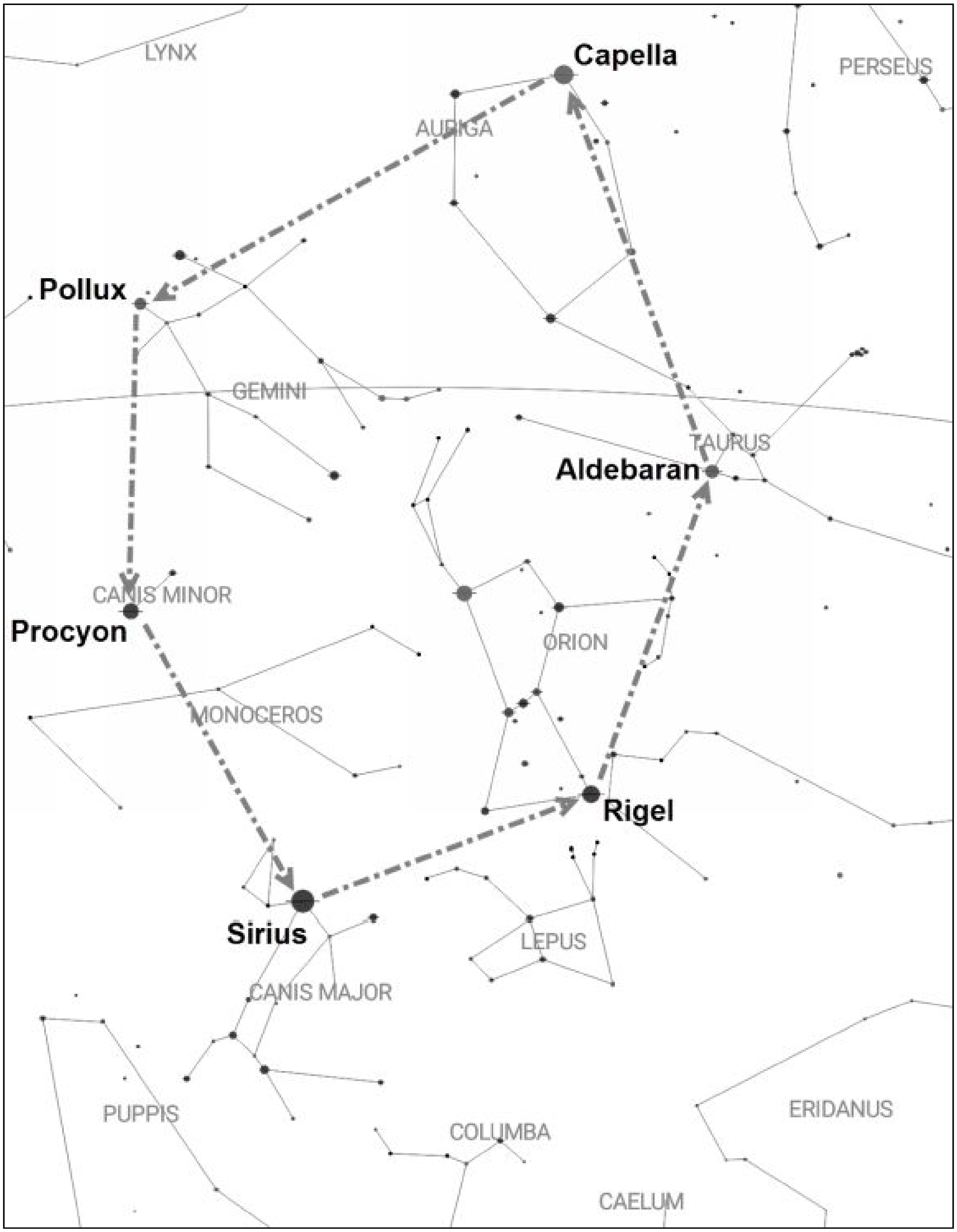
Winter – The Winter Triangle



(Double-tap image to enlarge.)

Orion, the Hunter, is our major signpost for the winter months and can be used to find a number of other constellations and bright stars. In particular, look out for Sirius, the brightest star in the sky, to the south-east and Procyon to the east. Together with Betelgeuse, the shoulder of Orion himself, these three stars make up the Winter Triangle.

Winter – The Winter Hexagon

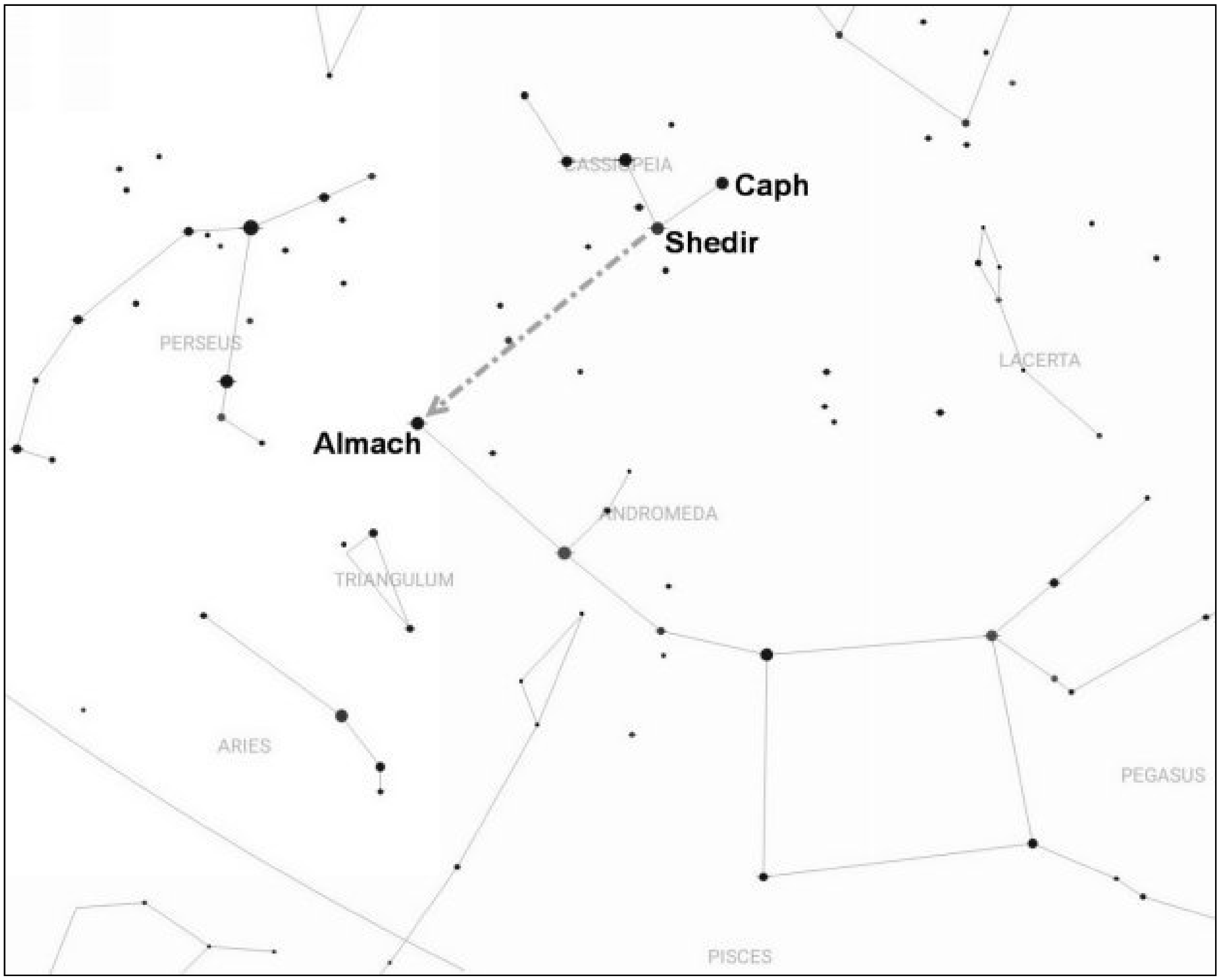


(Double-tap image to enlarge.)

Two of the stars of the Winter Triangle, Procyon and Sirius, mark two points in a much larger asterism – the Winter Hexagon. From Procyon look north to Pollux in the constellation of Gemini, the Twins. Next, look to the north-west for Capella in Auriga, the Charioteer. Then it's slightly south-west to Aldebaran, the red eye of Taurus the Bull and then, lastly, to Rigel in Orion.

The Constellations

Andromeda



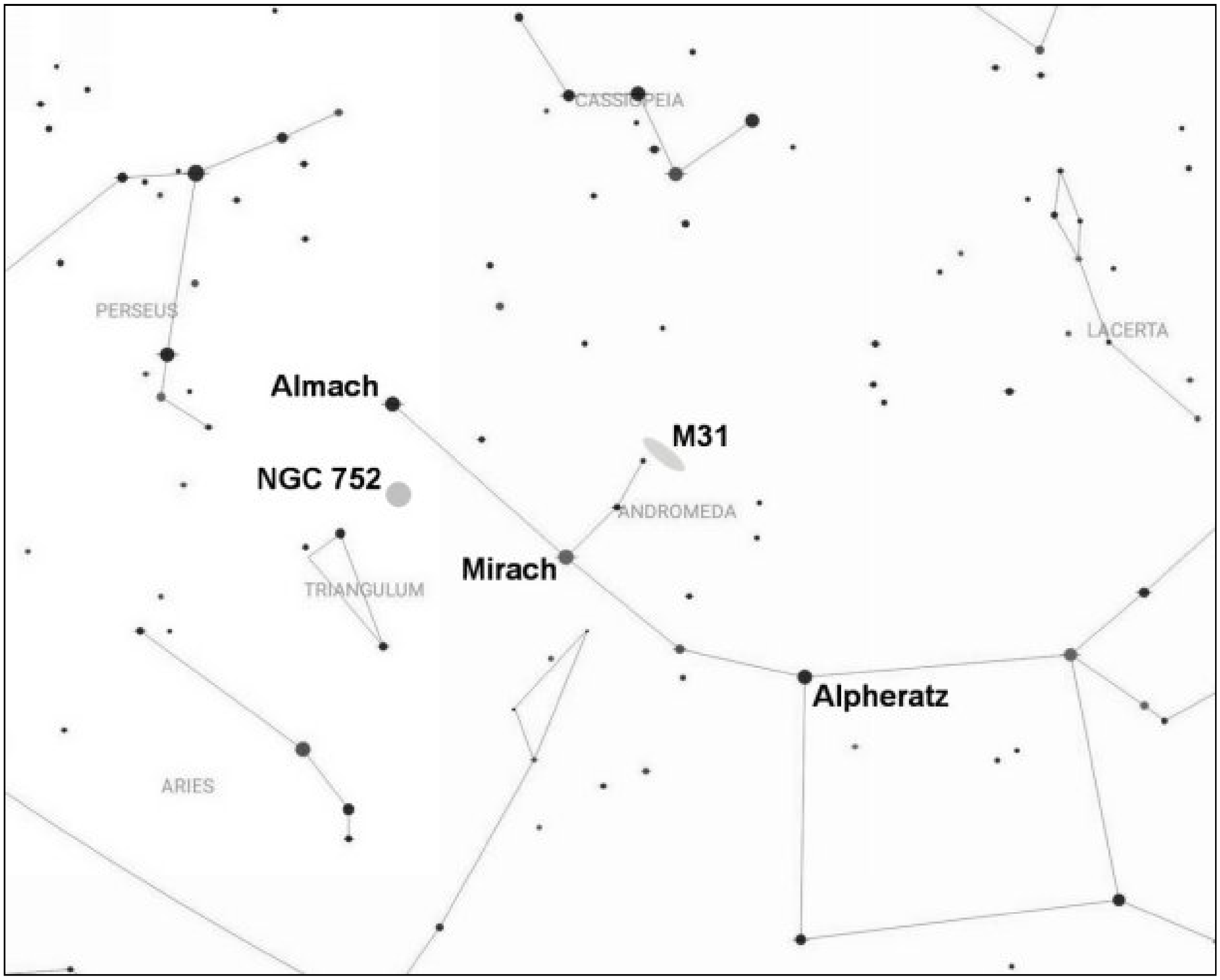
First find [Cassiopeia](#) on the opposite side of Polaris from [Ursa Major](#). Then draw a line through Caph and Shedir to reach Almach, at the end of the constellation. (Double-tap image to enlarge.)

This constellation represents Andromeda, a princess who, according to Greek legend, was the daughter of Queen Cassiopeia and King Cepheus. Cassiopeia was a vain and foolish woman. After boasting that her daughter was more beautiful than all the sea-nymphs, Poseidon, god of the sea, sent the Kraken to ravage the kingdom.

King Cepheus was desperate to save his people and was advised to chain his daughter to a rock as a sacrifice to the monster. This he did, but fortunately

Andromeda was saved by Perseus before the worst could happen.

Swooping down on his trusty steed, Pegasus, the flying horse, Perseus pulled the head of Medusa from his bag and turned it toward the Kraken. Medusa was a snake haired woman whose gaze could turn a living creature to stone. Sure enough, the monster turned to rock and Andromeda was saved.



(Double-tap image to enlarge.)

Andromeda actually shares a star with another constellation. Its brightest star, Alpha, is known as Alpheratz and also marks the north-eastern corner of the great Square of Pegasus.

A magnitude 2 star, it's a binary system some 97 light years away but the constellation also contains something a lot more distant.

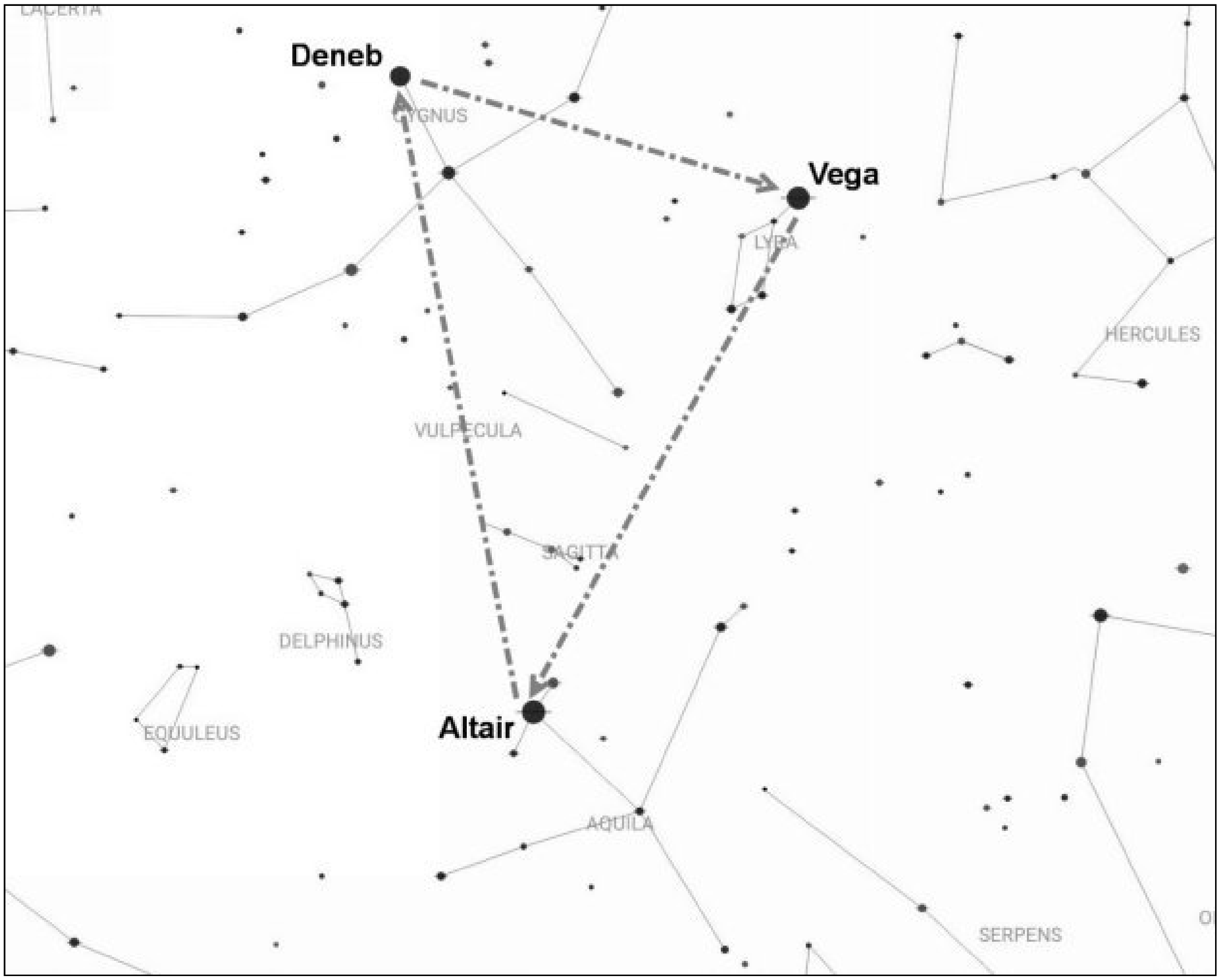
If you follow the curve of Andromeda to about halfway along her length, you'll come to Beta Andromedae, also known as Mirach. This in itself leads to Messier 31 (M31), commonly known as the Andromeda Galaxy.

At a distance of about 2.2 million light years away, this is the most distant object you can see with just your eyes – but you might need to be under clear, dark skies to see it. It appears as a tiny, misty patch to the unaided eye but binoculars may reveal its elongated shape. A small telescope reveals a little more; even low power will show its bright core but you'll need larger equipment to see more than that.

Follow the line of Andromeda to the end and you'll encounter Almach, a beautiful double for a telescope at mid power. A magnification of about 50x will show a pale yellow-white gold star with a fainter pale blue companion.

Can you find NGC 752? Visible with binoculars, it appears within the same field of view as Almach as a large, faint misty patch. Through a small telescope at low power (about 35x) you'll see a large, sparse group of predominantly blue-white stars with a scattering of orange stars among them. Also look out for the double star 56 Andromedae on the cluster's edge.

Aquila



The easiest way to find Aquila is by first locating brilliant Vega, the brightest star in the constellation of [Lyra](). This star, along with Deneb in [Cygnus]() and Altair in Aquila, form the Summer Triangle which is easily visible through the summer and autumn months. (Double-tap image to enlarge.)

In Greek mythology, Aquila represents the eagle that kidnapped the young boy Ganymede and carried him to Mount Olympus. There he served as the cup-bearer to the gods.

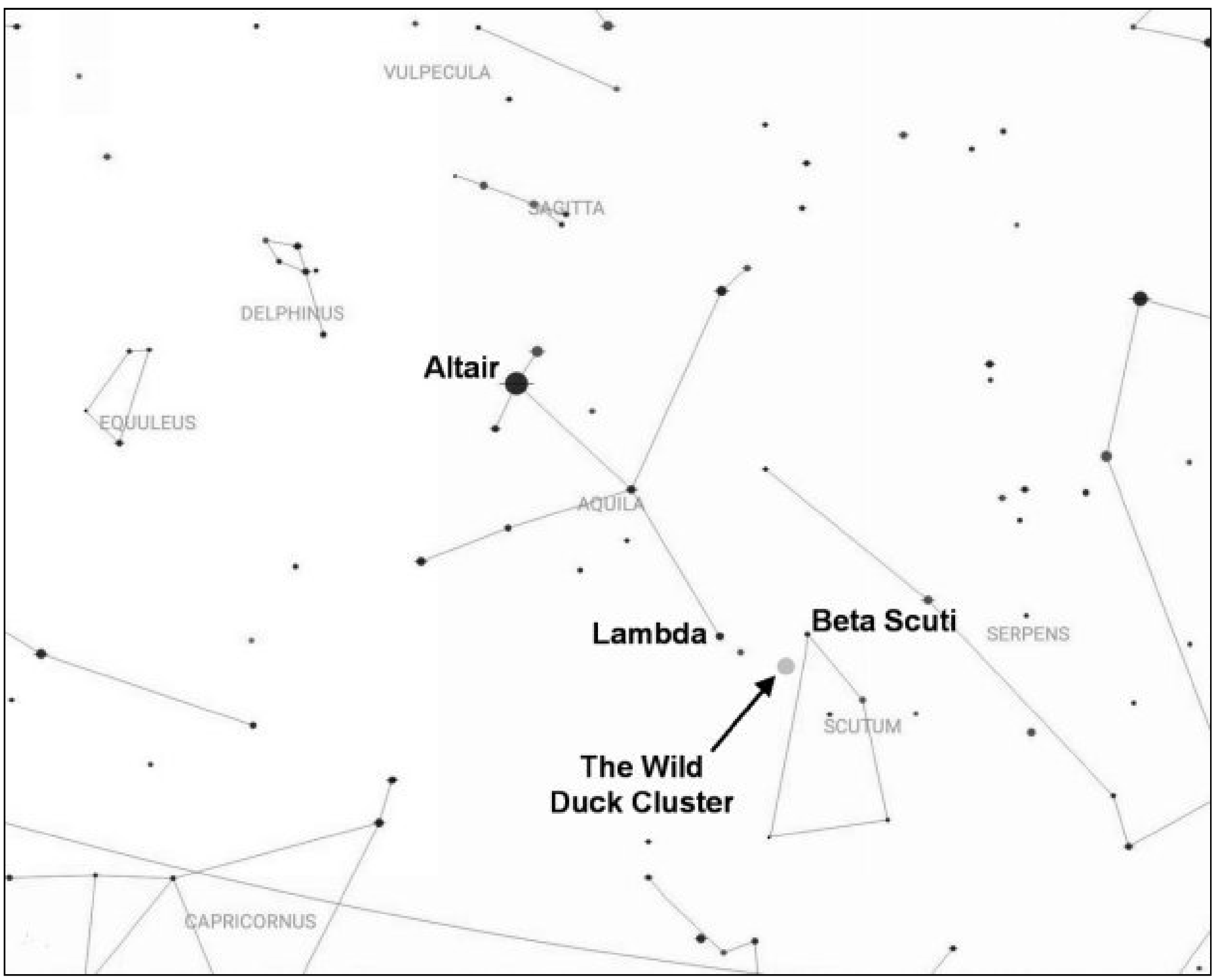
As a reward, Zeus placed the eagle among the stars while Ganymede was immortalized as the faint autumn constellation of Aquarius.

Altair, the brightest star in the constellation, has its own legend. The details vary, but in many Asian cultures Altair represents a cow herder while Vega represents a weaver girl.

It’s said that the pair met, fell deeply in love and married. As a result, they both neglected their duties; the cattle roamed and the weaver girl stopped producing clothes. This angered her father who separated the pair on opposite sides of a river, as represented by the Milky Way in the sky.

(Incidentally, the two stars on either side of Altair, known as Alshaid and Tarazed, are said to be the couple’s two children.)

The pair can only be together one night each year, on the seventh day of the seventh month. If the weather is bad, the pair are unable to meet and it’s said the tears of the lovers fall as rain. Today, their story is celebrated annually during the Tanabata festival in Japan.



(Double-tap image to enlarge.)

Out of the three Summer Triangle stars, Vega is the brightest with Altair being a little fainter and Deneb being the faintest.

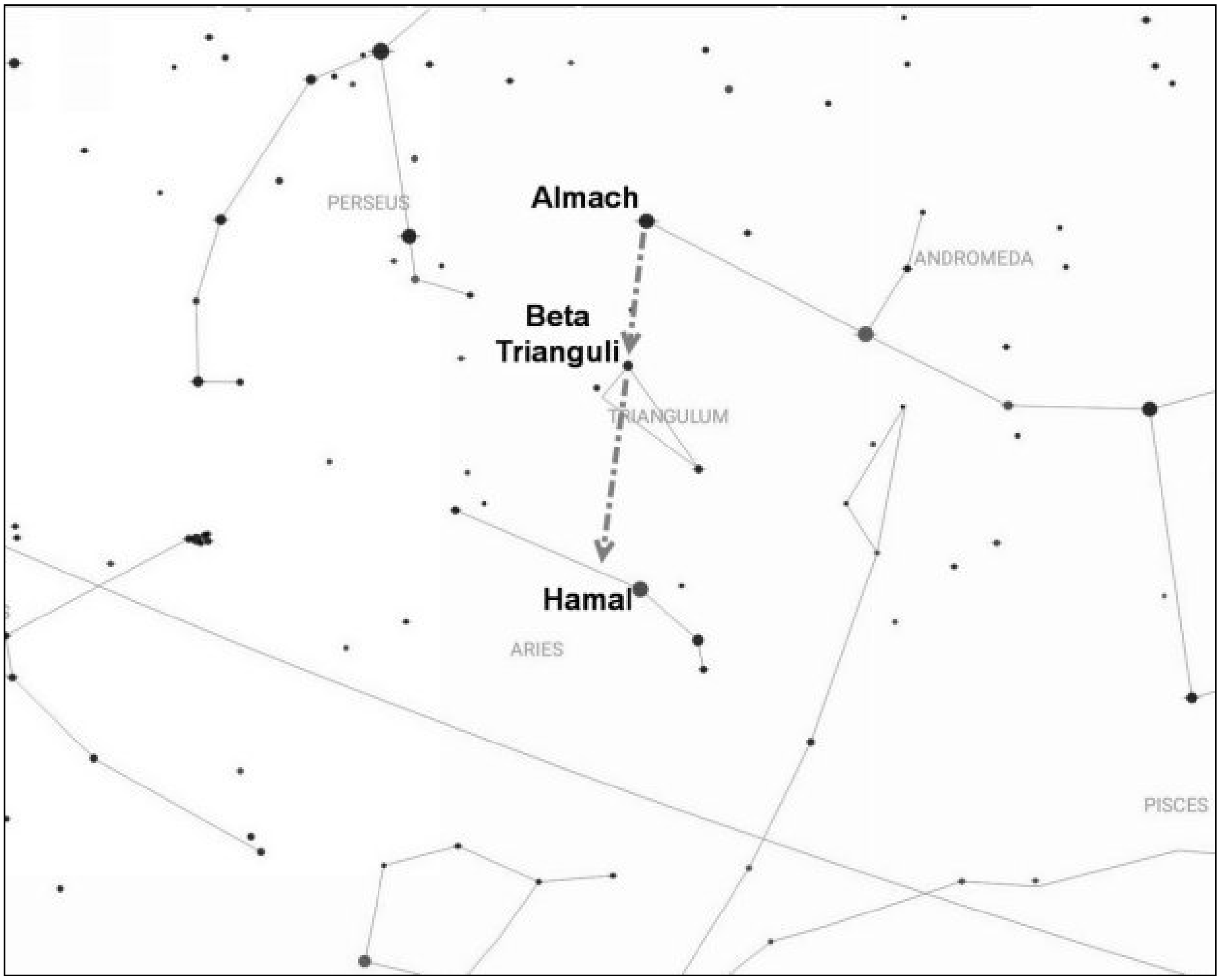
Altair is the 12^{th} brightest star in the entire night sky and, at 17 light years away, is also one of the closest. It’s a pale yellow star with nearly twice the mass of the Sun, but what’s particularly interesting is its shape.

Altair is not, technically a sphere, but rather an ellipsoid. It spins once on its axis every nine hours, which causes the star to become flattened at the poles.

Aquila doesn’t contain any fascinating naked eye deep sky objects, but if you have binoculars (and, ideally, dark skies) you may be able to spy the Wild Duck cluster in nearby Scutum. Look for a small, faint, circular patch within the same field of view as Lambda Aquilae and Beta Scuti.

Likewise, if you have a small telescope, you won’t be disappointed. Even a low power of about 35x is enough to show the V-shape that gives the cluster its name while higher powers will reveal many more blue-white stars.

Aries



First find [Andromeda](#) and look for Almach at the end of the constellation. Draw a line from Almach, through Beta Trianguli and arrive close to Hamal in Aries. Be aware that Beta Trianguli is actually a little fainter than Hamal itself! (Double-tap image to enlarge.)

Aries, the Ram, is one of the more ancient constellations and was first identified by the ancient Babylonians. At that time, around 1200 BCE, it was seen as a worker and was the last sign in the Babylonian zodiac.

The shift to a ram took place in the next few centuries. The Egyptians associated it with Amon-Ra, their ram-headed god, while the ancient Greeks saw it as the golden-fleeced ram that saved the lives of the twins Helles and

Phrixus. Unfortunately Helles fell off the ram during the rescue and was killed, but Phrixus survived and consequently sacrificed the ram to honor Zeus.

(It seems a particularly ungrateful way to treat the creature that saved your life!)

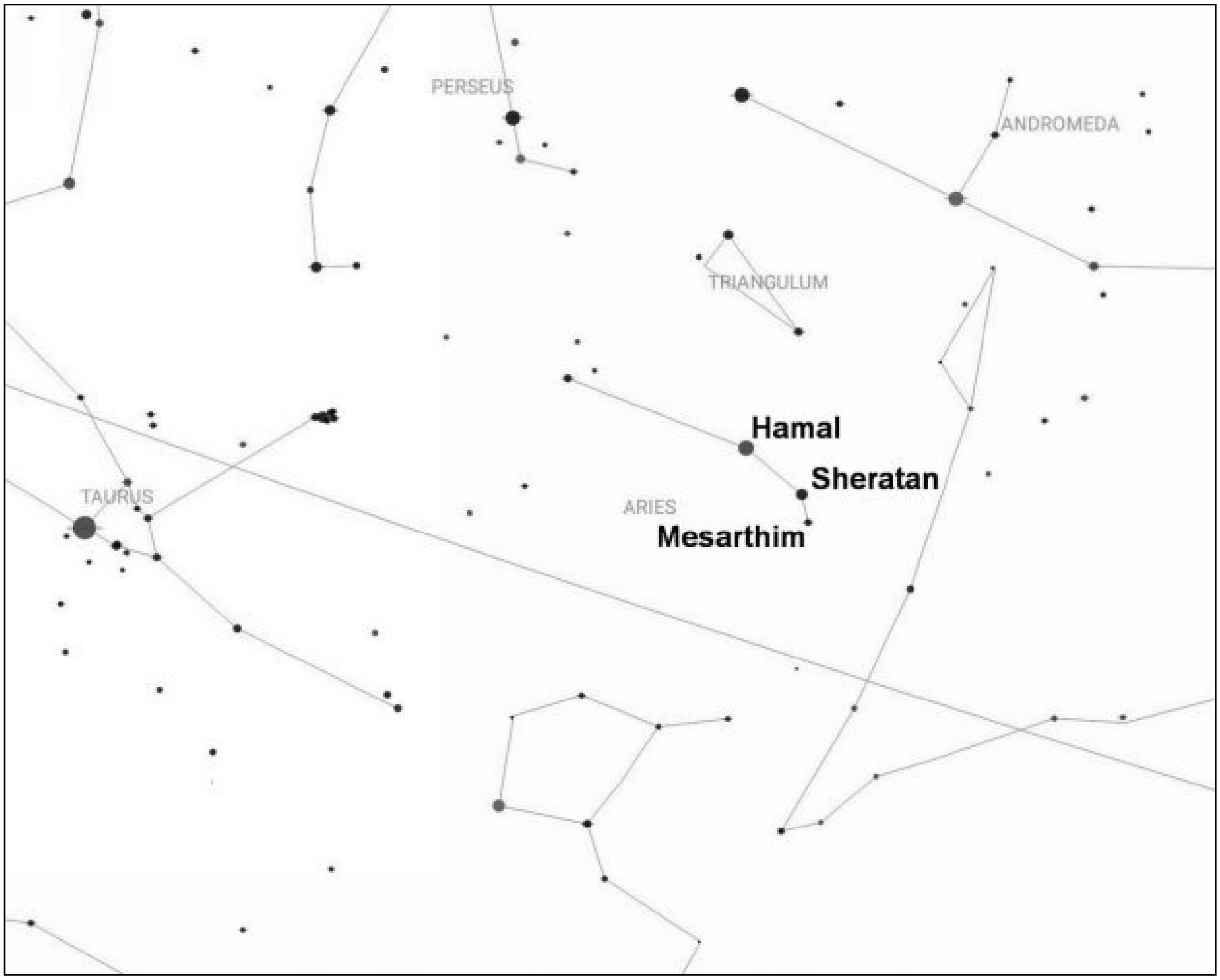
In ancient times the constellation contained the first point of Aries. This is where the Sun crosses from the southern celestial hemisphere to the north during the March equinox.

In the intervening millennia, that point has since moved backwards into Pisces, but the name of the celestial waypoint remains the same.

Aries isn’t a particularly large constellation (it’s ranked 39th in size) and it doesn’t contain much of interest except its three brightest stars.

Of those, Hamal (Alpha Arietis) is the brightest and shines at a respectable magnitude 2.0. An orange giant star some 66 light years away, its name is derived from the Arabic for “head of the ram.” It has one known planet, about the size of Saturn, but it orbits outside the stars’ habitable zone and cannot support life.

Next is Sheratan (Beta Arietis), a multiple star system about 60 light years away. This pair orbit one another about once every 107 days but the stars are too close to be seen with amateur equipment from Earth.



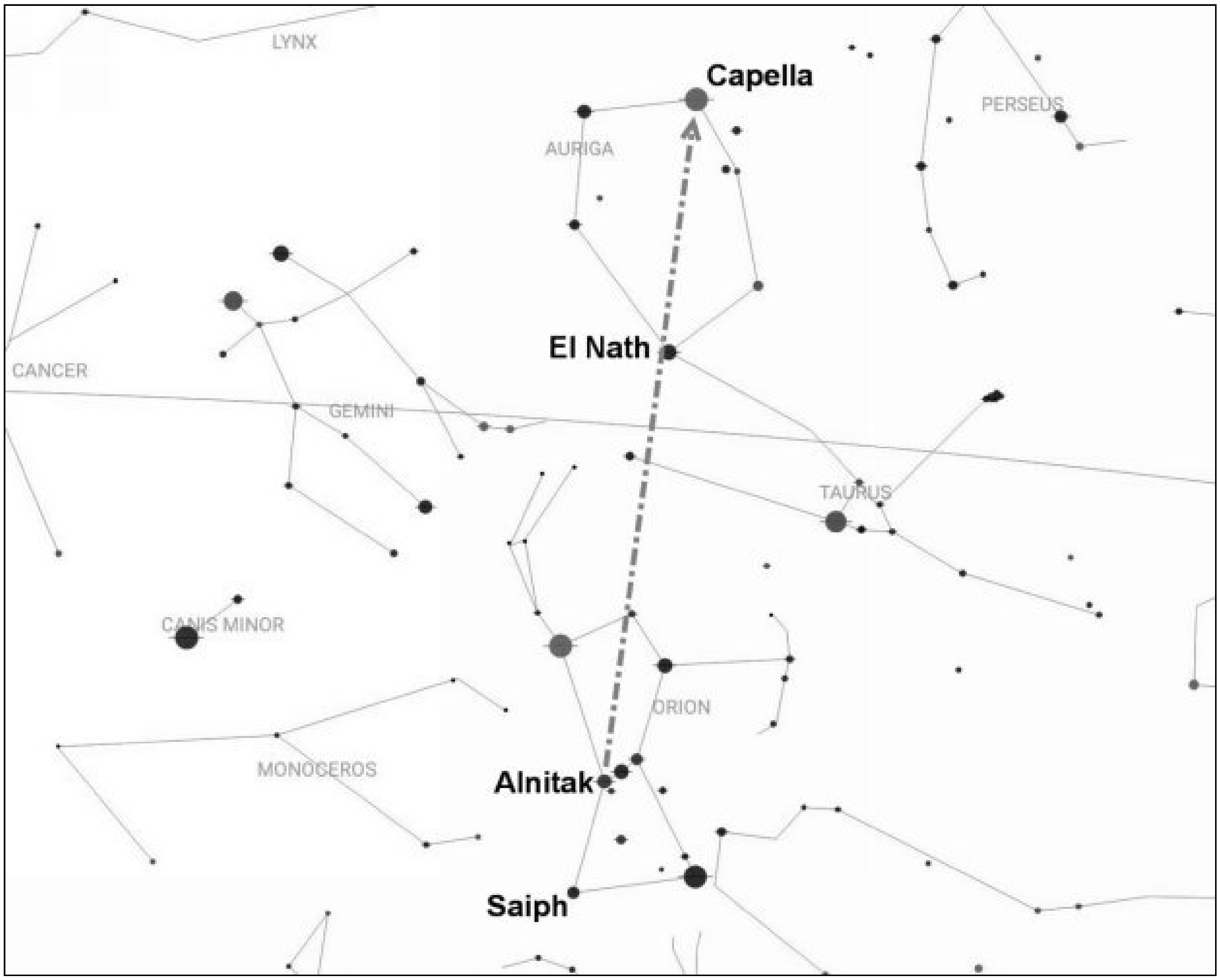
(Double-tap image to enlarge.)

Fortunately, there's a lovely alternative that's a favorite with astronomers across the world. Mesarthim (Gamma Arietis), the faintest of the three stars, is a multiple star system about 165 light years away. It's comprised of two stars that take approximately 5,000 years to orbit one another.

You can see them both with a small telescope. Low power (about 26x) might be barely enough to split the star but medium power – about 50x – will definitely do the trick.

An identical pair of gleaming white gems will be revealed, but look carefully and you might also see a third, unrelated star nearby. This showcase is not to be missed!

Auriga



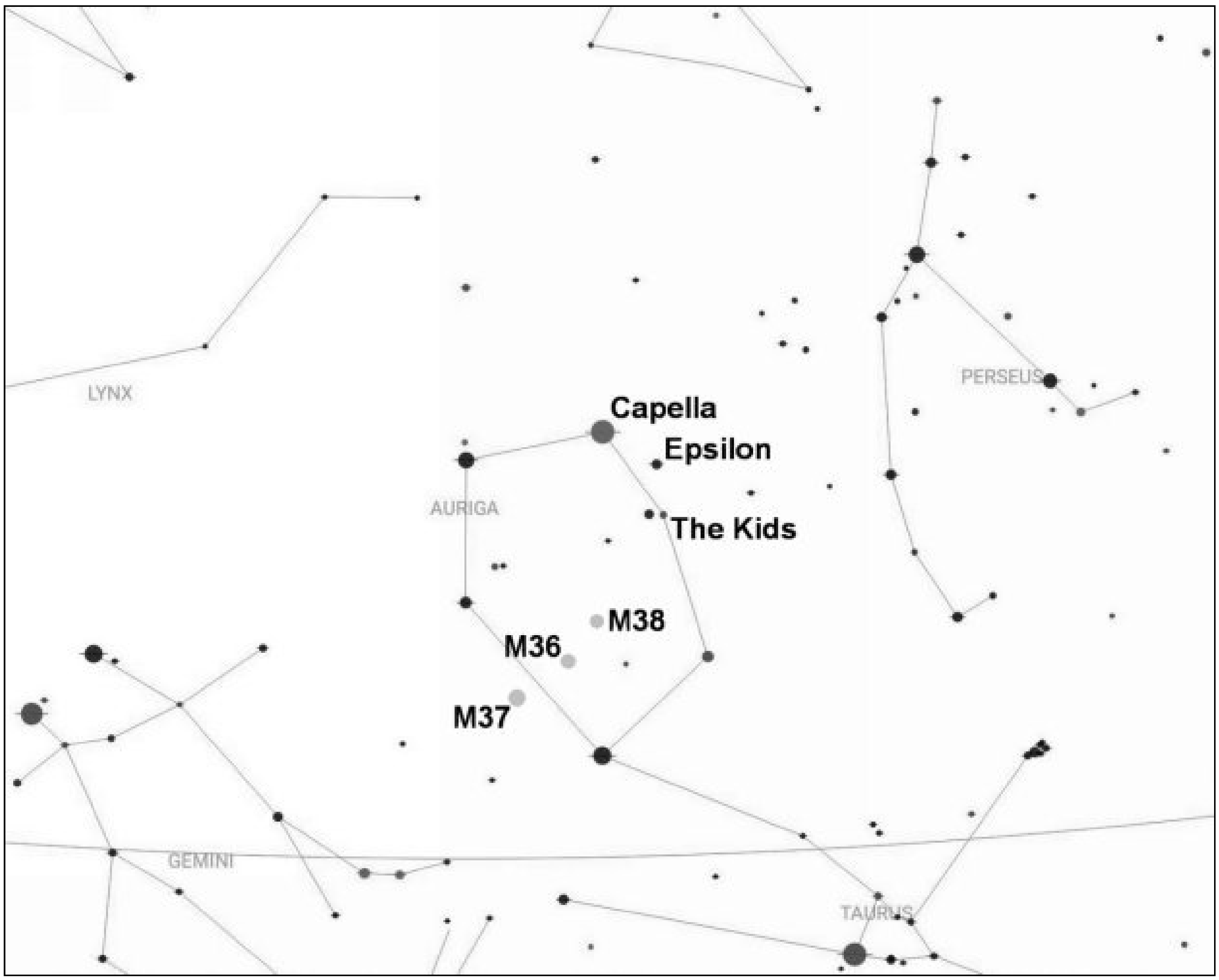
During the winter months, Auriga is easiest found by drawing a line north through Saiph and Alnitak in Orion. In early spring, when Orion is sinking in the west, you can use the stars of Ursa Major to locate the constellation. (Double-tap image to enlarge.)

Auriga represents a charioteer and is thought to depict Erichthonius, the lame footed king of Athens, who invented the chariot as a means of transportation.

It's a moderately large constellation, ranked 21st in size and covering roughly 657 square degrees of sky. It's visible throughout the winter months and is located between Perseus, to the west, and Gemini to the east.

Its brightest star is Capella, the 6th brightest star in the sky and a member of the "winter hexagon of stars." Besides Capella, this asterism also comprises of Aldebaran in Taurus, Rigel in Orion, Sirius in Canis Major, Procyon in Canis Minor and Pollux in Gemini.

This game of celestial join-the-dots can sometimes help beginners to identify the major constellations of winter and includes four of the ten brightest stars in the night sky. (Pollux is the 17th brightest star and, therefore, the faintest star in the hexagon while Aldebaran is the 14th brightest star in the sky.)



(Double-tap image to enlarge.)

Capella shines at magnitude 0.1 and is a multiple star system some 43 light years away. Two pairs of stars orbit one another, with two sun-like stars forming one pair while two red dwarfs form the other.

Look carefully in Capella's direction and you'll also see an elongated triangle of stars, just to the south-west and on the Perseus-side of the constellation.

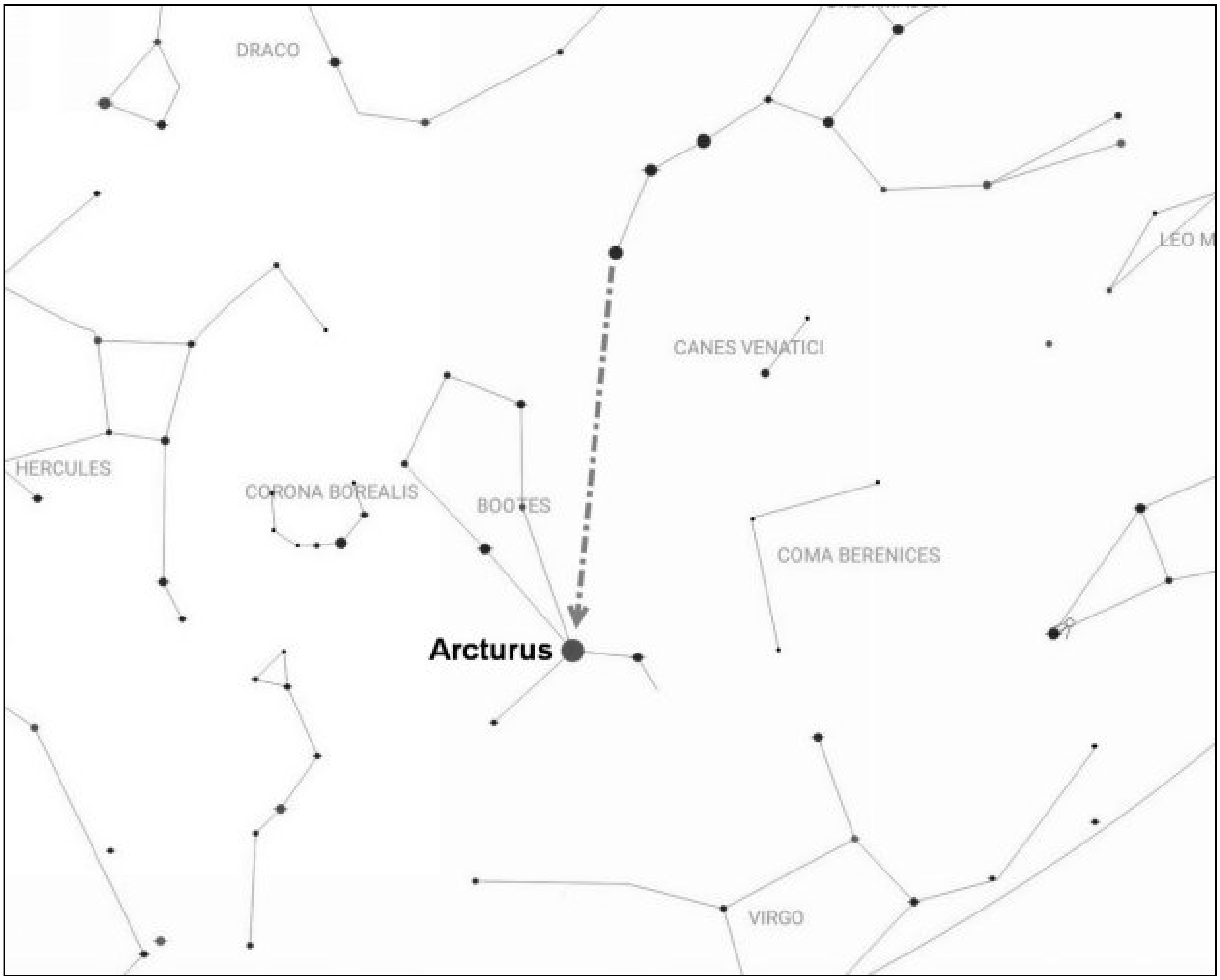
The northernmost star is Epsilon, a star whose light fades for a year once every 27 light years. This is due to a faint companion star eclipsing the primary stars and causing its light to dim when observed from Earth.

The two stars to the south are known as the *Haedi* or "the kids" and represent the two young goats sometimes depicted in the arms of the charioteer.

Auriga is also home to three conspicuous open star clusters, Messiers 36, 37 and 38 (M36, M37 and M38). The trio are visible with binoculars but you'll need to get away from light polluted skies to see them.

All three provide attractive views through a telescope but Messier 37 is the brightest and densest with hundreds of stars being visible, even at low power.

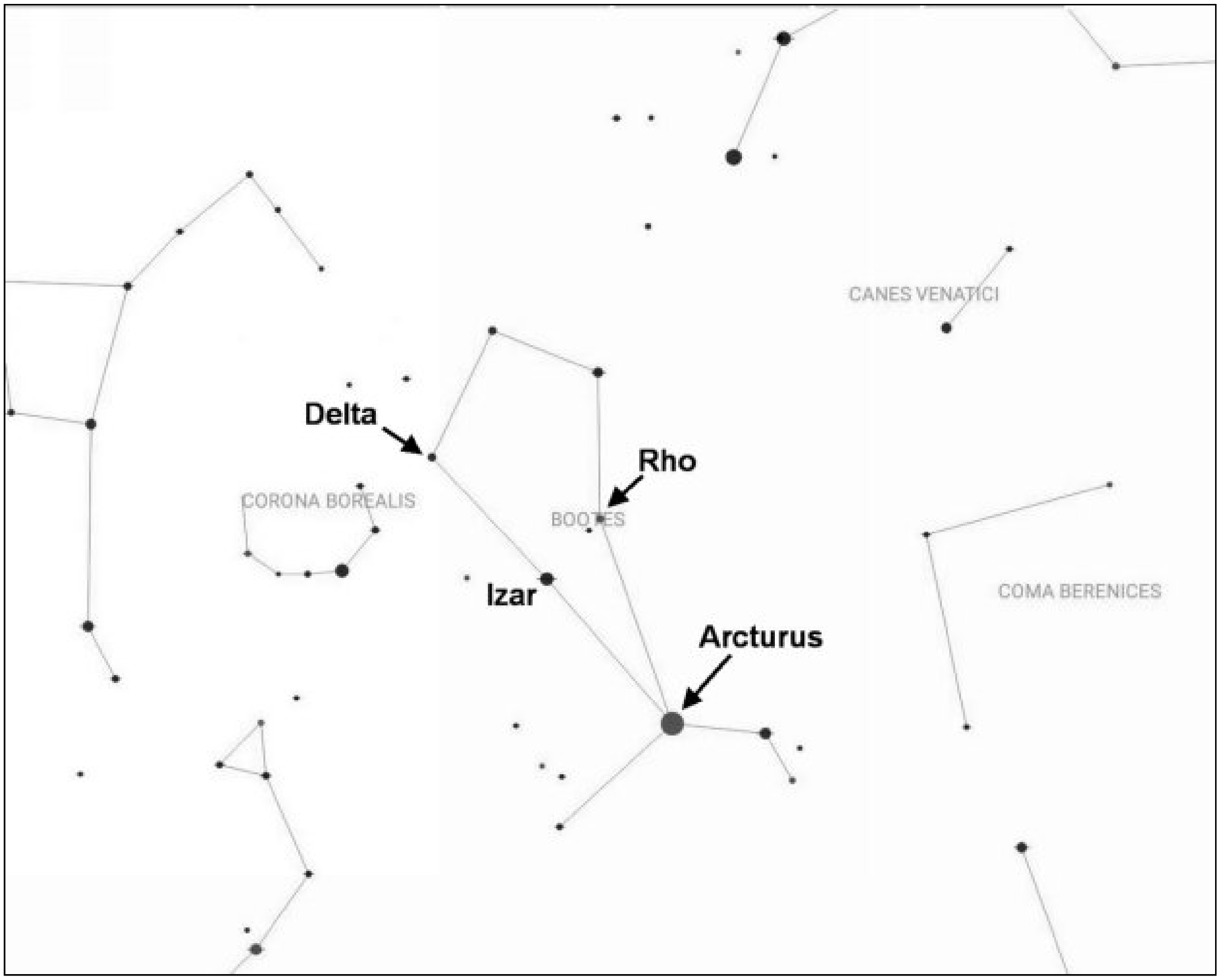
Boötes



Boötes is an easy constellation to locate, thanks to its brightest star, Arcturus. To find it, simply draw a curved line through the tail of Ursa Major and follow it to the south. (Double-tap image to enlarge.)

Boötes is an ancient constellation whose origins can be traced back to the Babylonians. They were the first to associate it with farming and saw the stars as representing a herdsman.

The Greeks continued the tradition by sometimes associating the stars of Ursa Major with oxen or a plough. However, when Ursa Major later became associated with a bear, the Greeks named its brightest star Arcturus – “the bear watcher.”



(Double-tap image to enlarge.)

The fourth brightest star in the entire sky, Arcturus is comparable in brightness to Capella in Auriga and Vega in Lyra. (It's slighter brighter than both rival stars.)

It's an orange giant star with a long observational history that goes back thousands of years. For example, the Polynesians used the star to navigate to the Hawaiian Islands from Tahiti and the star has been known by many names and by many different cultures across the world.

In 1635 it became the first star to be observed telescopically during the daytime and, more recently, light from the star was used to open the 1933 Chicago World's Fair.

Arcturus appears to be a single star with no known companions at this time. (Although, previously, a faint companion star or even a planet were suspected.)

To the unaided eye, it has a distinctive orange tint but binoculars or a small telescope reveal little else to be seen here.

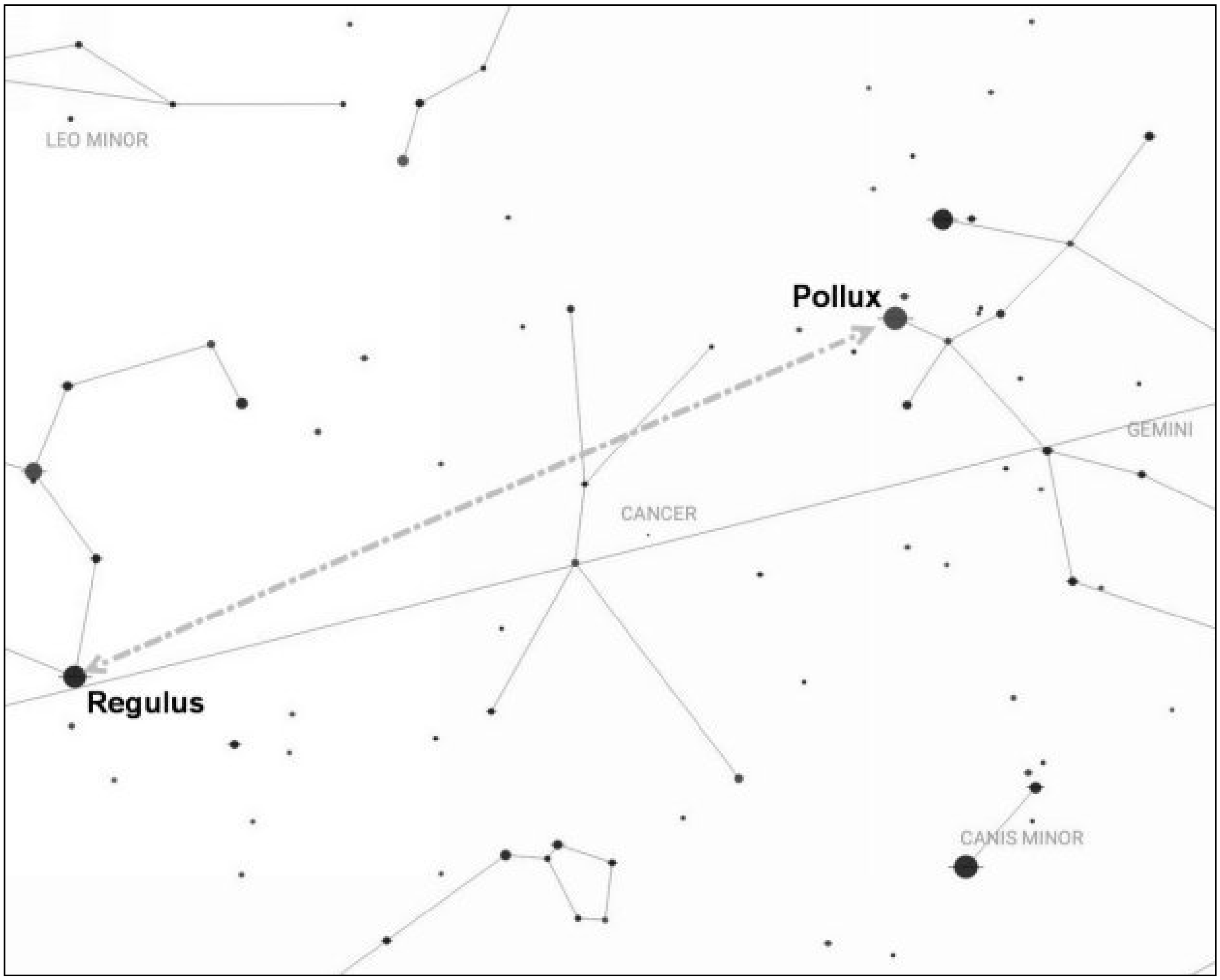
We should count ourselves lucky to see it at all: as one of the fastest moving stars, it’s moving quickly through our stellar neighborhood and was a faint magnitude four star just half a million years ago.

There are also a few double stars of note in the constellation with Delta Boötis being one of the best.

This star is a challenge for binoculars, but can be definitely split with a small telescope at low power. Just 25x will show a pale yellow-white primary star that appears to be about five times brighter than its pale blue companion.

If you have binoculars, turn your gaze toward the middle of the constellation, where you can find Izar and Rho Boötis. You can easily fit both stars into the same field of view and regular 10x50’s will show both stars with wide companions. Look carefully and you might also glimpse a much fainter star very close to Rho.

Cancer



Cancer, despite being faint, is relatively easy to find. Look midway between Regulus, the brightest star in Leo, and Pollux, the brightest star in Gemini. (Double-tap image to enlarge.)

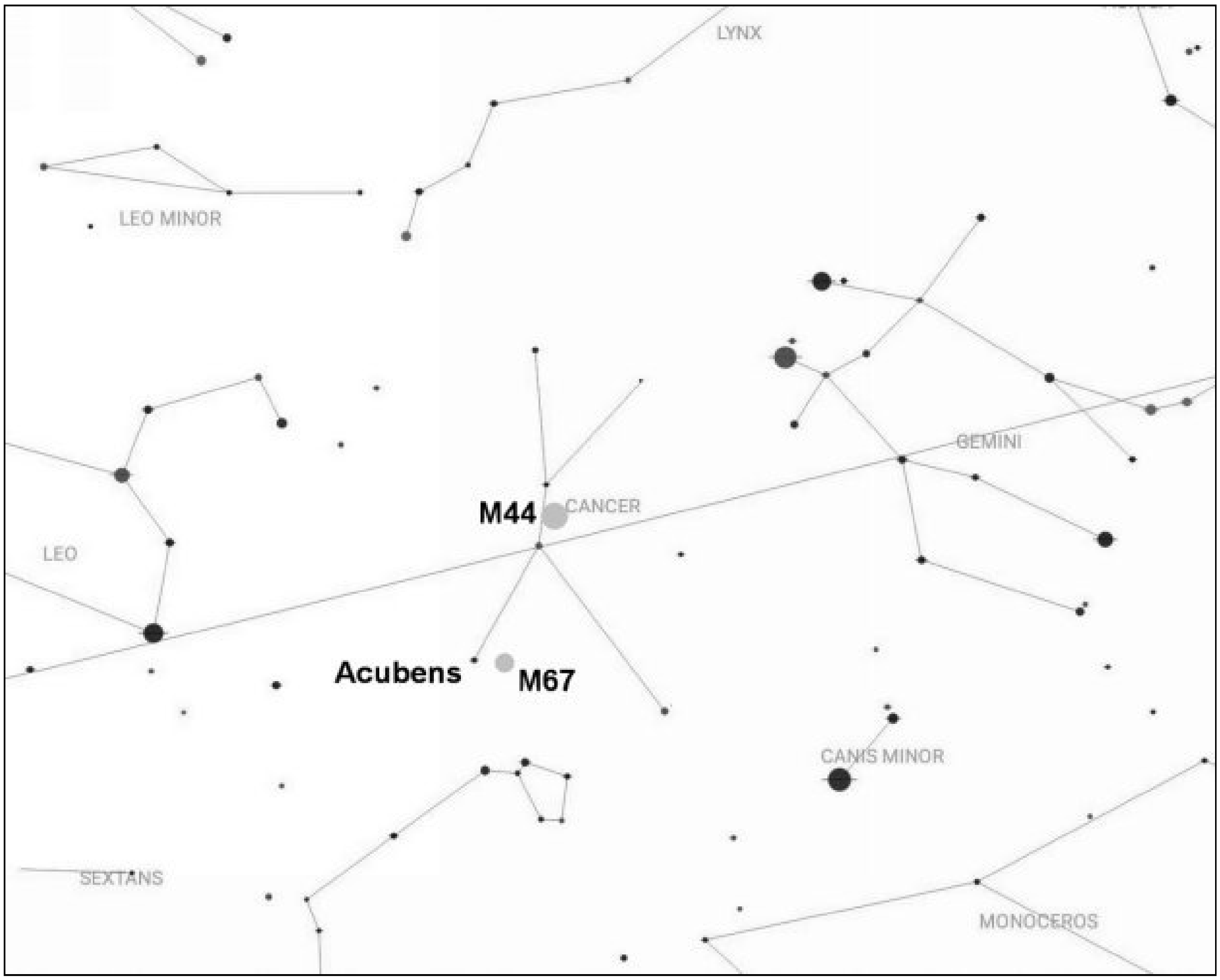
As almost everyone knows, Cancer represents a crab but, being a minor crustacean in the pantheon of constellations, few people know the myth associated with it.

In fact, it's said to the crab the goddess Hera sent to attack the hero Hercules as he battled the mighty sea serpent, Hydra. (Hera had it in for Hercules as he was the illegitimate son of her husband Zeus and the result of one of his many amorous adventures.)

Fortunately for Hercules (and unfortunately for Hera) the hero was easily able to crush the crab with his foot and could then slay the sea serpent without distraction.

Cancer is the faintest sign of the zodiac and can be problematic to spot from the suburbs of a town or city. There are no stars brighter than magnitude 3.5, so unless you know where to look, you may not see it at all.

However, if you live under dark skies, you may be able to pick out the stars that form the K-shaped constellation.



(Double-tap image to enlarge.)

Can you see the Praesepe open star cluster? To the unaided eye it appears as a small, misty patch midway between Leo and Gemini. If you can't see

Cancer at all, try scanning the area with binoculars as locating the cluster is sometimes easier than spotting the constellation itself!

This cluster has been known since antiquity and was once used to forecast the weather. It’s said that if the cluster can’t be seen, then rain is on its way. (If you live in a town, you’ll be lucky to see the cluster with just your eyes anyway!)

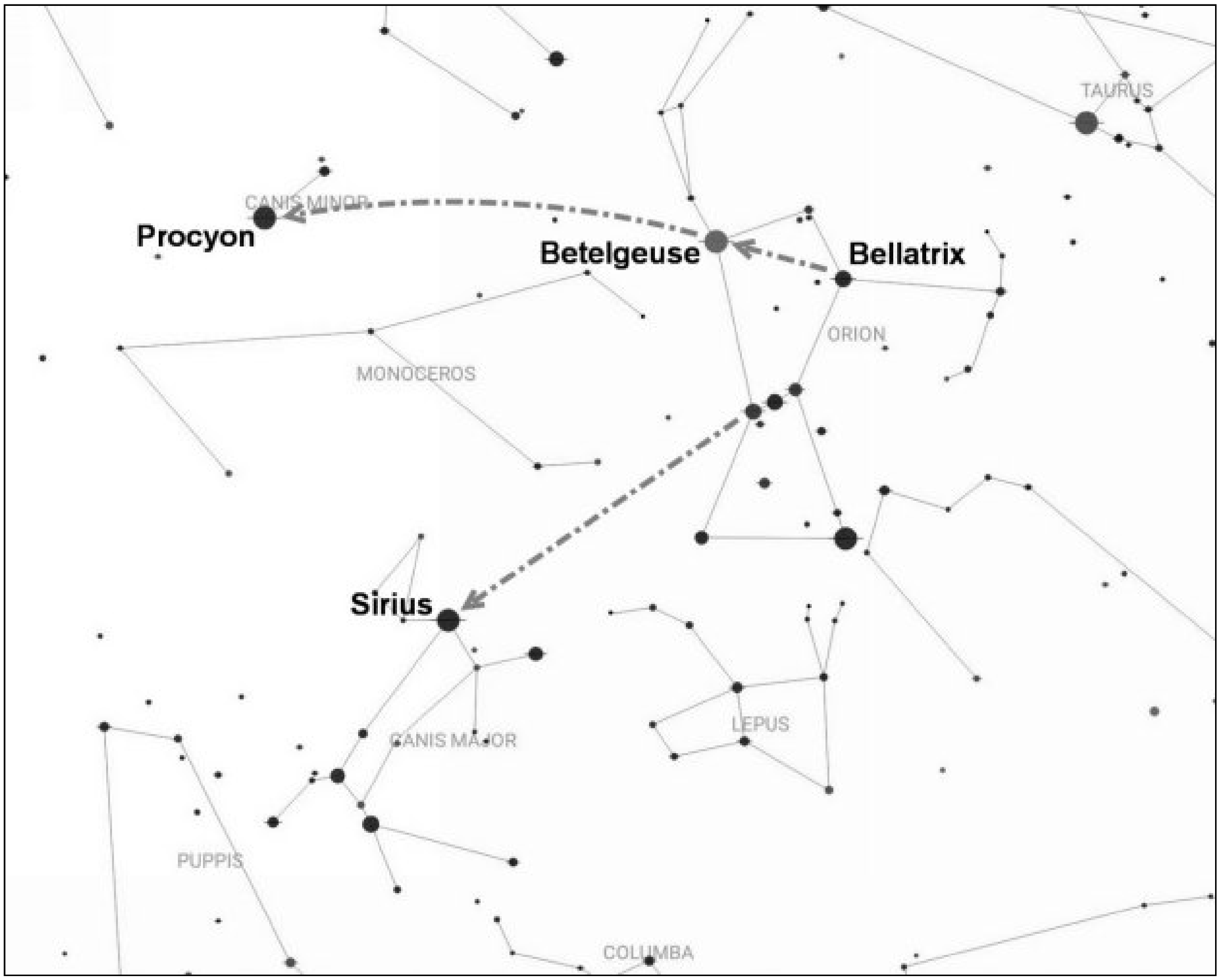
Also known as the Beehive, it can be a fine sight when observed with binoculars and is also worth a look through a small telescope. Like the Pleaides in Taurus, this cluster is best observed at low power because it appears fairly large in our sky and so the whole cluster can only be seen at low magnification.

The Praesepe is number 44 on Charles Messier’s list of deep sky objects. Another binocular open star cluster, Messier 67 (M67), can also be found in Cancer but a little further to the south.

Look for it within the same field of view as Acubens but, at magnitude 6, it’s a lot fainter than the Praesepe and not nearly as impressive.

Suburban binocular observers may not spot it but a small telescope should be able to pick it up. Low power will show a shield-shaped cluster with an orange star adorning its outer edge.

Canis Major and Canis Minor



You can use [Orion] to locate both these constellations. Procyon, the brightest star in Canis Minor, can be found by drawing a curved line through Betelgeuse and Bellatrix, the two stars that mark the shoulders of the hunter. Meanwhile Sirius, the brightest star in Canis Major, can be found by drawing a line south through the three stars of the hunter's belt. (Double-tap image to enlarge.)

Canis Minor, the little dog, and Canis Major, the greater dog, are the canine companions of Orion the hunter and can be seen faithfully following their master across the winter sky.

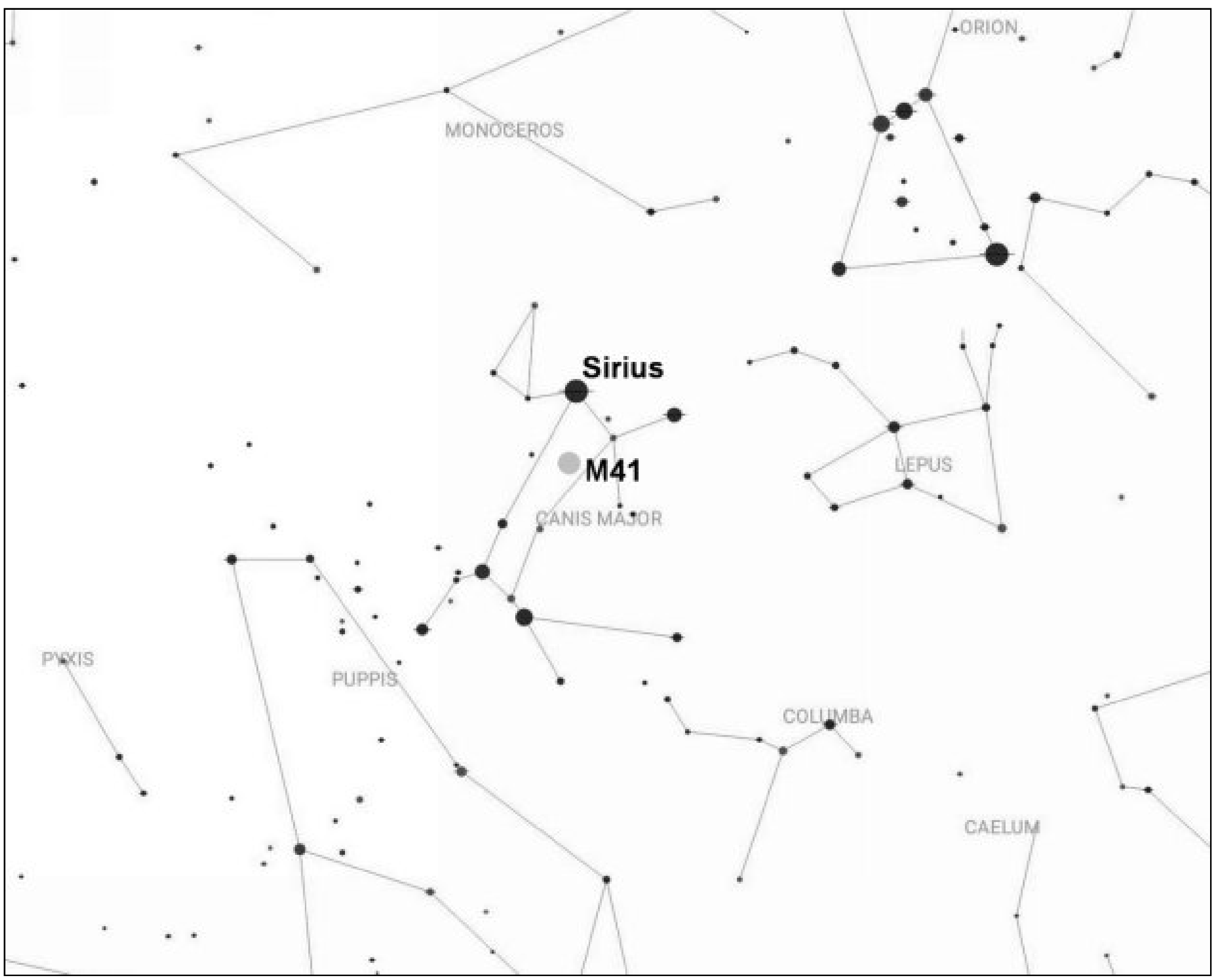
(Their prey, Lepus, the hare, safely remains out of reach under the heels of the hunter himself!)

Of the two, Canis Minor is the smaller constellation, ranked 71st in size, and comprises of only two bright stars – Procyon and Gomeisa.

Procyon shines at magnitude 0.3, is the 8th brightest star in the sky and, at just under 11 light years away, is also one of the nearest. It's a large white star, just beginning to move into the subgiant stage, with a white dwarf companion

Procyon forms one corner of what's known as the Winter Triangle and the Winter Hexagon, an asterism of stars that looms large in the winter skies.

With Procyon marking the north-eastern corner and Betelgeuse marking the north-west, brilliant Sirius completes the triangle with its light from the south.



(Double-tap image to enlarge.)

You can’t miss it. Sirius is the brightest star in the entire night sky and can often be seen glinting over the southern horizon from the northern hemisphere. Ordinarily it appears pure white, but when it’s especially low, you may see it flashing a myriad of other colors.

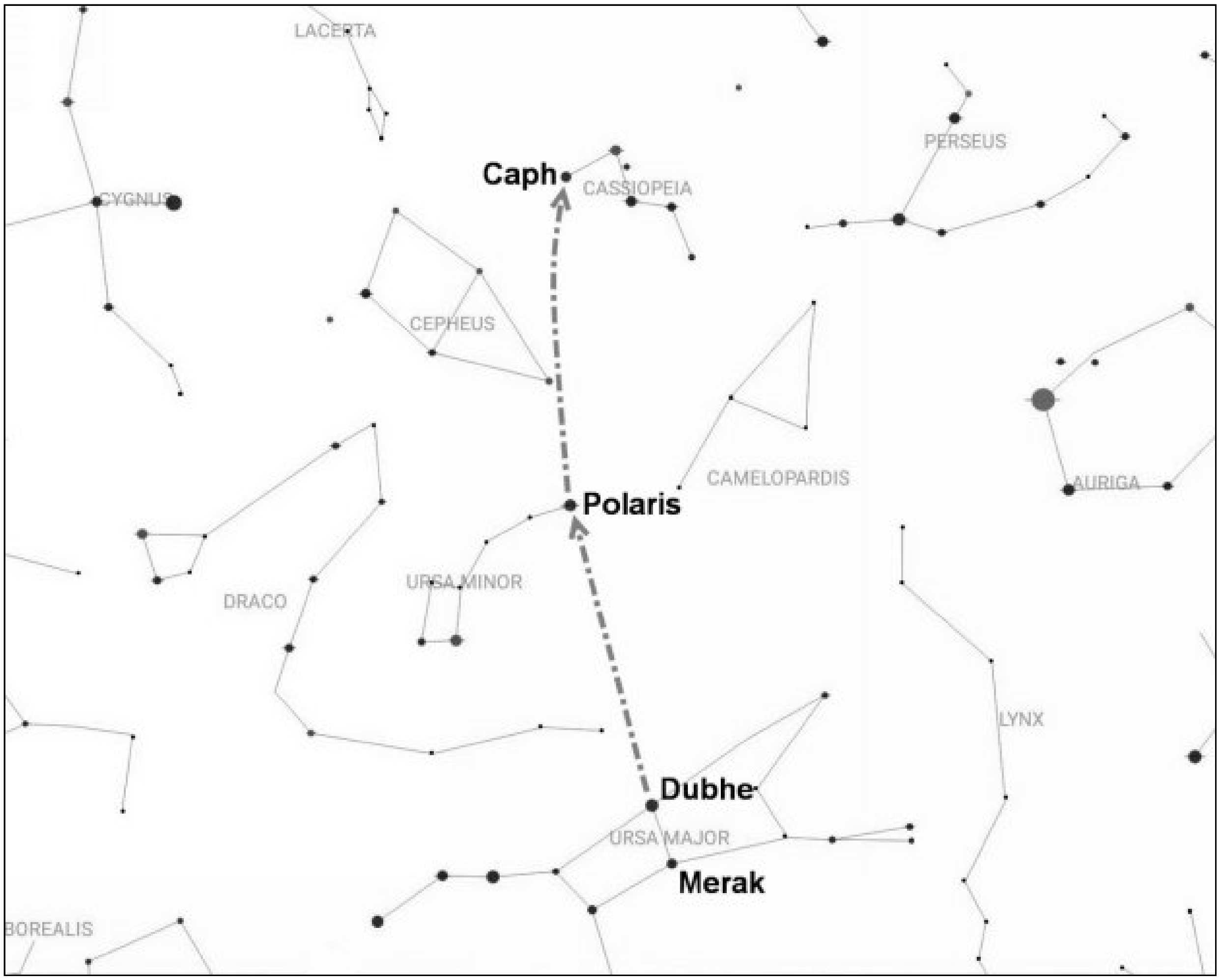
Like Procyon, Sirius is one of the closest stars and lies just over 8½ light years away. Also like Procyon, it has a white dwarf companion (nicknamed “the pup”) that may be glimpsed with larger telescopes.

Unlike Procyon, Sirius has something else of interest that appears quite close to it in the sky. Another of Charles Messier’s objects, Messier 41 (M41), can easily be seen with binoculars - even from the suburbs!

With Sirius near the edge of your binocular view, look for this open star cluster almost due south of that star. (You might also notice a triangular formation of stars just to the east.)

Messier 41 is always an attractive and welcome group and, I feel, comes close to rivalling the Praesepe in Cancer for binocular observers. Again, like many other clusters, it’s best observed through a small telescope and can be a stunning sight on any winter’s night.

Cassiopeia



An autumnal constellation, you can find Cassiopeia by drawing a line north through the "pointers" Merak and Dubhe, then through Polaris and a slight curve over to Caph, the constellation's second brightest star. (Double-tap image to enlarge.)

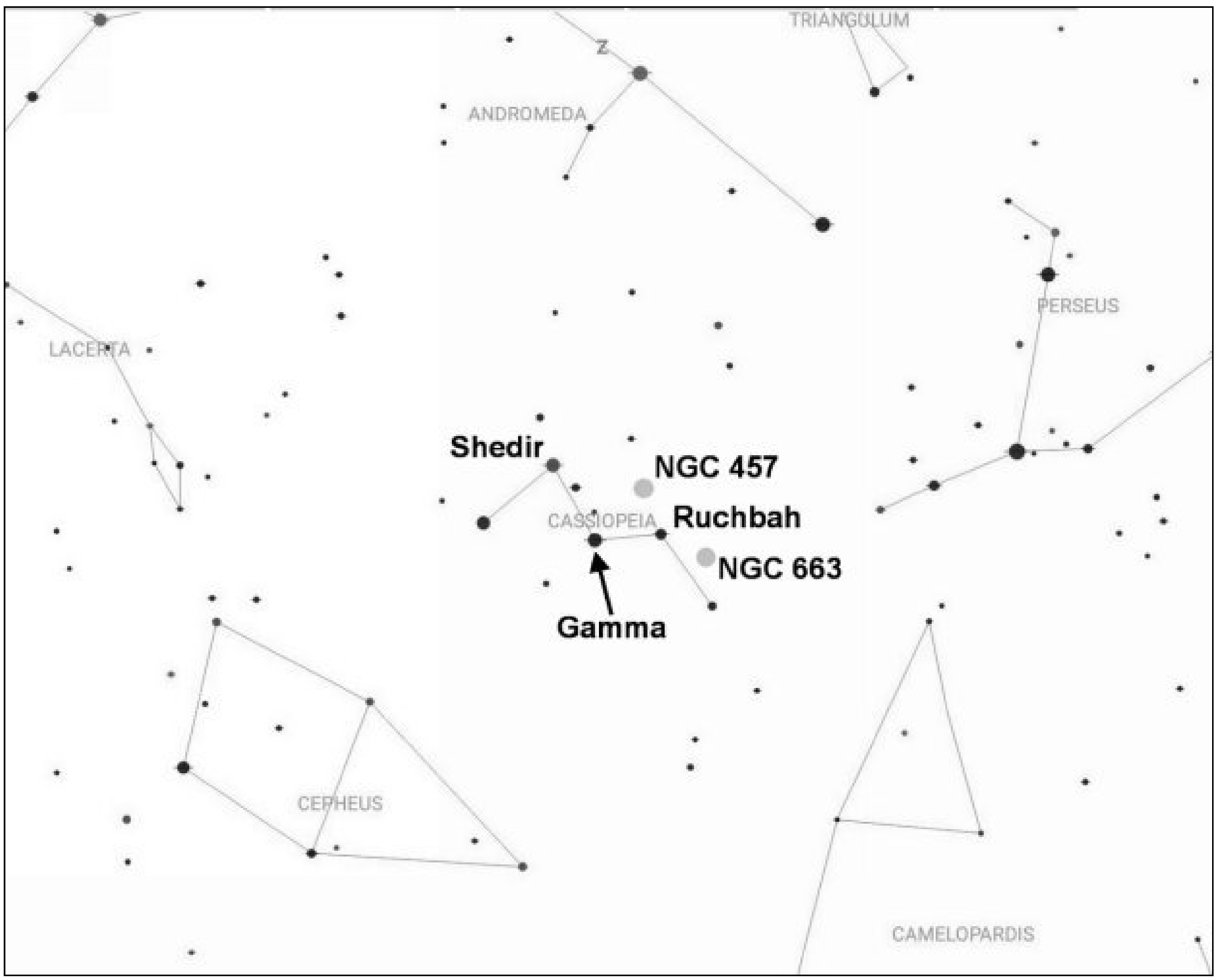
According to Greek myth, Cassiopeia was the mother of Andromeda and the vain queen who boasted that her daughter was more beautiful than the sea nymphs.

Zeus placed her among the stars, seated upon her throne, but to punish her for her vanity he caused the queen to circle Polaris, the pole star, for all eternity.

Hence, sometimes Cassiopeia can be seen sitting upright on her throne, while at other times she appears to be hanging upside down!

Many writers have commented on the shape of the constellation. Its five brightest stars form an easily recognizable pattern which many have called the “W” of Cassiopeia.

It’s a little bit of a misnomer; the constellation only appears as a W when it’s at its lowest, just above the northern horizon in the spring evening sky. During the summer it appears as a 3, to the east of Polaris and then appears as an M throughout the autumn months, when the constellation is at its highest. Lastly, it appears as an E, to the west of Polaris, during the winter.



(Double-tap image to enlarge.)

The brightest star is usually Shedir, also known as Alpha Cassiopeiae. I say "usually" because Gamma, the central star (and the star with no name) is actually a star of unpredictable variable magnitude and is currently slightly brighter.

Cassiopeia is also home to several deep sky objects, including two open star clusters that can be spotted with binoculars. Curiously, neither of them were included in Messier's catalog!

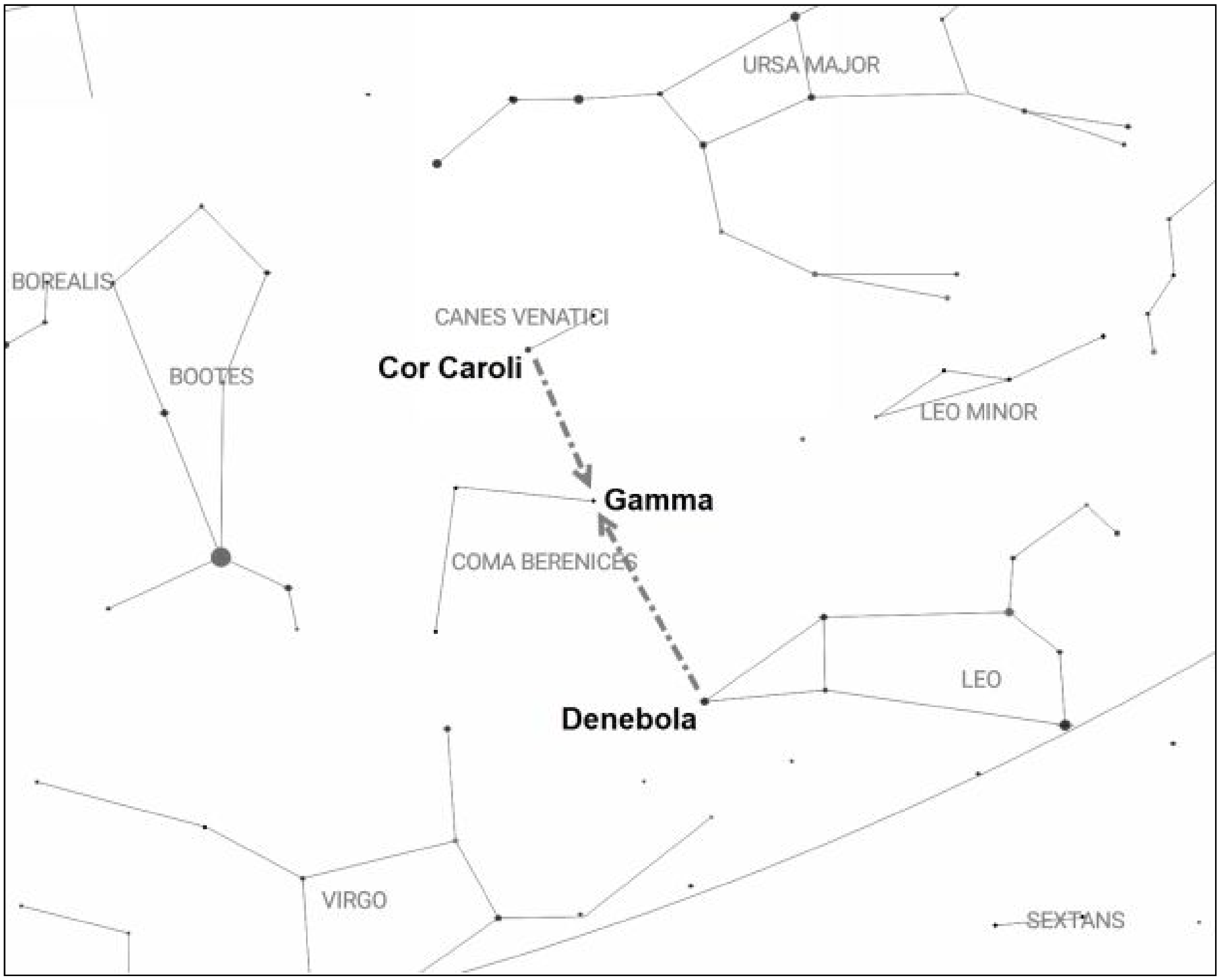
The first, NGC 457, is more commonly known as the Owl Cluster. It's a fairly large cluster that may be glimpsed with binoculars under suburban skies but is stunning through a small telescope.

It has a pair of bright stars that mark the eyes and a scattering of stars that form the body and wings of the owl. Look for it within the same binocular/finder field of view as Ruchbah.

Also within the same field of view is NGC 663, a cluster with no name that appears as a large, faint circular patch through binoculars.

Again, it's best observed with a small telescope when your imagination can run wild. Two pairs of stars seem to form eyes of not one but two celestial spectres in the night sky!

Coma Berenices

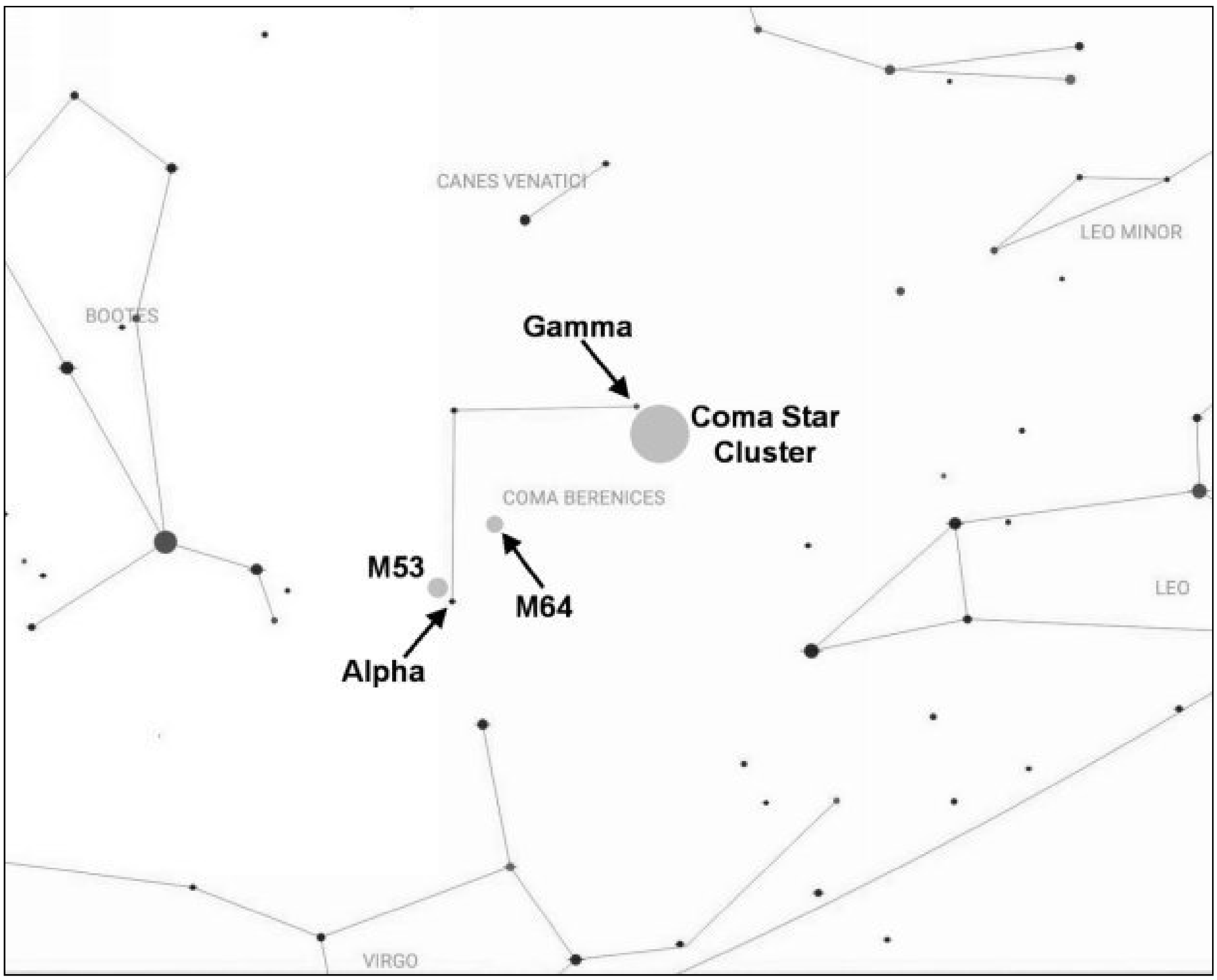


Coma Berenices would be a tricky constellation to find if it wasn't for two reasonably bright stars. First look to the south from the tail of [Ursa Major] to find Cor Caroli, the brightest star in Canes Venatici. Continue the line until you come to Denebola, which marks the tail of [Leo], the Lion. Now look about midway between the two for Gamma, the third brightest star in the Coma Berenices. (Double-tap image to enlarge.)

Coma Berenices is unusual in that it's the only one of the ancient constellations to be based upon an actual historical person, Queen Berenices, who was married to King Ptolemy of Egypt. The pair lived around the third century B.C.E. and it's said the Queen promised the goddess Aphrodite she would cut off her hair if her husband returned safely from battle.

Sure enough, the King returned and the Queen dutifully cut off her hair and placed it in Aphrodite's temple. Unfortunately, the hair vanished overnight, thereby angering Ptolemy, who was only calmed by a priest who claimed the hair had been placed among the stars by Aphrodite herself.

Why would he say this when the sky seems empty and barren in this area? Look carefully, under clear dark skies, with nothing but your eyes and you might catch sight of a small scattering of stars just to the south of Gamma.



(Double-tap image to enlarge.)

This is the Coma Star Cluster, a group of more than fifty stars that lie about 288 light years away. It makes for a very nice sight in binoculars, even from light polluted suburban skies.

It’s this cluster that the priest claimed to be the hair of the queen and, consequently, the constellation became known as Coma Berenices – or to give it its English name, Berenices’ Hair.

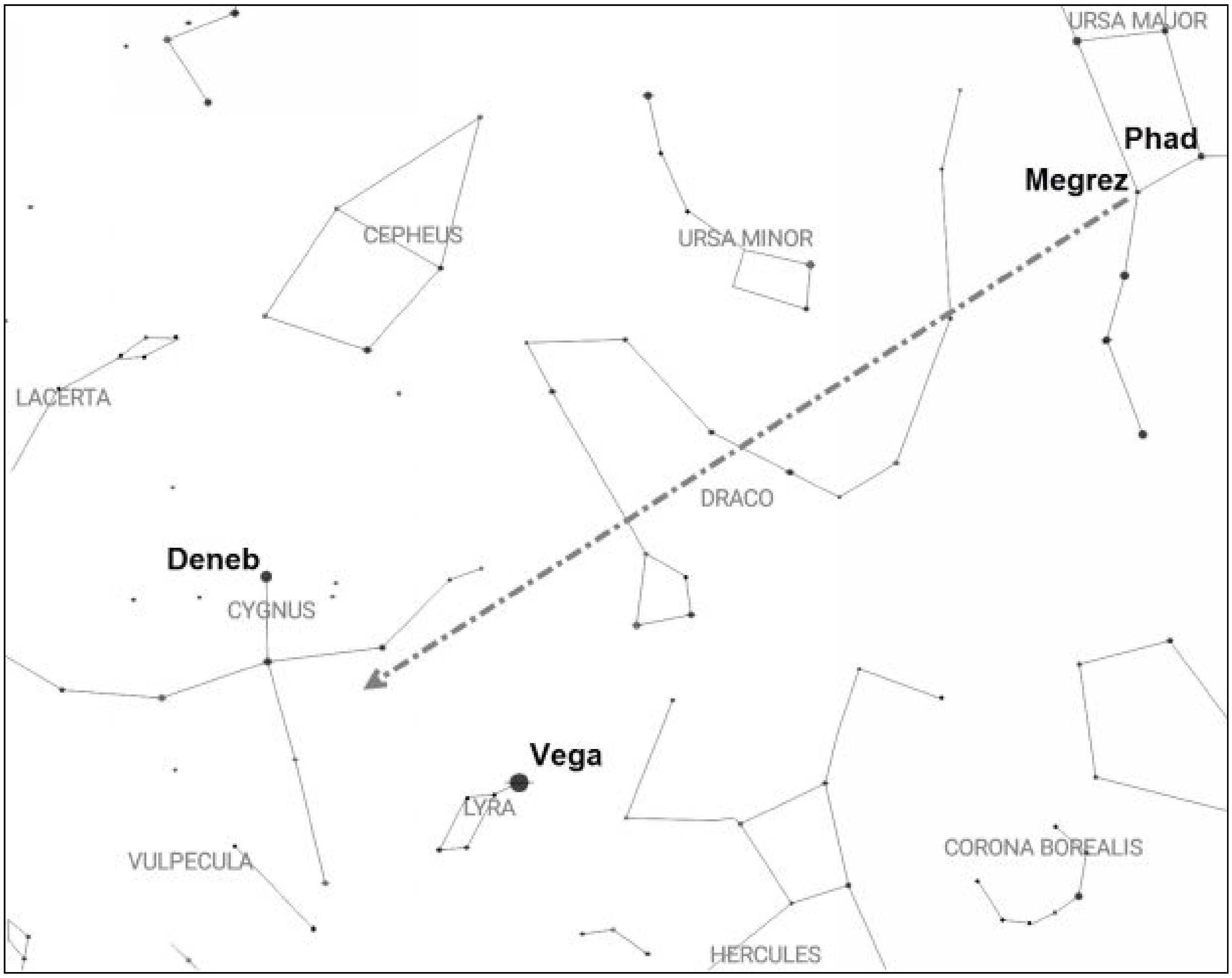
(Incidentally, Gamma is not thought to be a member of the cluster and may be about 100 light years closer.)

If you only have your eyes and/or live under suburban skies, there’s little else to see here. If, however, you have good binoculars or a small telescope and live under dark skies, trillions of stars could be within your reach.

For this area of the sky, like neighboring Virgo, is the realm of the galaxies and a number are bright enough to be seen with just binoculars. In particular, look out for Messier 64 (M64), also known as the Blackeye Galaxy. It lies about 17 million light years away (relatively close!) and is one of eight galaxies in Coma Berenices that Messier listed in his catalog of deep sky objects.

It lies within the same binocular field of view as Alpha, as does another sight, Messier 53 (M53.) This magnitude 8.3 globular cluster, some 60,000 light years away, appears as a tiny, faint and fuzzy star just to the north-east of Alpha.

Cygnus



Cygnus is relatively easy to find as Deneb, its brightest star, is one of the three stars of the Summer Triangle. You can also use Megrez and Phad in Ursa Major to point toward Draco and then on to the stars of summer. (Double-tap image to enlarge.)

In Greek mythology, Zeus transformed himself into Cygnus, a swan, so that he may seduce Leda, the Queen of Sparta. Leda consequently gave birth to the twins Castor and Pollux who were themselves immortalized as Gemini.

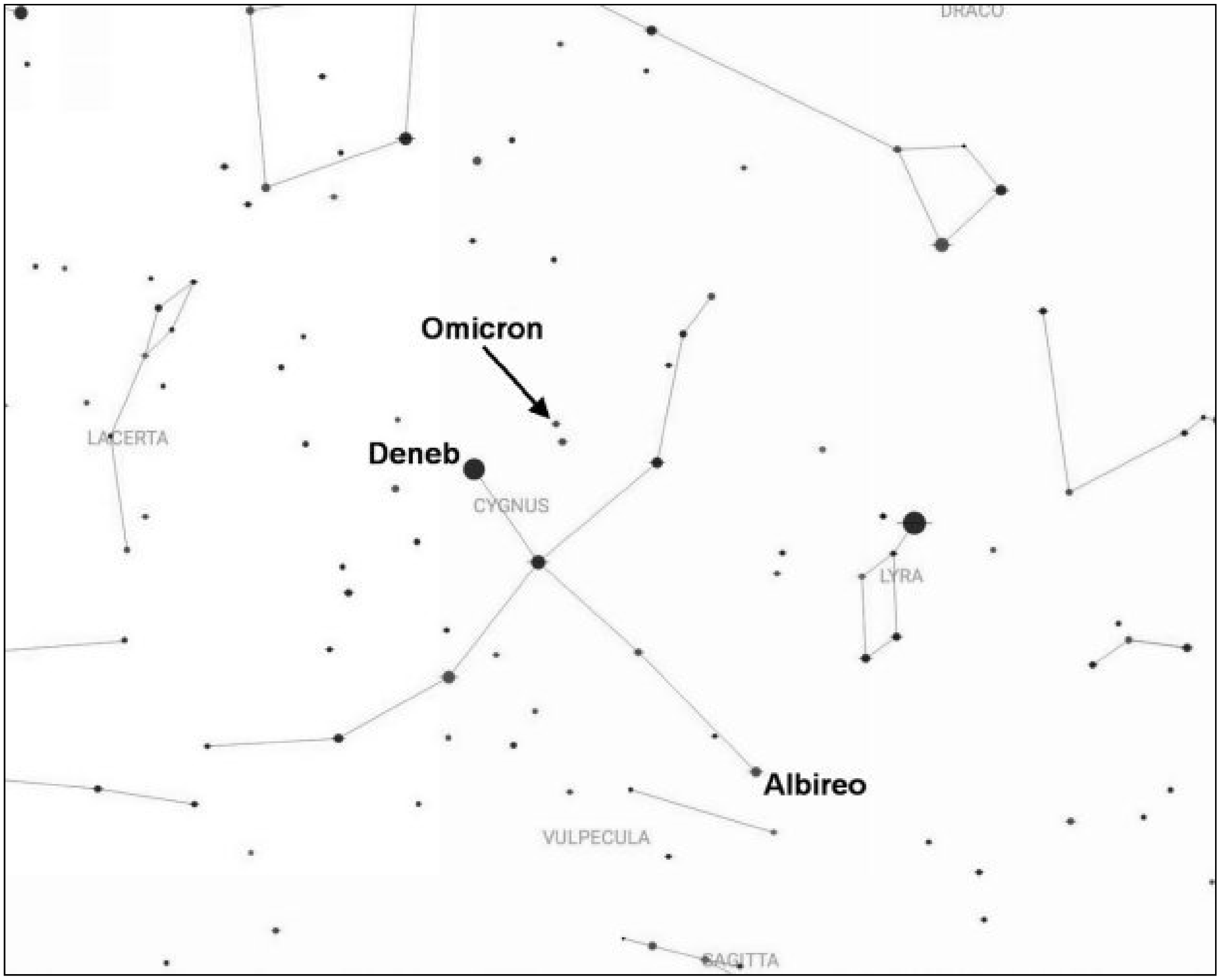
It's a large constellation, 16th in size, with Deneb, its brightest star, forming the northernmost corner of the Summer Triangle of stars. Deneb is the 19th brightest star in the sky and although its exact distance is unknown, it's also thought to be one of the most luminous. Estimates vary, but some astronomers believe the star shines with a light 200,000 times brighter than the Sun!

If you can get away from the lights of your town or city and stand under truly dark skies, you'll witness something truly awe-inspriing: our own Milky Way galaxy.

It runs right through Cygnus, from north to south, and although it's brightest in the constellation of Sagittarius, that part of the sky never rises very high above the horizon for much of the northern hemisphere.

But Cygnus is another story. It's best seen from late spring to late autumn and can be easily seen flying overhead during the summer months. The faint, misty glow of our own galaxy meanders through it like a river, providing rich rewards for anyone scanning the area with binoculars.

Even without optical aid it can be a dizzying experience. You're staring at the spiral arm of our galaxy, seen edge-on and from within. A little imagination is all that's needed to feel as though you're falling through space!



(Double-tap image to enlarge.)

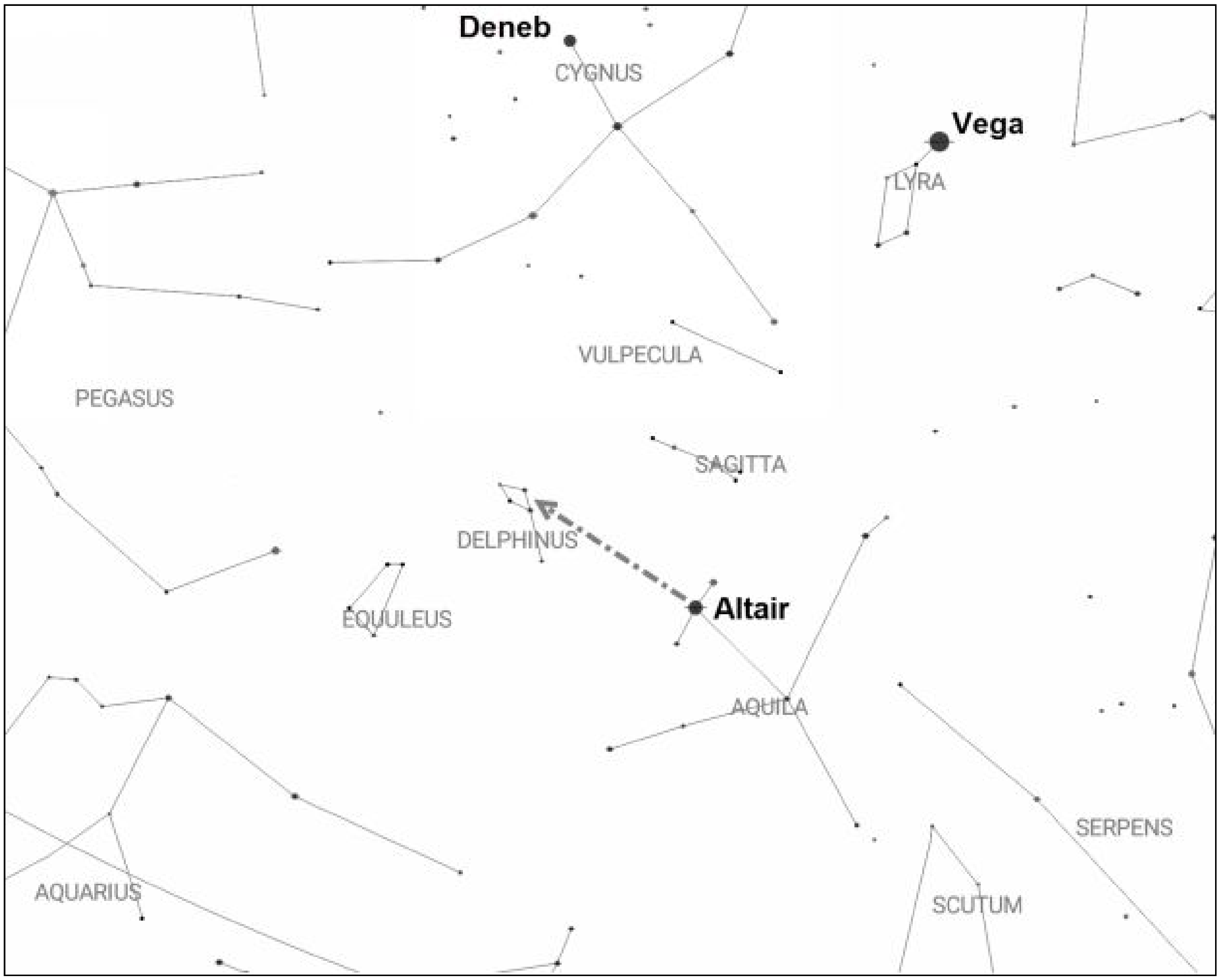
But the Milky Way isn't the only treasure to be found here. To the west of Deneb, and within the same field of view, lie the two stars of Omicron Cygni.

Through binoculars, with Deneb on the eastern edge of the field of view, you'll see two golden suns. But look closely at Omicron[1], the southern star of the pair. Can you see a third, faint, pale blue star close beside it?

If you have a small telescope, turn it toward Beta Cygni. Commonly known as Albireo, this is widely reckoned to be the finest double star in the entire northern sky.

A low magnification of only 27x is enough to split this star in two and reveal a golden primary with a slightly fainter pale blue companion. Not to be missed, this star is on every astronomer’s summer observation list!

Delphinus

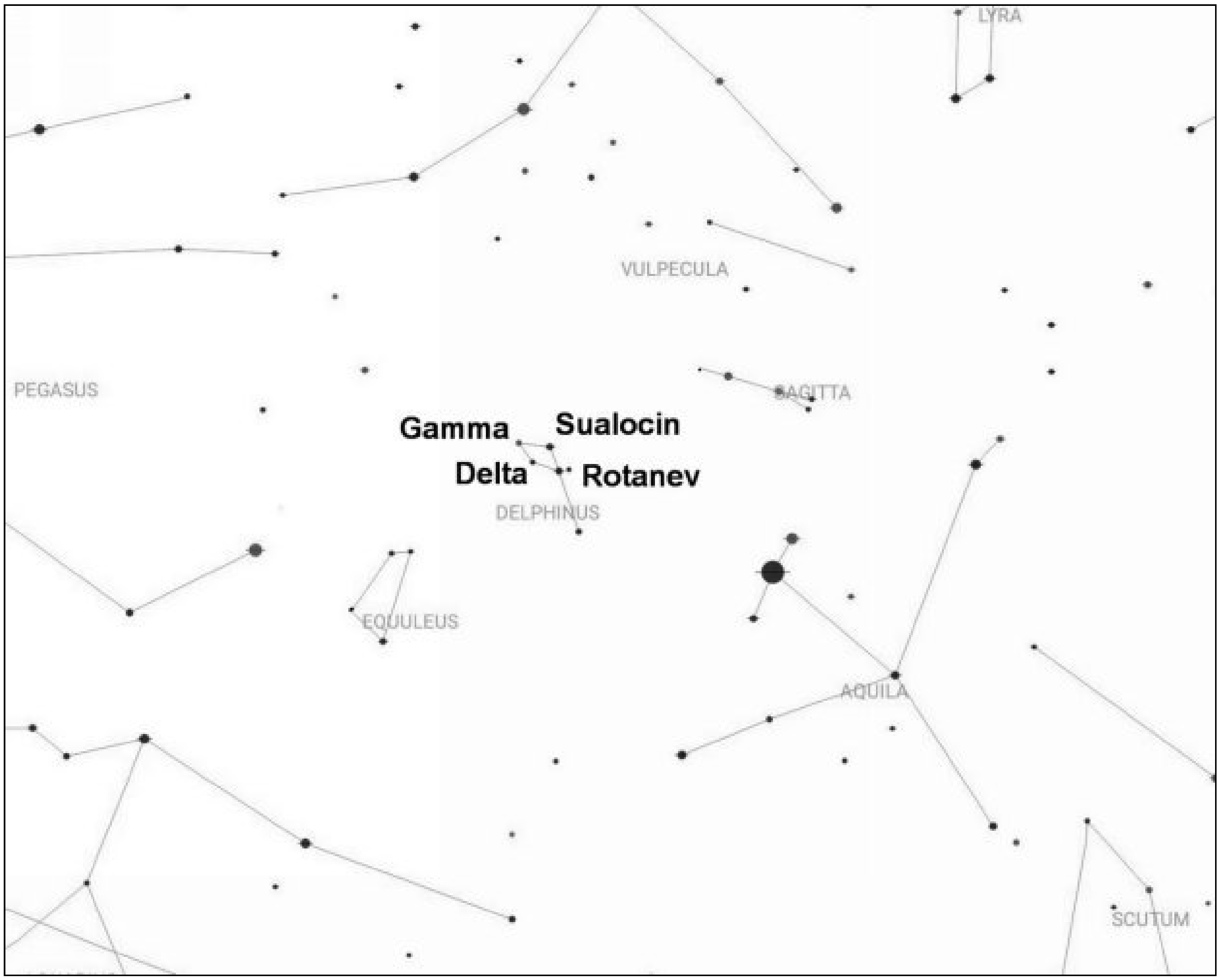


Perhaps the easiest way to find Delphinus is by drawing a slightly curved line north through [Aquila](), the Eagle. Altair, the brightest star in [Aquila](), is one of the three stars of the Summer Triangle. (Double-tap image to enlarge.)

Delphinus depicts the dolphin that helped Poseidon, god of the sea, find his love. According to Greek legend, it's said that Poseidon fell in love with the sea nymph Amphitrite. Unfortunately, she didn't feel the same way and fled to the mountains to escape him.

Desperate to find her, Poseidon dispatched an armada of sea creatures to track her down. Only one, the determined dolphin, was successful. Not only did he find her, but he also persuaded her to return to Poseidon. The grateful god then rewarded the dolphin by immortalizing it among the stars.

Like [Canis Minor](), Delphinus is a tiny constellation, ranked 69th in size. Somewhat of a personal favorite, I've always considered it to be the last of the summer constellations and the first of the aquatic constellations of autumn.



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Delphinus is not an especially bright constellation but it has a distinctive shape. Its four brightest stars, Alpha (Sualocin), Beta (Rotanev), Gamma and Delta, form an asterism popularly known as Job's Coffin. The name refers to the Biblical character, but beyond this its origins are something of a mystery.

Two other names remained a mystery for quite some time. Alpha (Sualocin) and Beta (Rotanev) both have names that are neither Greek nor Arabic in origin. In fact, it wasn't until relatively recently that the stars had names at all.

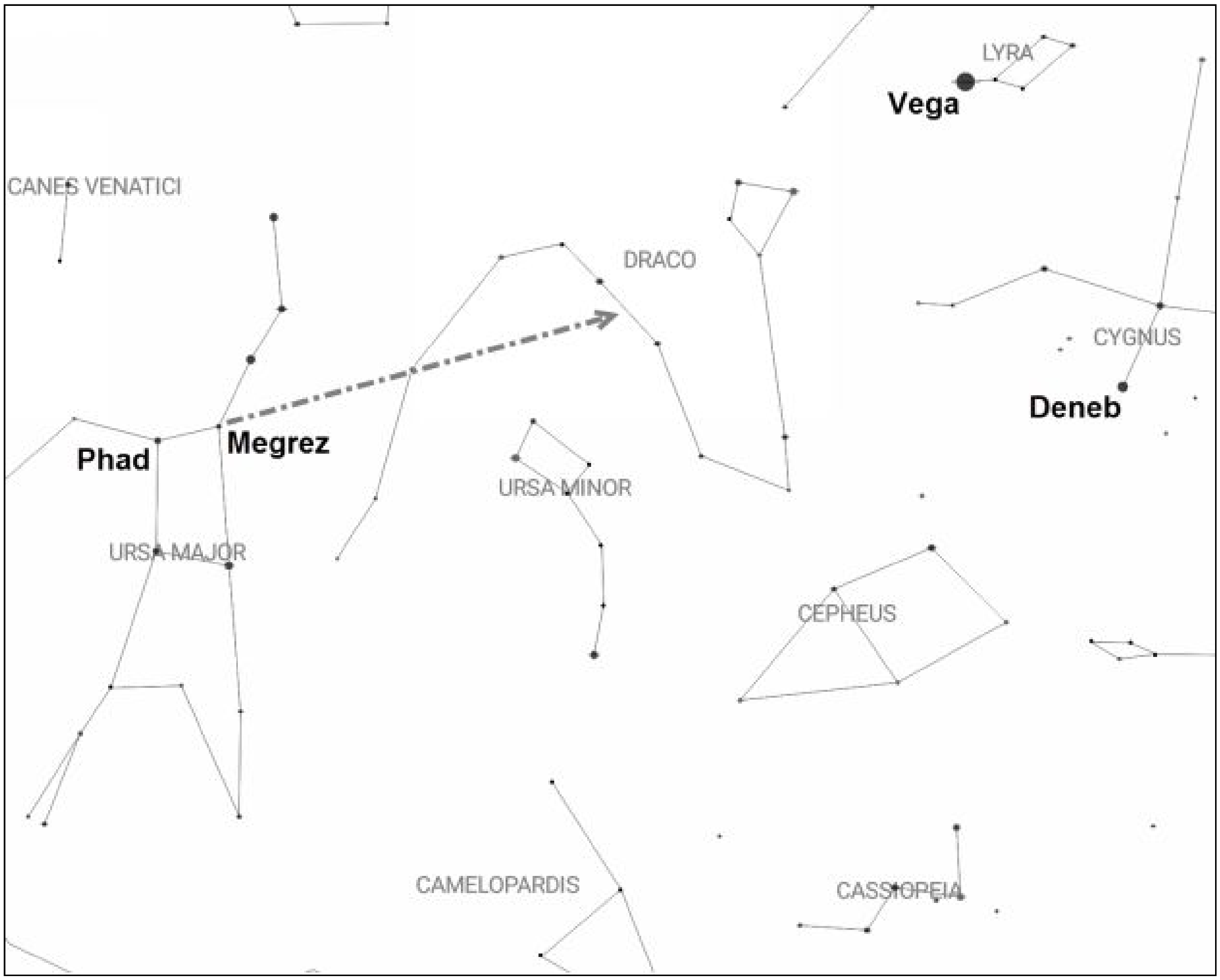
In the early 19th century, the Italian astronomer Niccolò Cacciatore was helping to compile a star catalog at the Palermo Observatory. Unbeknownst to everyone at the time, he found a way of immortalizing himself among the stars without the help of any Greek gods.

In 1814, the star catalog was published with the names Sualocin and Rotanev attached to the previously unnamed stars. No one knew the origins of the names until one wily British astronomer, the Reverend Thomas William Webb, realized that Niccolò Cacciatore had named them for himself.

Taking the Anglicized version of his name as Nicholas Hunter, Cacciatore then Latinized his name into Nicolaus Venator and then reversed it to read Sualocin and Rotanev!

Before you leave, take a closer look at Sualocin. Binoculars should reveal a fainter, unrelated white companion to the southwest.

Draco

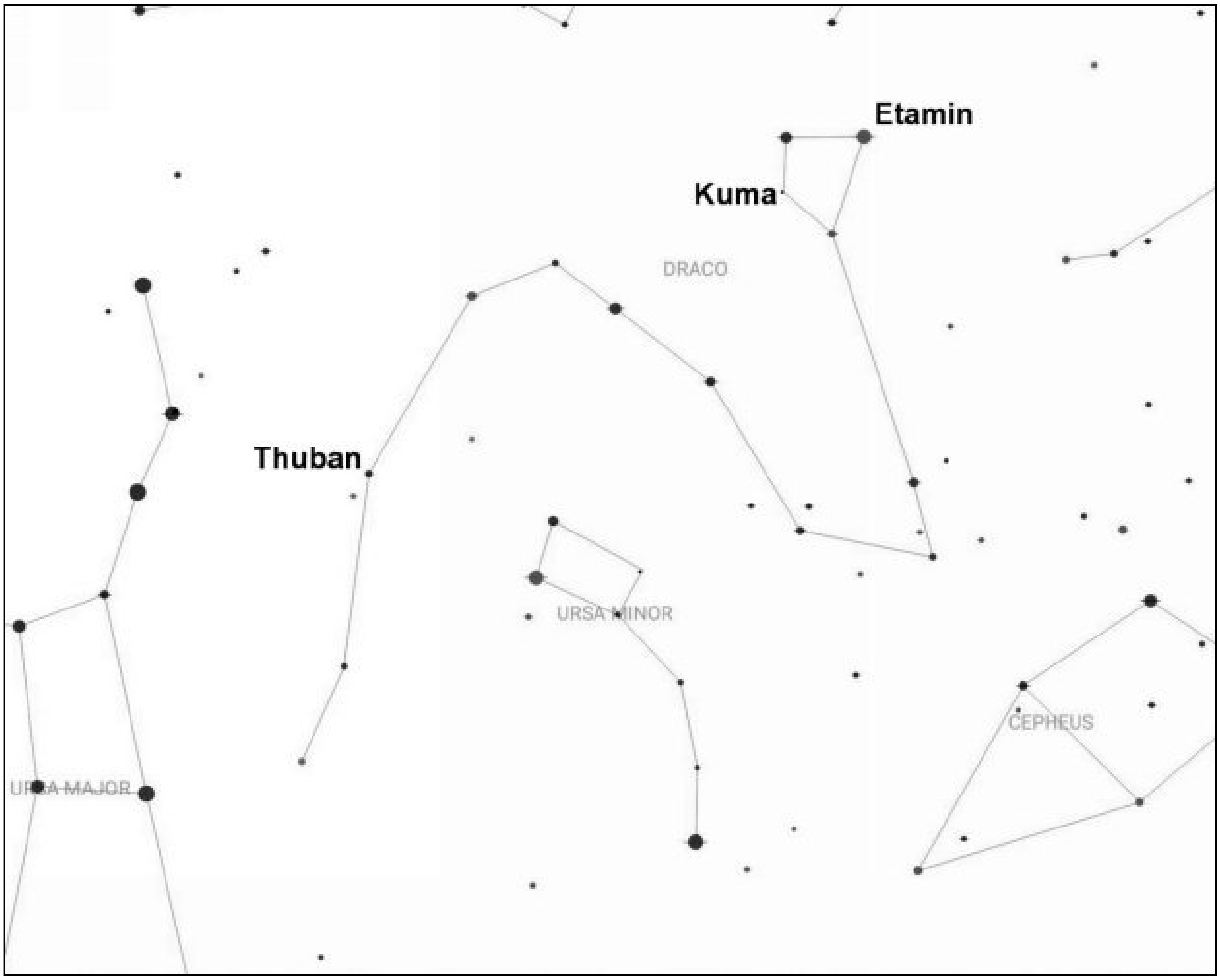


The easiest way to find Draco is to draw a line through Megrez and Phad in [Ursa Major](). This will take you through the body of the dragon. Look out for its head to the north-east of [Hercules]() and to the north-west of Vega, the brightest star in [Lyra](). (Double-tap image to enlarge.)

Draco represents Ladon, the serpent-like dragon that guarded the golden apples in the garden of Hesperides. The garden belonged to Hera, wife of Zeus, and the goddess placed the dragon there to prevent the Hesperides from taking the apples for themselves.

Not much is known of the creature except for his untimely end: poor Ladon was killed by Hercules as one of his twelve labors and was consequently given a permanent place in the stars as a reward.

Draco is the 8th largest constellation in the entire sky and covers an area of nearly 1,100 square degrees. It can be a tricky constellation to spot as the majority of its stars are relatively faint. It’s also a long, twisting constellation that snakes around Ursa Minor just as the mythical dragon curled around the tree it was guarding.



(Double-tap image to enlarge.)

Its brightest star is Gamma, also known as Etamin, from the original Arabic for “great serpent.” It can be found in the head of the dragon and is a magnitude 2.2 giant star about 154 light years away.

Draco holds another star that might be of greater interest to the naked eye observer.

As every astronomer knows, Polaris in Ursa Minor is our north pole star. But thousands of years ago, from 3942 BCE to 1793 BCE, that honor belonged to Thuban ("the snake"), also known as Alpha Draconis.

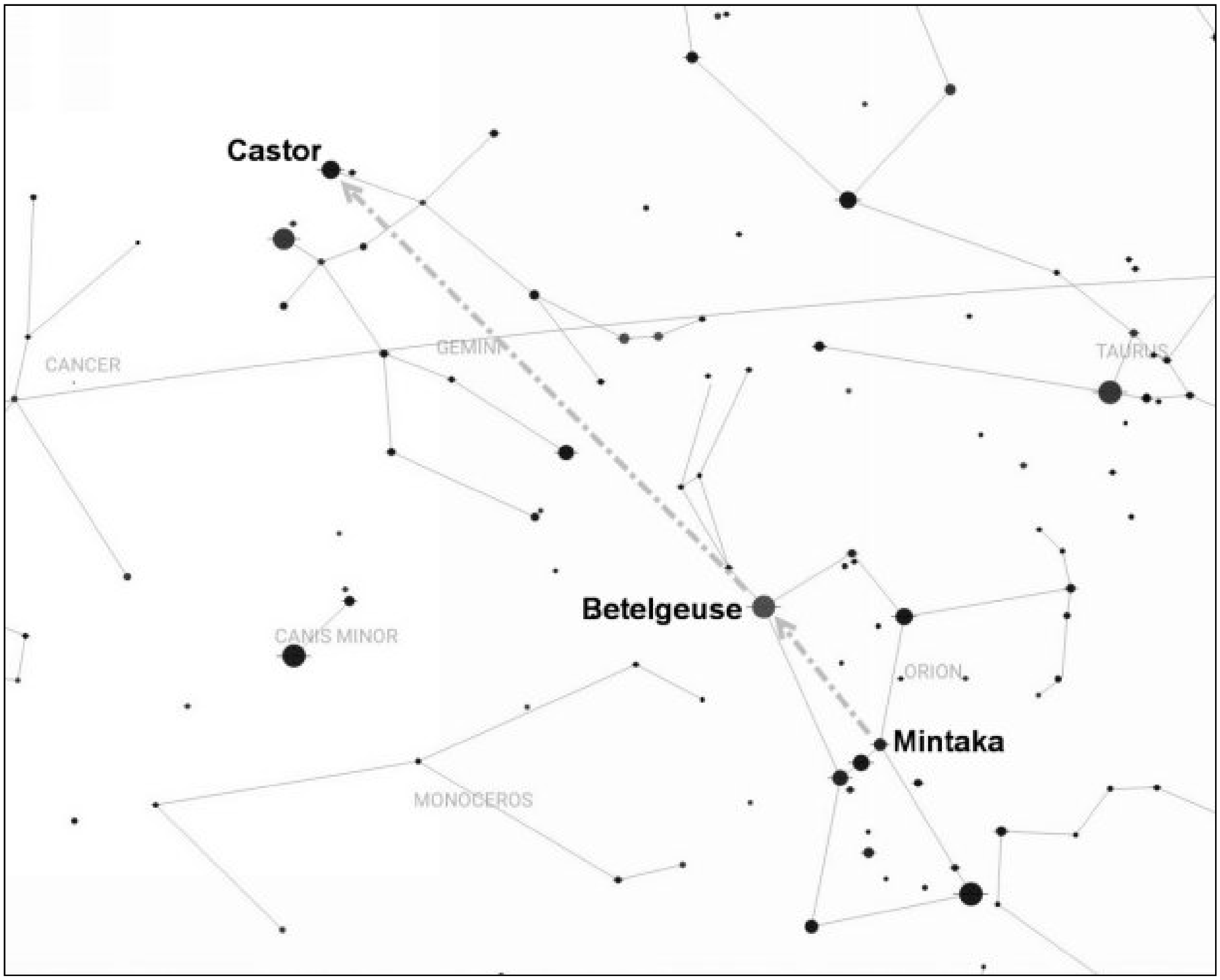
The change is due to the precession of the equinoxes. This is the result of the Sun and the Moon exerting their gravitational influences upon the Earth and, over the course of 26,000 years, causing the Earth to wobble on its axis.

Right now, the Earth's north pole points toward Polaris but this will change over the millennia. For example, another former and future northern pole star is brilliant Vega in Lyra. (The southern pole has no bright stars close to it.)

More interesting to the casual observer is Nu Draconis, also known as Kuma. This is the faintest of four stars that form the dragon's head. It's also a fine double star, easily split with 10x50 binoculars or even (reportedly!) the naked eye, if you have exceptional eyesight and good, clear dark skies.

With 10x50 binoculars you should easily see a pair of white stars of equal brightness. No wonder then that the stars have earnt the nickname "the eyes of the dragon!"

Gemini



There are two ways to find the constellation of Gemini. One way is to use the stars of [Orion] and draw a line through Mintaka and Betelgeuse to reach Castor. You can also find the constellation by using [Ursa Major] (Double-tap image to enlarge.)

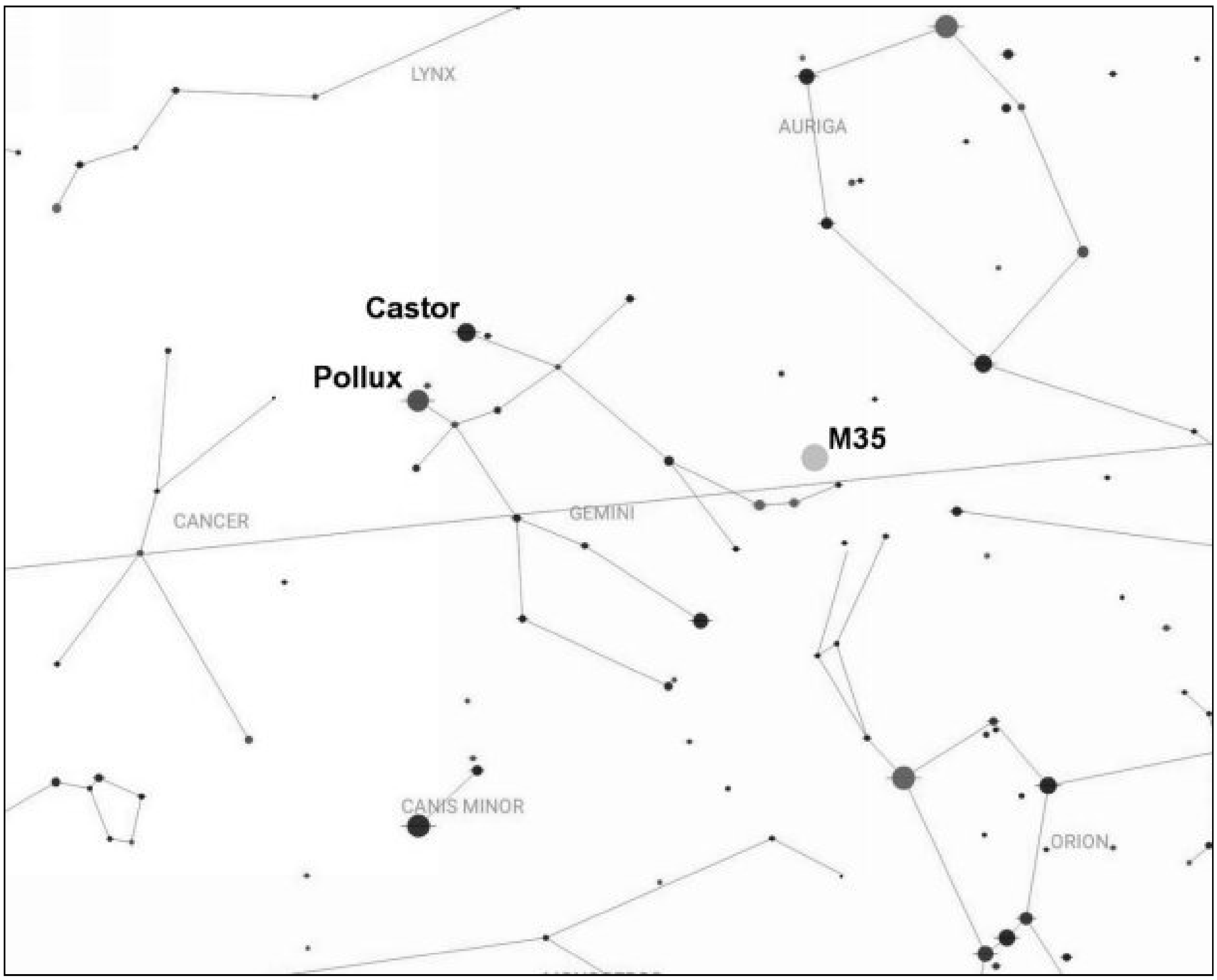
Gemini represents the twins of Castor and Pollux, born to Queen Leda of Sparta but with two different fathers. Castor's father was Leda's husband, Tyndareus, the King of Sparta. Pollux was the son of Zeus, who had seduced Leda during one of his many amorous adventures.

Consequently, Pollux, the son of a god, was immortal while Castor, the son of a mortal man, was mortal himself.

The twins were close and embarked on many adventures together, including some while serving as crewmembers of the Argo under the command of its captain, Jason.

However, their adventures came to a bitter end in a rather trivial manner. Castor was fatally wounded as the twins attempted to steal cattle from their cousin. Poor Pollux, distraught with grief, pleaded with his father for help.

Taking pity upon them both, Zeus then granted immortality to the twins by placing them among the stars.



(Double-tap image to enlarge.)

Both twins have their own stars named after them. (If you have difficulty remembering which star is which, remember that Castor is close to Capella while Pollux is in proximity to Procyon.)

Pollux is the slightly brighter of the two – and is therefore the brightest star in the constellation. That being said, Castor has the edge as the more interesting of the pair.

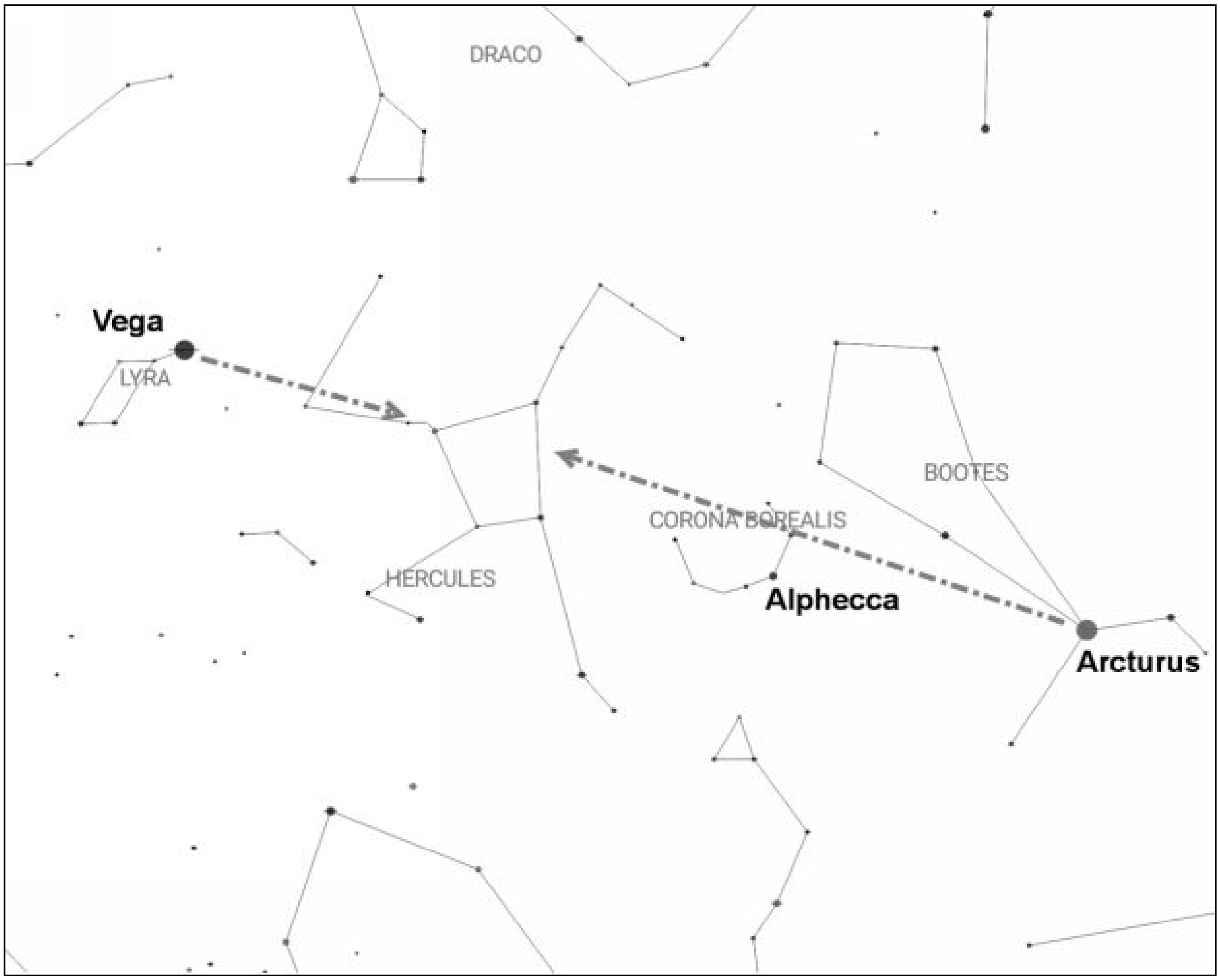
The reason is simple: Castor is a multiple star system, some 51 light years away, that’s actually made up of six stars in all. Amateur astronomers with small ‘scopes can see two of them with a magnification of between 50x and 100x. The pair appear as two brilliant white suns of almost equal magnitude.

While you’re in the area, look out for the open star cluster Messier 35 (M35), located close to Castor’s foot. It may be visible to the unaided eye under very clear, dark skies.

Through 10x50 binoculars it appears as a faint, grey misty patch with an hourglass shape. Take your time and look very carefully – can you see any of the cluster’s individual stars?

A small telescope at low power will provide a stunning view. A magnification of only 27x is needed to reveal a sparse scattering of blue-white stars against a backdrop of hundreds of fainter cluster members. In particular, look out for a pair of gold and blue stars on the cluster’s edge. Not to be missed!

Hercules

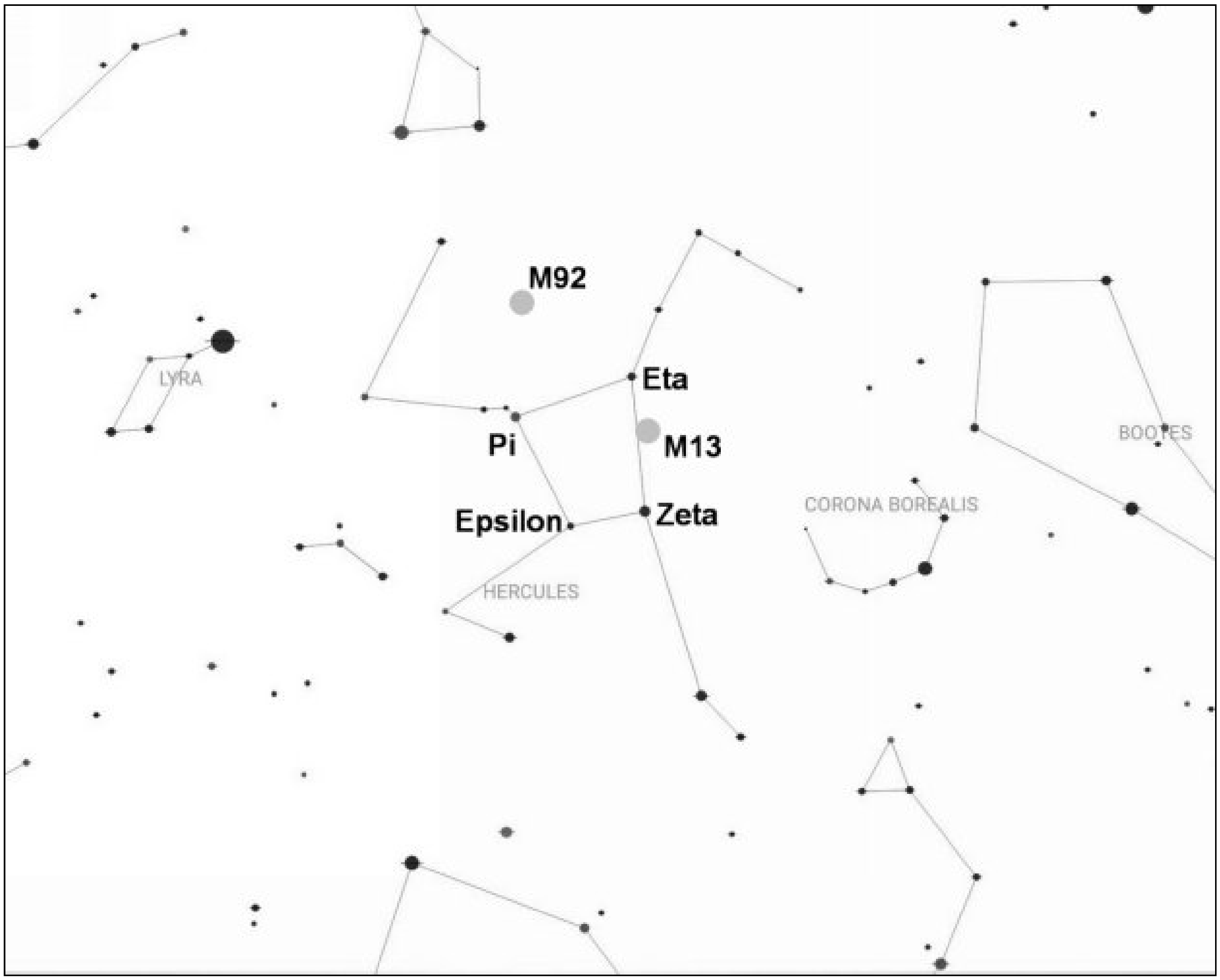


The easiest way to find Hercules is by first locating Arcturus in [Boötes]() and Vega and [Lyra](). Drawing a line connecting the two will take you through the top of the constellation. Alternatively, look midway between Vega and Alphecca, the brightest star in Corona Borealis. (Double-tap image to enlarge.)

Hercules, of course, depicts the hero of Greek myth who performed twelve labors. The son of Zeus and the mortal woman Alcmene, he was the victim of the wrath inflicted upon him by Hera, the wife of Zeus.

Driven mad by Hera, poor Hercules killed his family and was ordered to perform the labors as penance. Some of these labors have also been immortalized among the stars as constellations – specifically, Leo, the Nemean lion, Hydra the sea-serpent, Taurus the Cretan bull and Draco, the dragon Ladon.

Hercules is deceptively large and ranks 5th in size. Unfortunately, it contains no stars brighter than magnitude 2 and may be tricky to initially identify from the suburbs of a town or city.



(Double-tap image to enlarge.)

Your best bet is to look for Epsilon, Eta, Zeta and Pi, the four stars of the Keystone asterism of stars. You can find them by looking midway between Alphecca in Corona Borealis and Vega, the brightest star in Lyra. Once you've found the Keystone, look closely at Eta for a hidden gem.

If you live under very dark skies and have excellent eyesight you may be able to discern the Keystone Cluster, or Messier 13 (M13).

One of the brightest globular clusters in the entire night sky, binoculars will easily uncover the cluster, even from the light polluted skies of the suburbs.

It’s a famous globular, one of the best and easiest to find in the northern hemisphere, and appears as a small, hazy circular patch through binoculars.

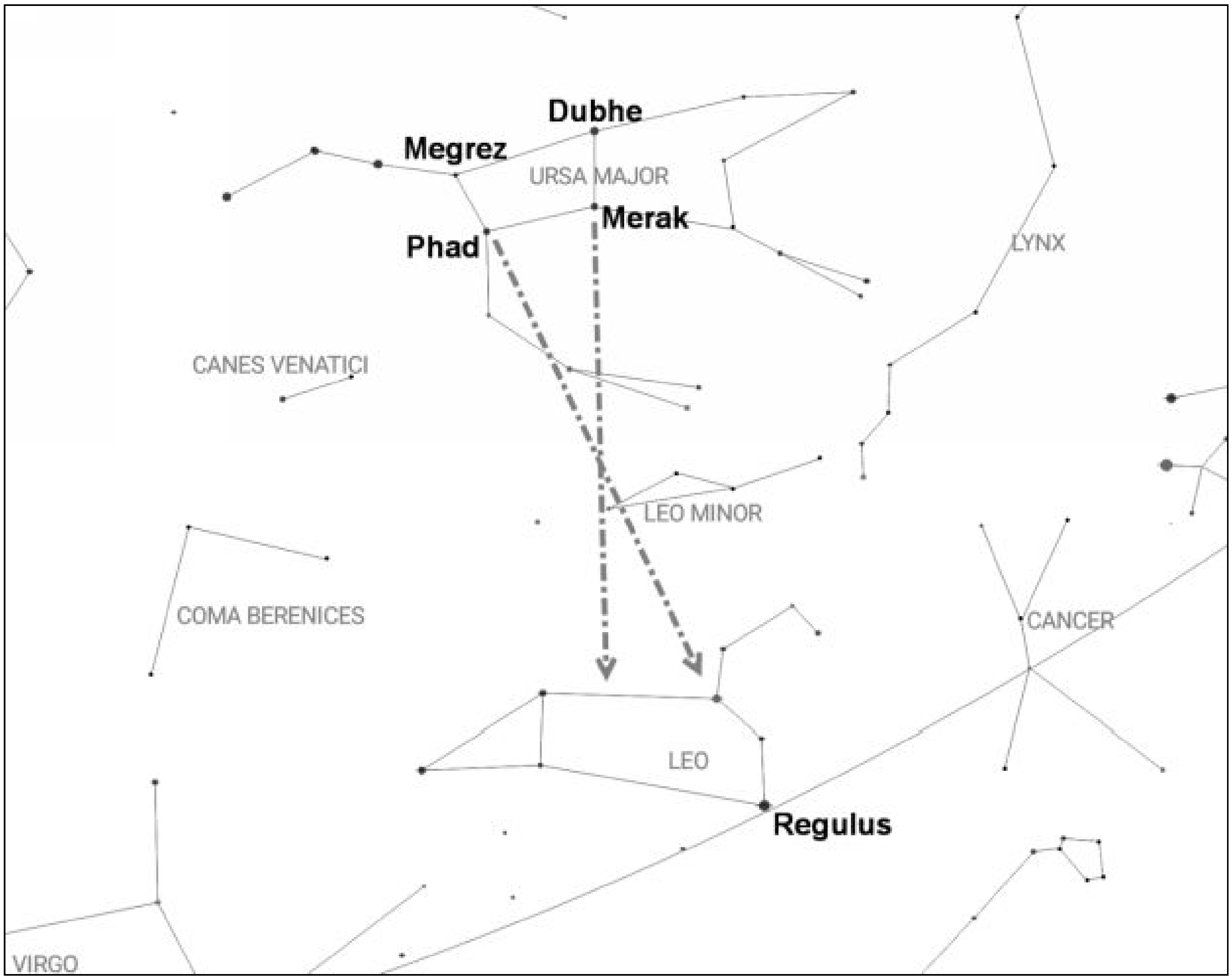
A small telescope at medium power (around 100x) can provide a fine view. In particular, you’ll notice chains of stars snaking away from the center. It always gives me the impression of a sea creature with tentacles at the bottom of the ocean!

Messier 13 was discovered by Edmund Halley in 1714 and is thought to contain about 300,000 stars. It lies about 22,000 light years away.

While you’re in the area, turn your binoculars toward Iota to find Hercules’ other globular – Messier 92. It’s further than the Keystone Cluster and appears fainter and smaller in our skies.

Consequently, it’s not as easily found and may prove to be a challenge from the suburbs of a town or city.

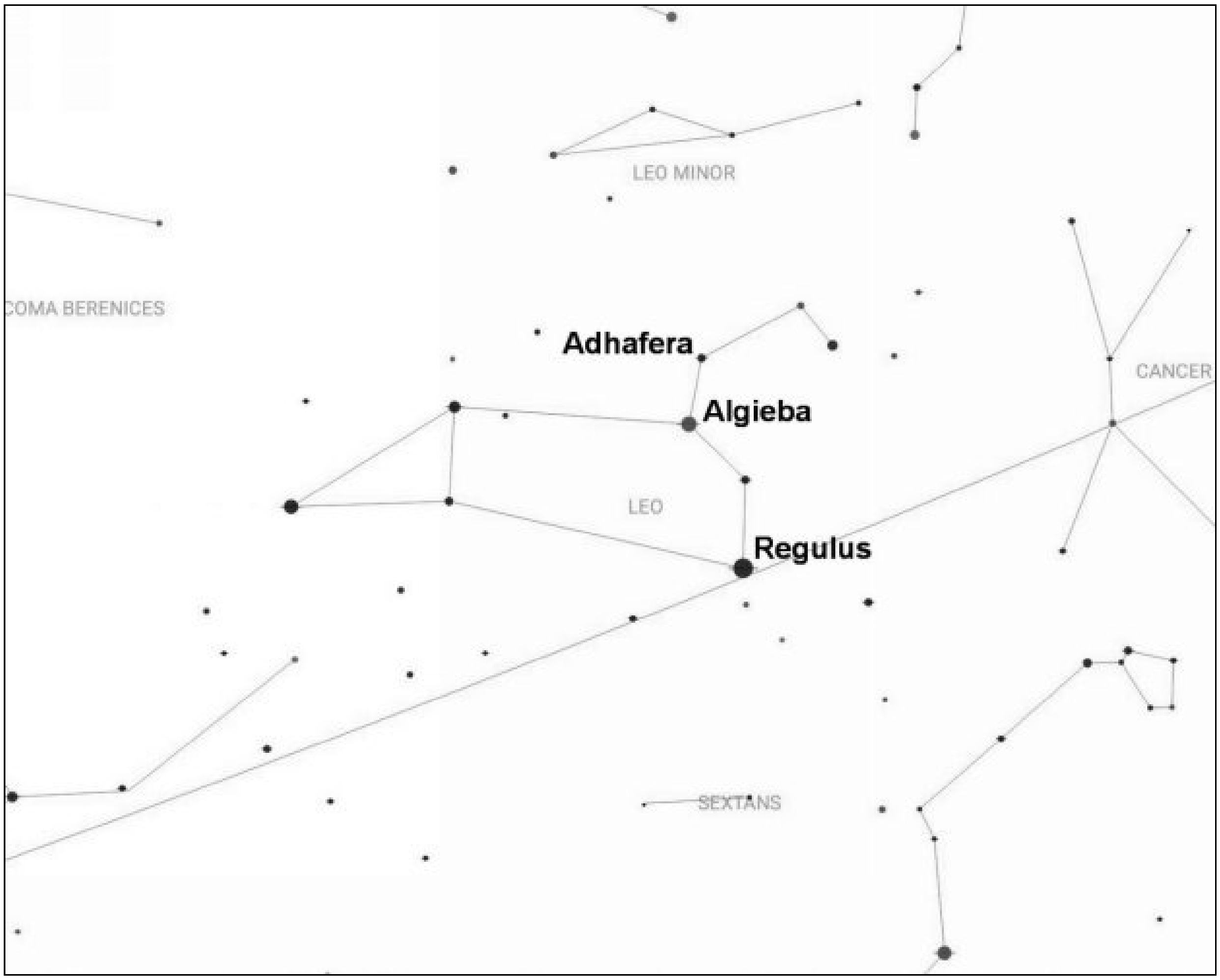
Leo



Leo is relatively easy to find if you use the stars of Ursa Major as pointers. Dubhe and Merak will bring you close to Regulus, while Megrez and Phad will point you toward the body of the lion. (Double-tap image to enlarge.)

Leo, one of the twelve signs of the zodiac, represents the Nemean Lion that used to terrorize warriors in Greek legend. He was finally slain by Hercules, who killed it with his bare hands as one of his twelve labors.

It's a large constellation, ranked 12th in size, and can easily be seen in the evening sky from late winter to early Summer. The constellation is made distinctive by the backwards question-mark (or sickle-shaped) asterism that marks the lion's head. You'll find Regulus, the constellation's brightest star, at the southernmost end of this asterism.



(Double-tap image to enlarge.)

The name Regulus is Latin for "little king" - an appropriate name for the brightest star in a constellation that represents the king of the beasts. Regulus lies very close to the ecliptic. This is the invisible path the Sun, Moon and planets take as they traverse across the sky.

Consequently you'll sometimes see a planet close to the star and it's not unusual for the Moon to hide it completely. A grouping of the Moon, a planet and Regulus is quite attractive.

Binoculars will show a fainter, bluish companion a little way from Regulus but Leo plays host to several better binocular sights.

In particular, take a look at Gamma and Zeta Leonis, also known as Algieba and Adhafera respectively. Both have companions that can be easily seen with 10x50 binoculars.

For example, 40 Leonis lies close to Algieba and appears as a magnitude 4.8 bluish star. If you have good eyesight, you may even be able to see this star with just your eyes.

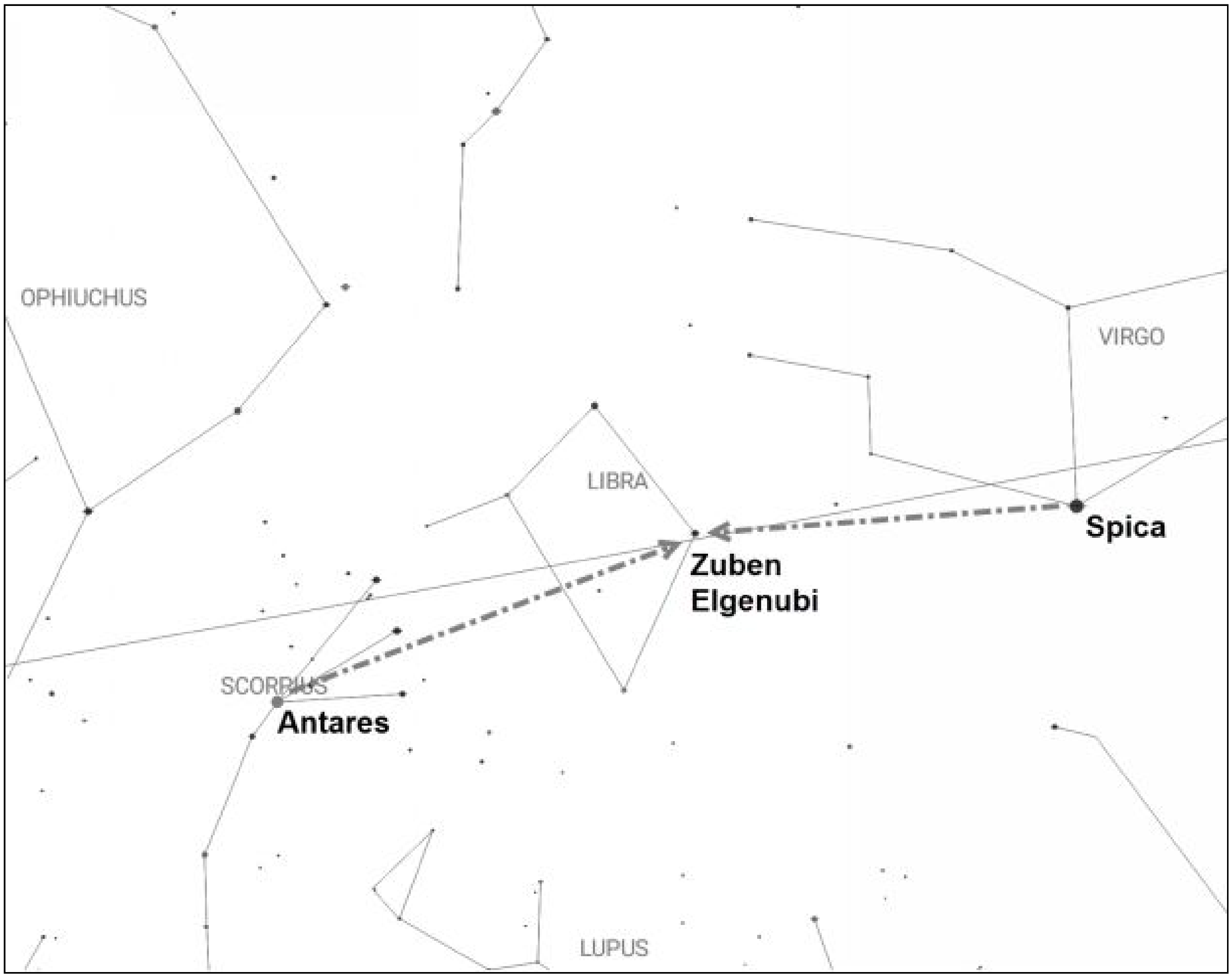
You'll need binoculars to see a third, fainter star forming a triangle with the brighter pair.

A small telescope at medium to high power – between 100x and about 150x - will resolve Algieba itself into a pair of golden stars. One of the highlights of the spring sky, it can be a challenging split for suburban astronomers with unsteady skies.

Now move a little north to Adhafera. It appears within the same binocular field of view as Algieba and has a fainter unrelated star, 35 Leonis, just to the south.

Hold your binoculars steady and look toward the north-west. On the opposite side of Adhafera is another companion, somewhat closer to the bright star than 35 Leonis itself. Once again, telescopes will provide a better view.

Libra

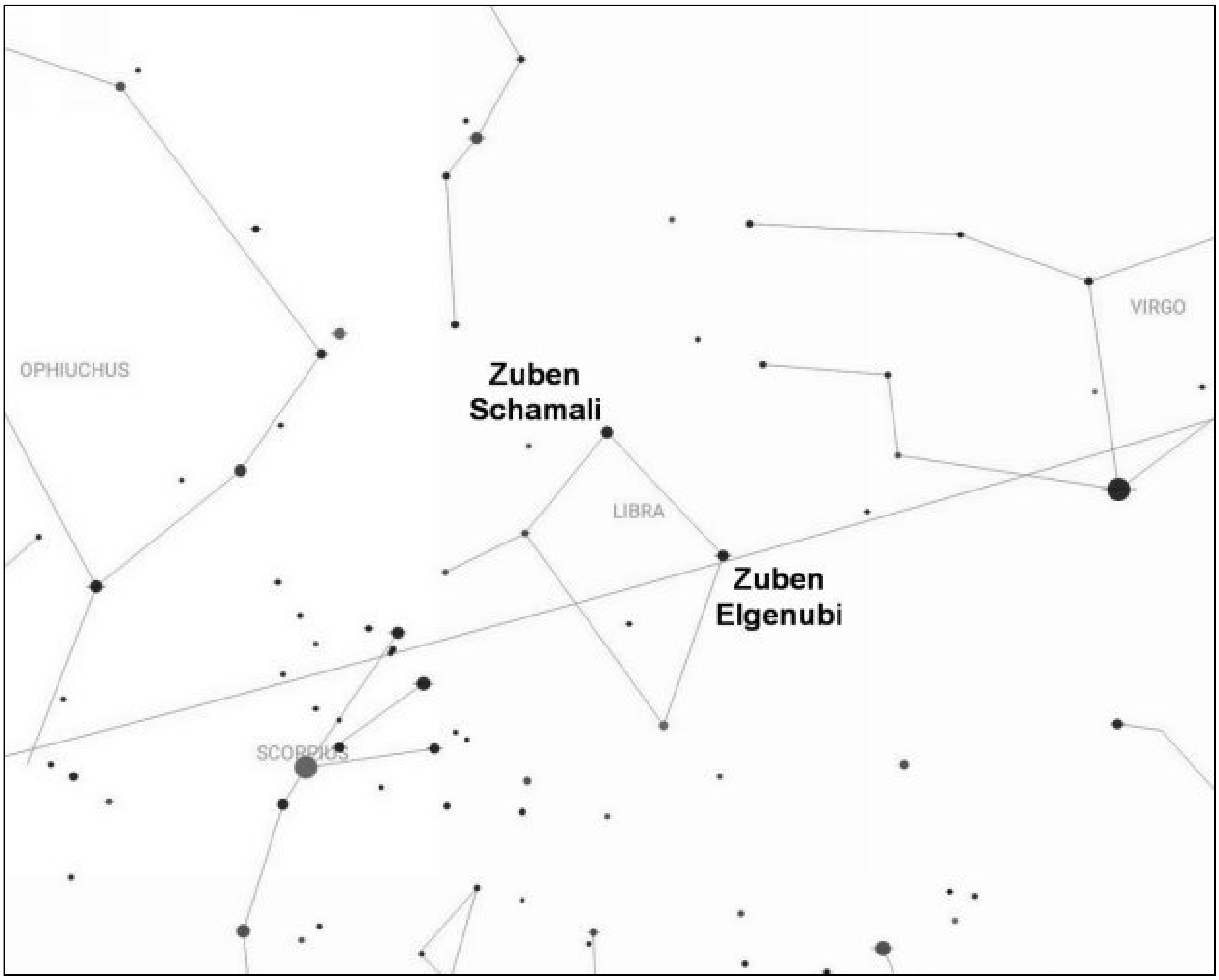


Libra is a small and faint constellation that may be tricky to spot from suburban skies. The easiest method of location is to look midway between Spica, in Virgo, and Antares in Scorpius. Zuben Elgenubi, Libra's brightest star, should be visible, even from light polluted skies. (Double-tap image to enlarge.)

Libra, the Scales (or the Balances) is one of the twelve signs of the zodiac and the only one that depicts an inanimate object. All the others represent some kind of living creature, whether it be the mundane (such as Aries the Ram or Pisces the Fishes) or something more fantastic (such as Capricornus the Sea-Goat.)

It was actually the last sign to be added to the zodiac and wasn't even recognized as a constellation by the Greeks at all. To them it was the claws of nearby Scorpius, the scorpion.

Consequently, it has no mythology of its own. Its association with weighing scales comes from the ancient Babylonians and may have originated at a time when the Sun passed through the constellation on the autumnal equinox. On that date the days and nights are of equal length – hence there was balance between darkness and light.



(Double-tap image to enlarge.)

Libra is one of the faintest constellations in the zodiac and, being only 29th in size, is not very conspicuous. It does, however, have a couple of interesting sights for the casual observer.

For starters, there's Alpha Librae, the constellation's brightest star. Also known as Zuben Elgenubi, the name is derived from the Arabic for "southern claw" and refers to a time when the constellation was still a part of Scorpius.

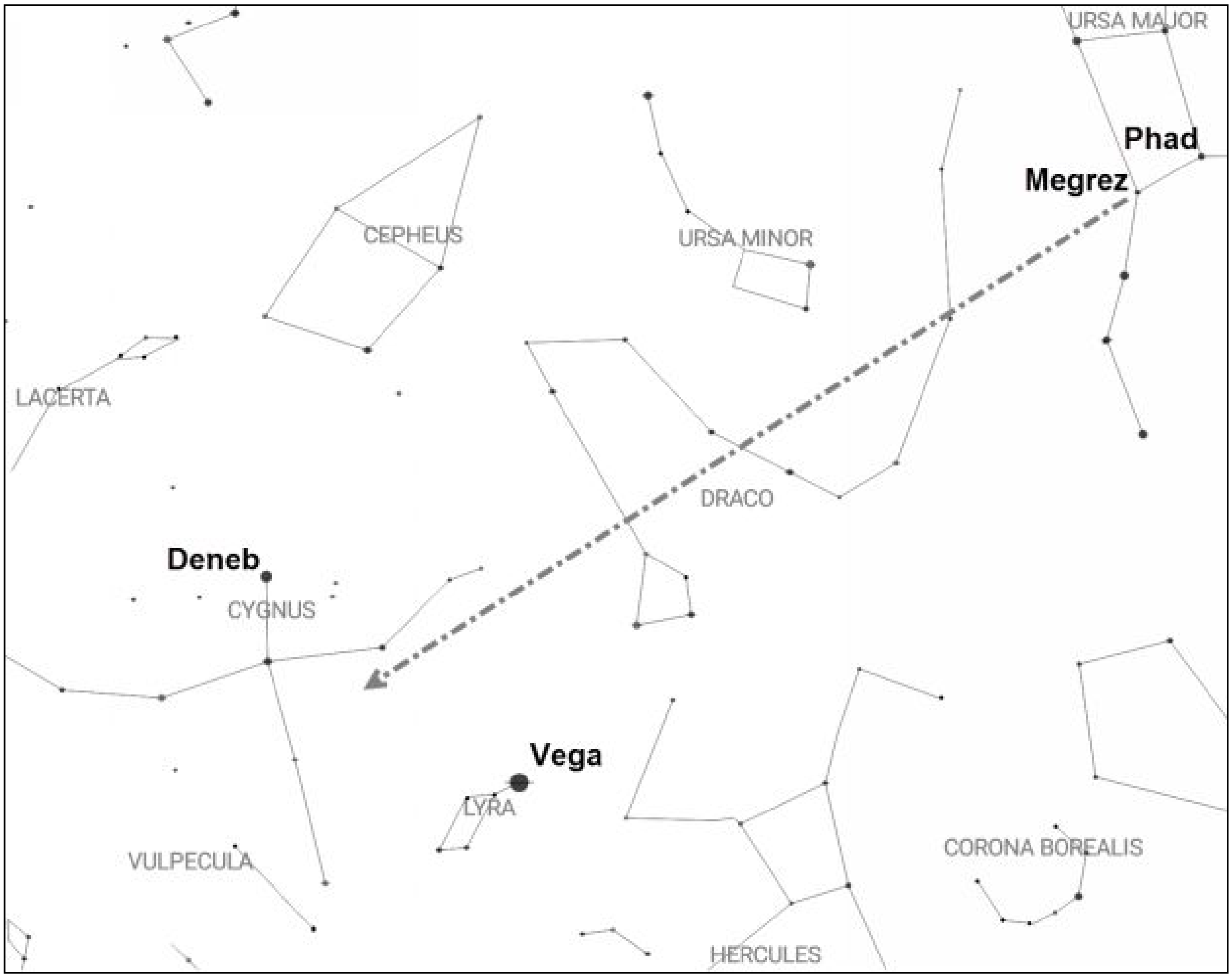
To almost everyone (except those with good eyesight and clear skies) the star appears as a single, magnitude 2.7 point of light. But binoculars will easily split it into a nice pair of white stars of equal magnitude. This is definitely a binocular showcase and well worth a look. A small telescope also provides a good view.

This is a true multiple star system, about 77 light years away, with each star being itself a double. This makes for four confirmed suns with an additional fifth also suspected.

Libra holds another cosmic curiosity. Zuben Schamali ("the northern claw") is the constellation's second brightest star and the subject of some debate among amateur astronomers.

What color do you see when you stare at the star? Look carefully, as some have reported a pale green color, making it almost unique and earning it the nickname "the emerald star." This would be a good star for St Patrick's Day, but you'd have to get up early that morning to see it!

Lyra



With Vega forming one corner of the Summer Triangle, Lyra is relatively easy to find, but should you need help you can also use Megrez and Phad in [Ursa Major](#) as pointers. (Double-tap image to enlarge.)

Lyra represents the lyre given to Orpheus as a gift from his father, the god Apollo. Orpheus used the gift to charm all the men, women and creatures of the land, including his future wife, Eurydice.

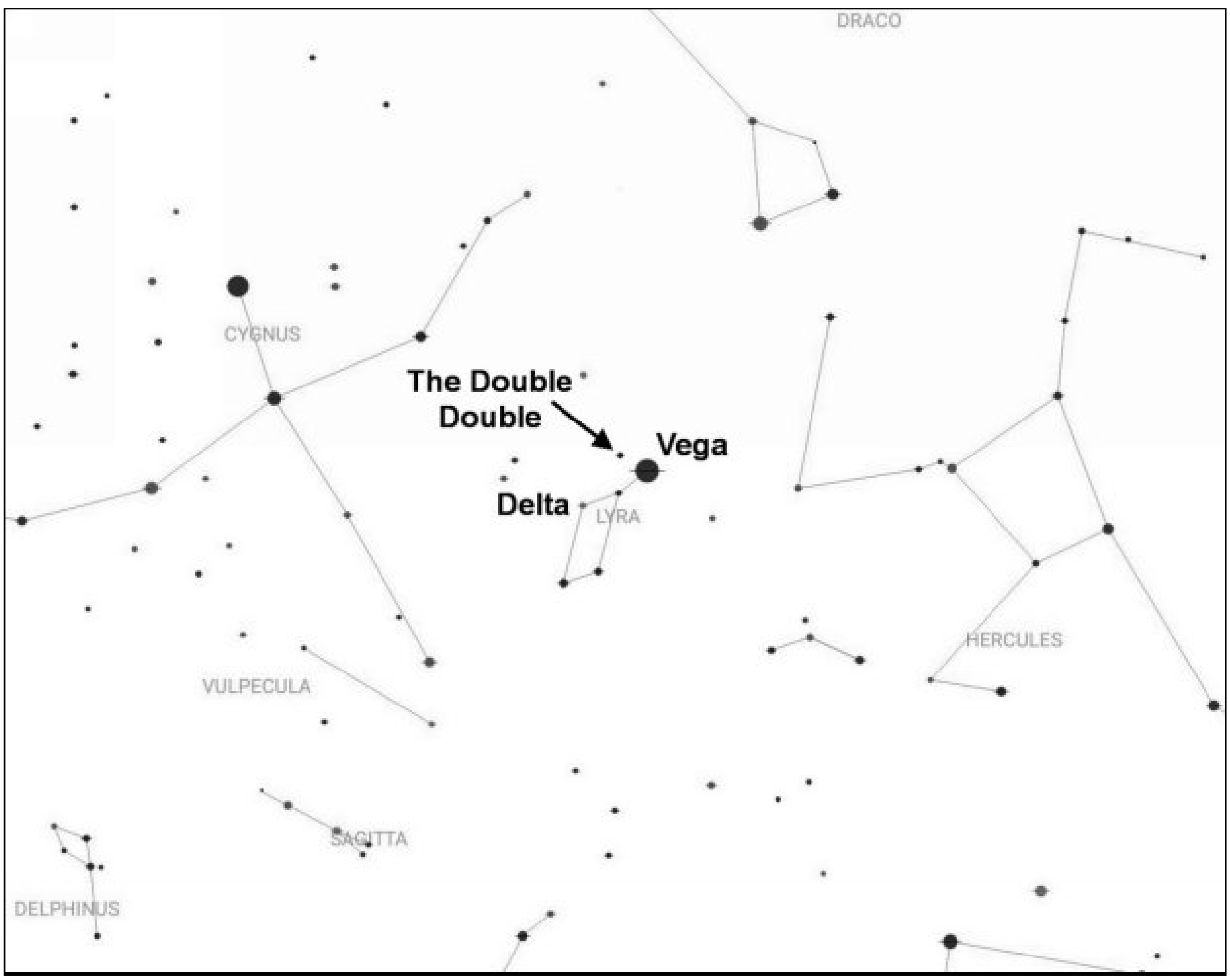
Unfortunately, Eurydice died after being bitten by a snake and was taken down to the Underworld. Orpheus was distraught and followed her with the intention of charming the god Hades into releasing her.

Hades agreed, but with one condition: Eurydice must follow Orpheus as he left and Orpheus was not allowed to look back. If he did, then his wife must stay in the Underworld for all eternity.

Orpheus did as he was asked and resisted the urge to look behind him. However, his insecurity got the better of him and he began to wonder if his wife was truly following or if Hades had tricked him into leaving alone.

Just as he was on the verge of returning to the world of the living, Orpheus could take it no more and looked behind him. Sure enough, he saw his wife, but having broken his promise, Hades pulled her back before she reached safety.

Heartbroken Orpheus remained in the world of the living where it's said he roamed the land, singing sad songs, until the day he died and he could be reunited with his wife in the afterlife.



(Double-tap image to enlarge.)

Lyra is a small but conspicuous constellation, thanks predominantly to Vega, its brightest star. A close neighbor of the Sun, it lies at a distance of only 25 light years away and, at magnitude 0.02, is the 5th brightest star in the sky.

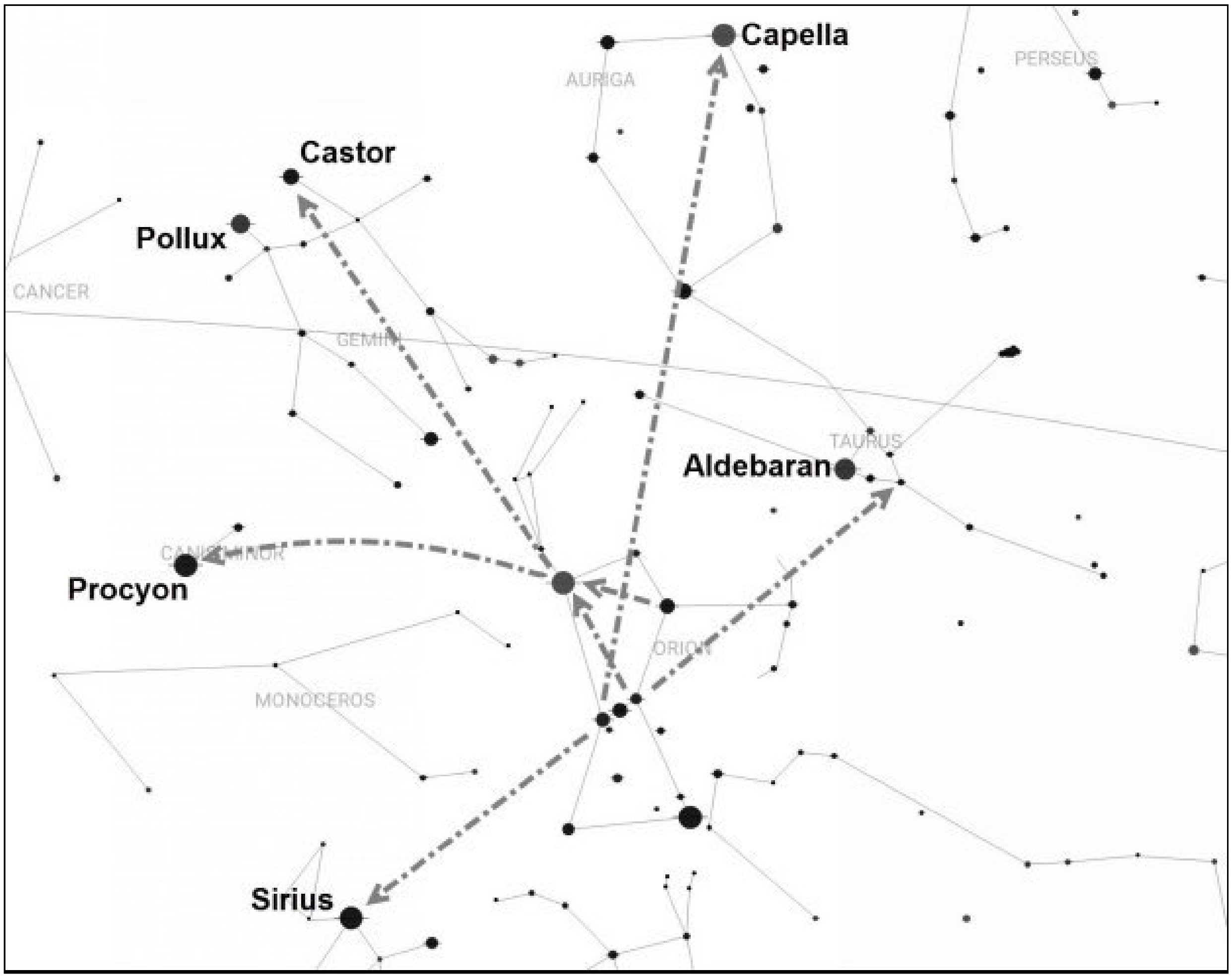
With the unaided eye or binoculars it appears as a single, brilliant white star. However, it's thought to be surrounded by a disk of gas and dust that may be planets forming. Binoculars will also reveal several other objects of interest within the same field of view.

Firstly, there's Epsilon Lyrae, the famous "double double." Binoculars show a pair of identical, bright white stars but turn a telescope toward them, increase the magnification to about 150x and you'll see that each star is split again.

All four stars will appear white and of almost equal brightness. This is a true multiple star system, some 160 light years away.

Secondly, within the same field of view, is Delta Lyrae, a chance alignment of two stars that can also be easily seen with binoculars. The brighter star is roughly 900 light years away while its fainter companion is about 200 light years more distant.

Orion



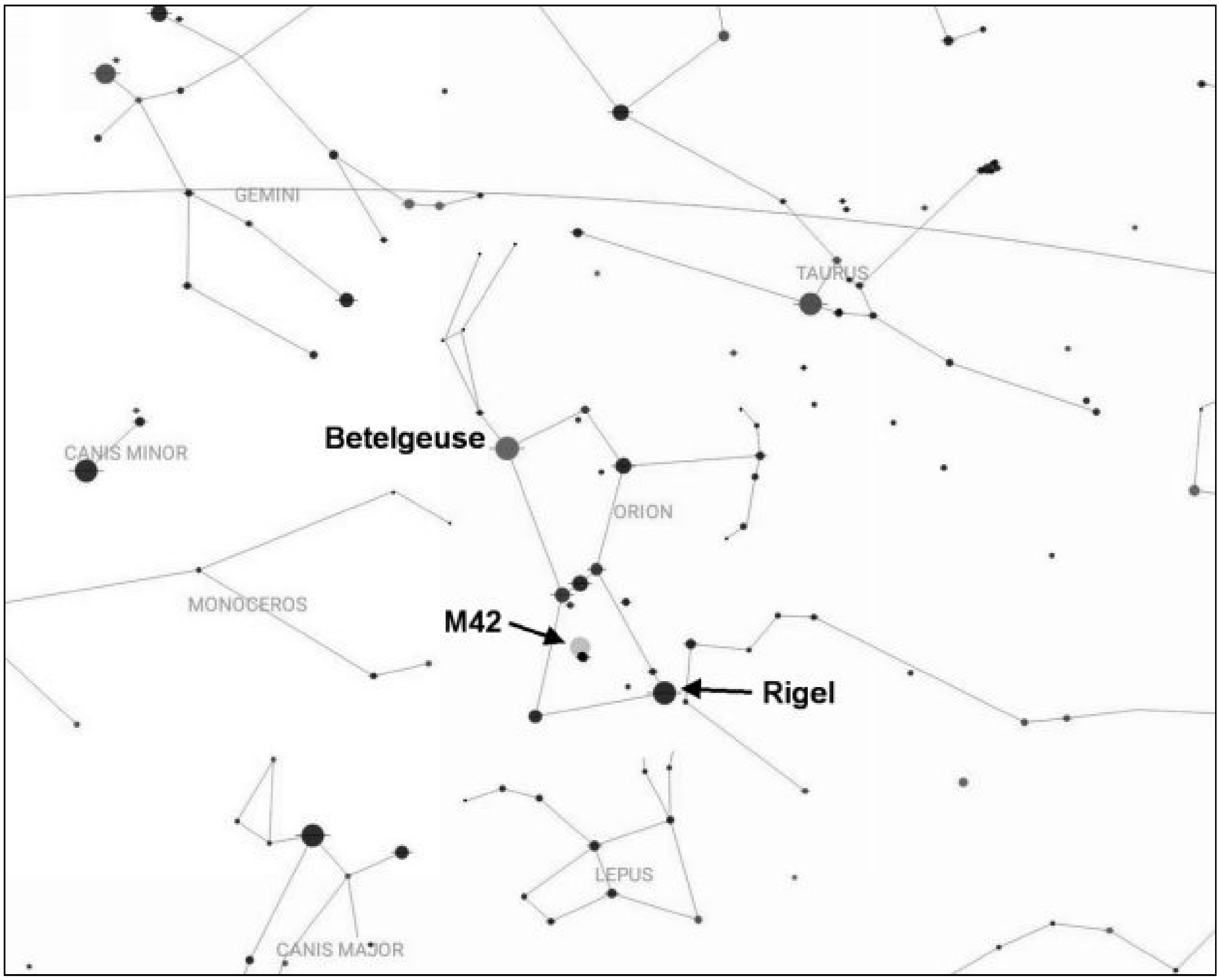
A prominent sight throughout the winter, Orion can be used to find a number of other seasonal constellations. In particular, you can use the three bright stars of the hunter's belt to find both Aldebaran in [Taurus](#) and Sirius in [Canis Major](#). (Double-tap image to enlarge.)

According to Greek myth, Orion was a hunter who once boasted he could kill any creature. This angered Gaia, the goddess of the Earth, who successfully sent a scorpion to kill him.

Zeus immortalized the hunter by placing him among the stars and, to ensure he could never come to harm him again, placed the scorpion opposite Orion in the sky.

Hence, Orion can be seen throughout the winter months but [Scorpius](), the scorpion, can only be seen in the summer. The two constellations can never be seen in the night sky at the same time.

The ancient Greeks saw Orion raising a club to defend himself against [Taurus]() the Bull, but other civilisations saw other characters. To the ancient Babylonians the constellation depicted a shepherd while the Egyptians saw Osiris, their god of the afterlife.



(Double-tap image to enlarge.)

It’s a reasonably large constellation, ranked 26th in size and covering nearly 600 degrees of sky.

Its two brightest stars are Betelgeuse, which marks the right shoulder of the hunter, and Rigel, which marks his leg or foot.

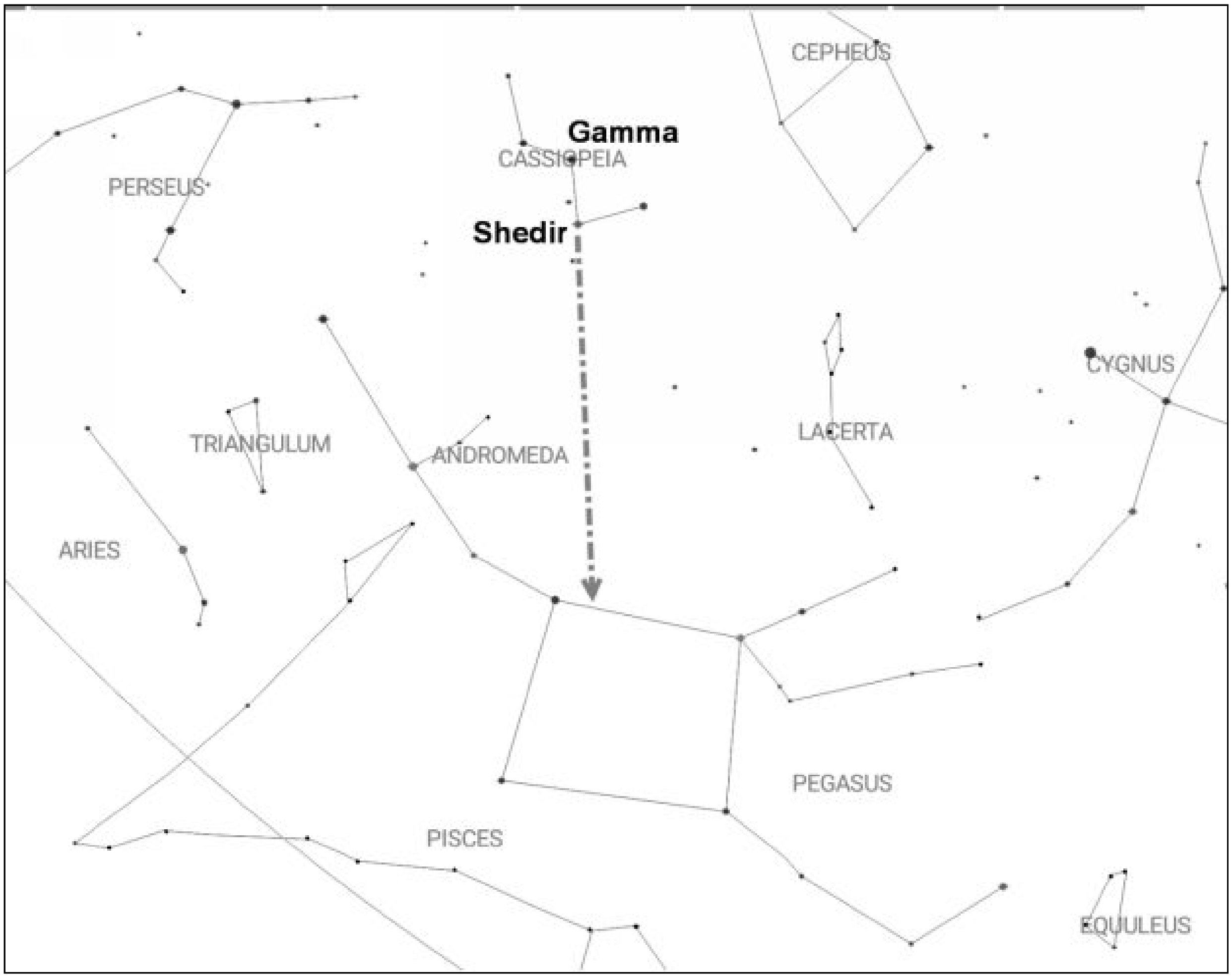
Rigel, despite also being known as Beta Orionis, is actually the brightest star in the constellation and the seventh brightest star in the entire night sky. It’s a blue-white supergiant roughly 900 light years away with a fainter companion that may be glimpsed with larger telescopes.

Betelgeuse (often pronounced as “betel-geez” and *not* “beetle-juice”) is the second brightest star in Orion and the ninth brightest in the entire night sky. It’s a dying red supergiant so large that if it were placed at the center of our solar system, it would extend past the orbit of Mars. It has a distinctive coppery color that’s easily seen with just your eyes.

Another easily seen sight is the Orion Nebula, one of the finest deep sky objects in the entire night sky. Visible to the naked eye as a tiny misty patch, even from the suburbs, it can be found below the three stars of Orion’s belt and is often identified as the hunter’s sword.

Nebulae are clouds of gas and dust in space, the birthplace of stars, and even binoculars will reveal two or three young stars buried in its heart. A must-see for owners of a small telescope, this is one object that’ll keep you coming back night after night as successive observations reveal more and more detail.

Pegasus & Equuleus

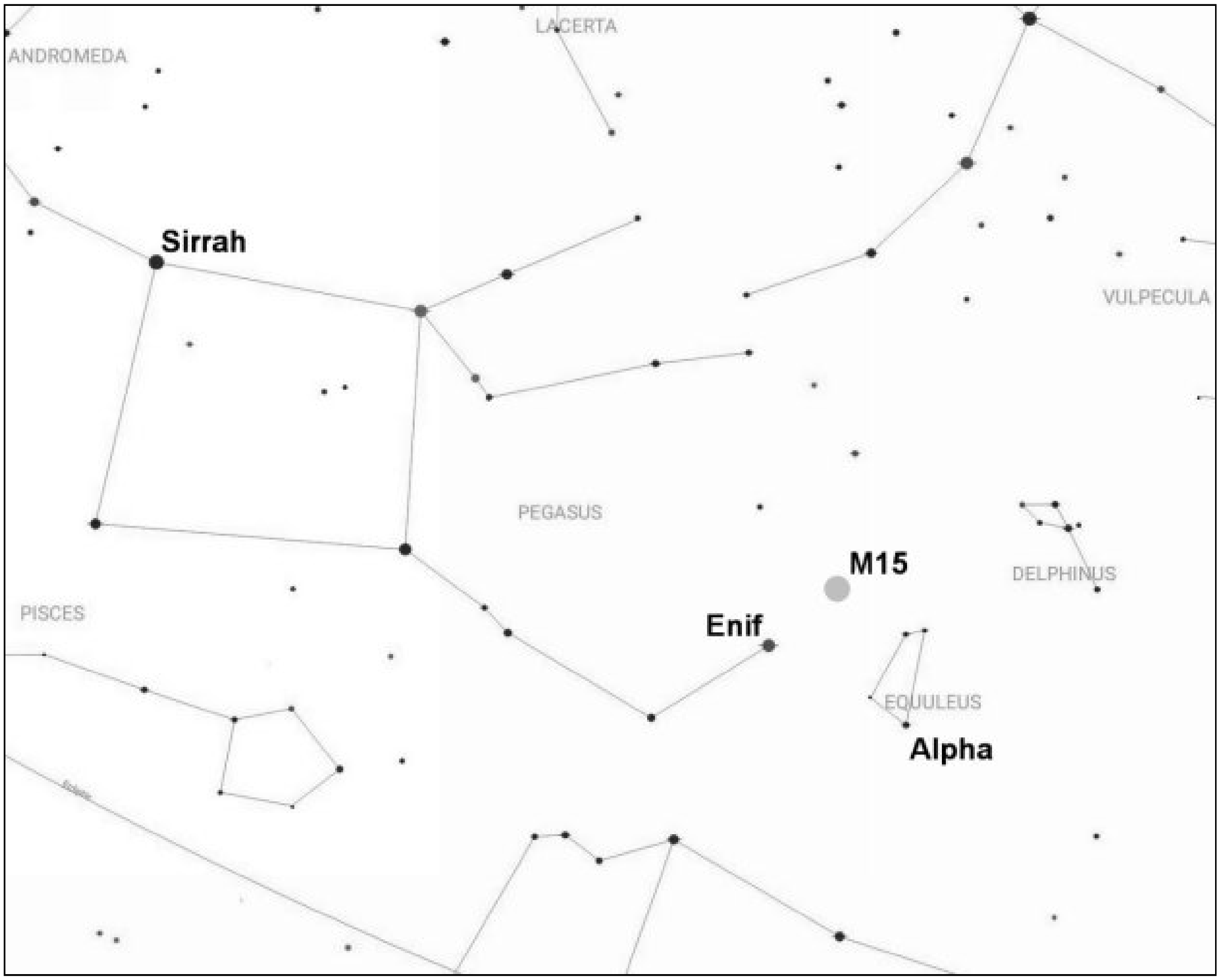


You can find Pegasus by first locating [Cassiopeia] and then using Gamma and Shedir to point toward the constellation. (Double-tap image to enlarge.)

According to Greek myth, Pegasus was a flying horse and the trusty steed of Perseus. It was Pegasus that allowed Perseus to rescue the princess Andromeda from the clutches of the Kraken. (See here for the full story.)

Ranked 7th overall in size, Pegasus is one of the largest constellations and covers over 1,100 square degrees of sky. It can be seen from late summer through to late winter and has a distinctive asterism, the Great Square of Pegasus, that can be used to determine the sky conditions of your observing location.

To do this, look toward the Square and count the number of stars you can see within it. Five stars can indicate good sky conditions while ten or more can be a sign of some very clear skies.



(Double-tap image to enlarge.)

The Great Square is noteworthy for another reason – it shares a star with neighboring Andromeda. Sirrah, which marks the north-eastern corner of the Square, was once known as Beta Pegasi but is now a part of Andromeda.

In fact, Pegasus and Andromeda are one of only two pairs of constellations to share a star. The other pair, Auriga and Taurus, can be seen high overhead during the winter months.

Unfortunately, there isn't much else to see here as Pegasus flies through a barren area of sky. Its brightest star, Alpha Pegasi, is also known as Enif and can be found on the eastern edge of the constellation.

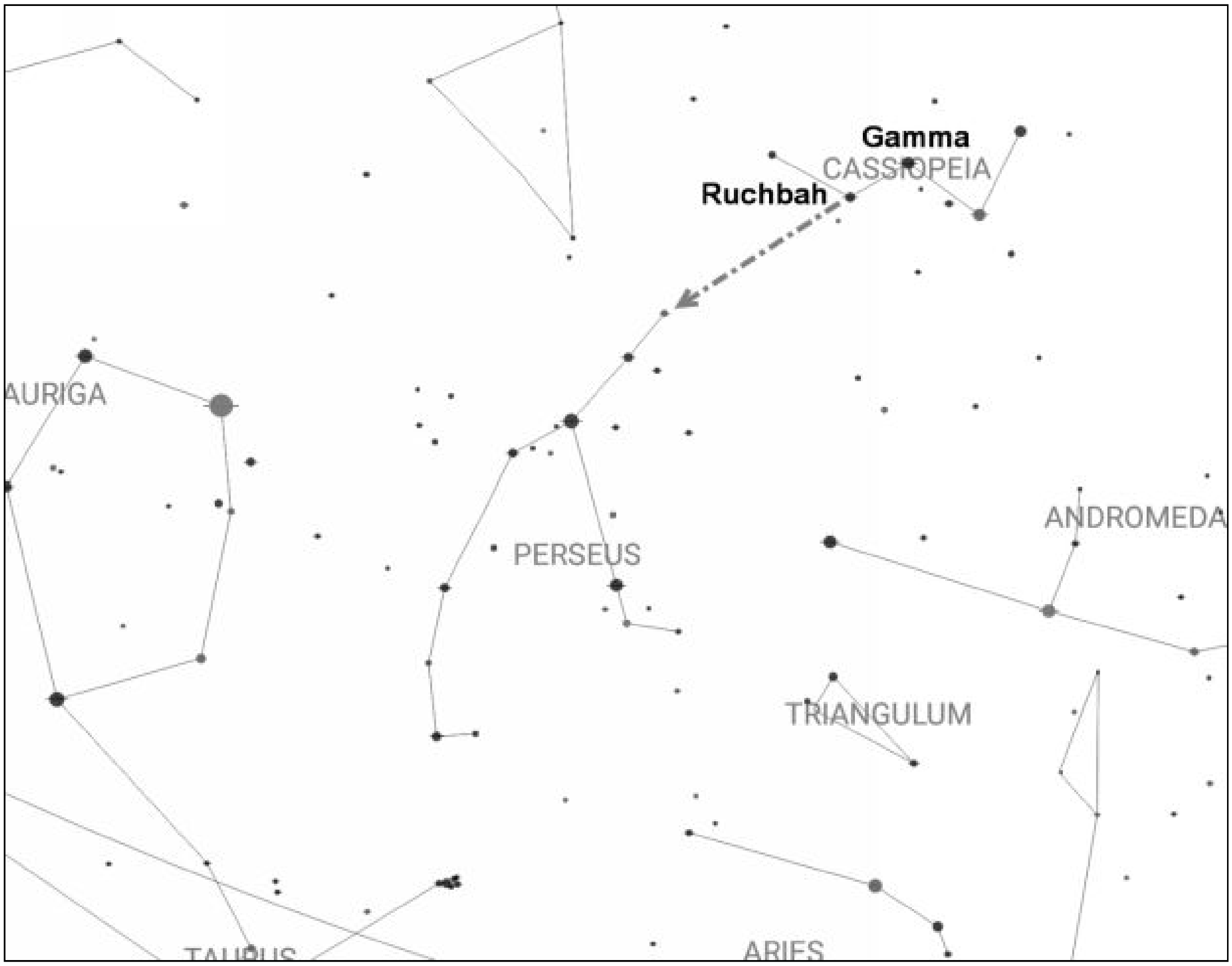
Within the same binocular field of view is the globular cluster Messier 15 (M15.) At magnitude 6.3, it’s reasonably bright and should be within range of binoculars from under dark skies.

The cluster appears as a faint, fuzzy star close to a slightly brighter one but, like many other globulars, little is revealed without some additional optical aid. A small telescope at medium power (about 100x) will show a bright core with the possibility of some individual stars being seen along the edges.

Further west from Pegasus is a much smaller (and fainter constellation) – Equuleus, the Foal. To all intents and purposes, it’s an unremarkable constellation but its brightest star, Alpha, may be glimpsed to the south-west of Enif.

To the naked eye it looks like a single star, but look carefully with binoculars or a small telescope with low power and you’ll see a white primary star and a wide, fainter bluish companion.

Perseus



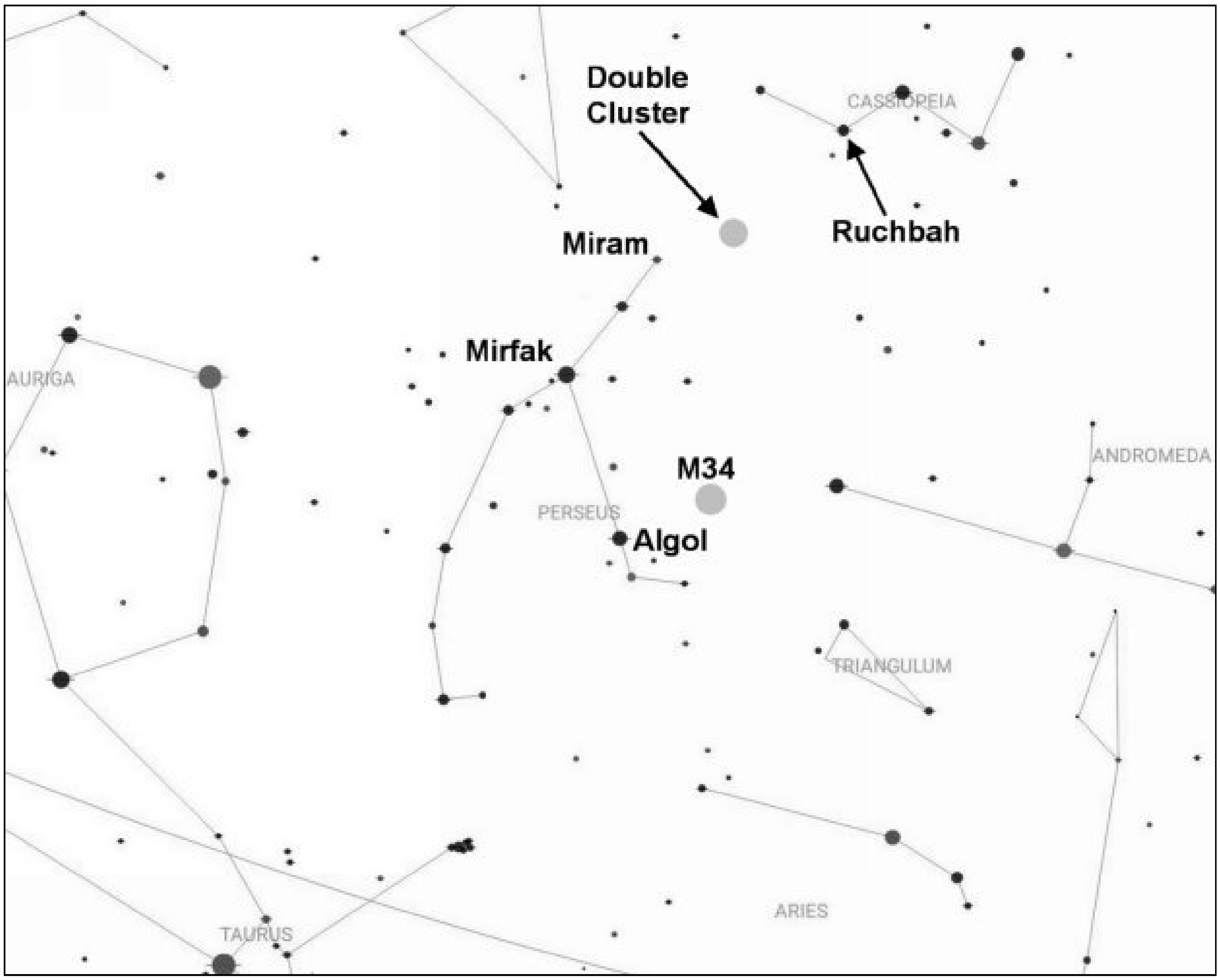
Use [Ursa Major] to find [Cassiopeia], on the opposite side of Polaris. From there, use Gamma and Ruchbah to point you toward Perseus. (Double-tap image to enlarge.)

Perseus, another son of Zeus by a mortal woman, is the hero who saved Andromeda from the clutches of the Kraken. According to Greek myth, he did this by turning the monster to stone with the head of Medusa. (You can read more about this here.)

Visible throughout the autumn and winter, the constellation's brightest star is Alpha Persei, also known as Mirfak. It's a magnitude 1.8 yellow-white supergiant star, sixty times larger than the Sun and about 600 light years away.

Turn your gaze toward it and you'll see the Alpha Persei Cluster, a swarm of stars that spans about three degrees of sky. (That's about six times the size of the full Moon.)

Mirfak itself appears near the edge of the cluster and is thought to be an actual member of the group. The cluster can be easily seen with the naked eye but is best observed with binoculars as it's too large to be appreciated through the higher magnification of a telescope.



(Double-tap image to enlarge.)

Perseus is also home to several other fascinating sights. Looking south-west from Mirfak we come to Algol, a famous star of variable brightness that's been known for thousands of years.

Algol usually shines at magnitude 2.1 but once every 2 days, 20 hours and 49 minutes it will fade to magnitude 3.4. Ten hours later, it will magically return to its previous brightness. You can track these changes with just your eyes!

What causes this? Algol is actually a multiple star system comprising of a bright primary and a smaller, fainter secondary. When the secondary passes in front of the primary, it dims its light and, hence, the star appears to fade from Earth.

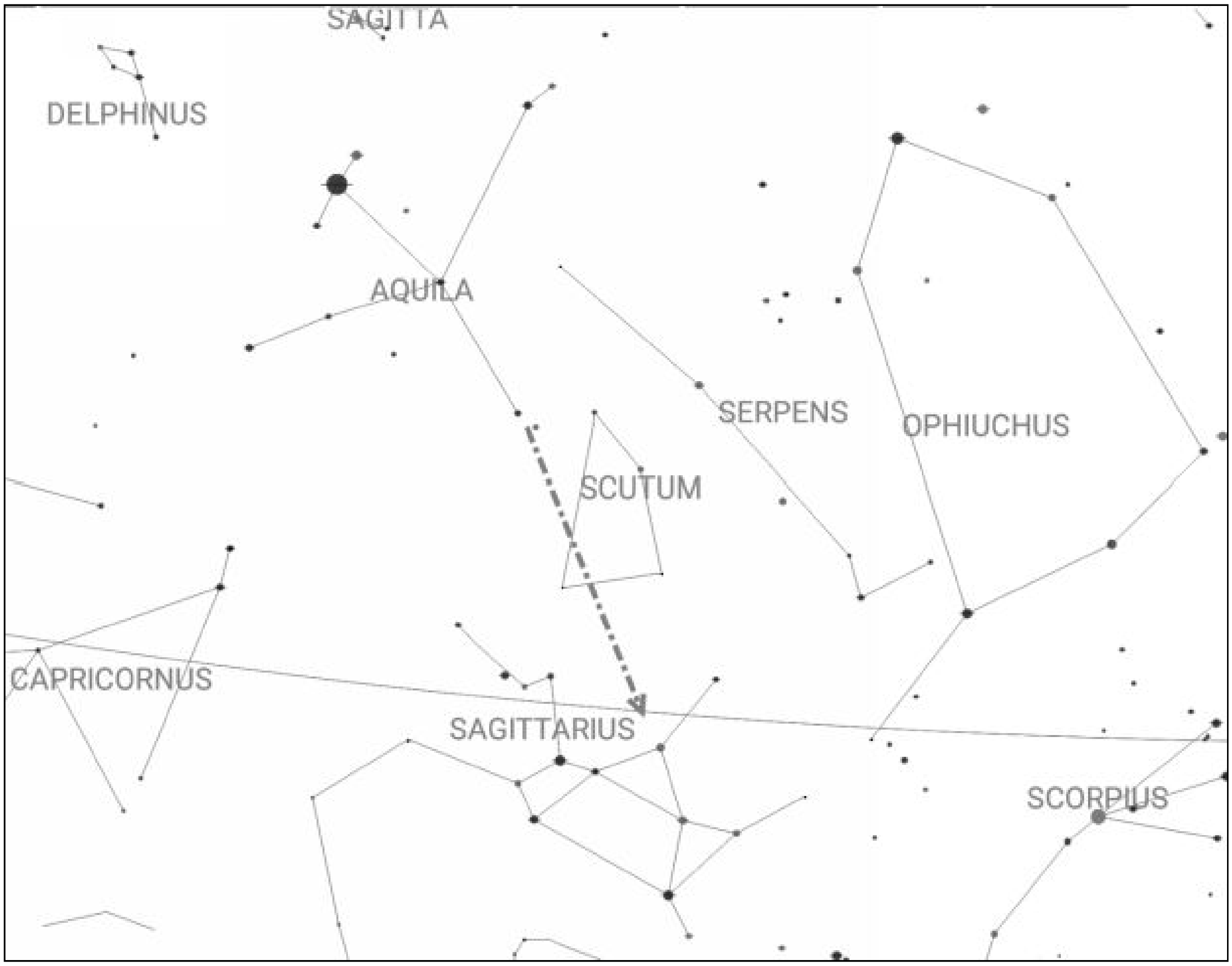
No wonder then that Algol has earnt the nickname of “the demon star!”

Within the same binocular field of view is Messier 34 (M34), a bright open star cluster that can be easily seen with the naked eye under dark skies. It appears as a misty patch through binoculars but a small telescope will reveal an X shape and a number of double stars within it.

Return to Mirfak and look to the north-west for Miram. About midway between that star and Ruchbah in Cassiopeia is the Double Cluster. Like Messier 34, the pair can be seen with just your eyes, are great in binoculars and simply stunning through a small telescope at low power.

For many, the double cluster is the finest sight that Perseus has to offer. If you have a small telescope, take some time to enjoy the view. You won’t regret it!

Sagittarius



Sagittarius may be found by drawing a line south-west through [Aquila](), the Eagle. (Double-tap image to enlarge.)

Sagittarius, the Archer, is one of the twelve signs of the zodiac and is often associated with Chiron, a centaur. Chiron was the tutor of Jason, the Greek hero who embarked on a quest to find the Golden Fleece in Colchis. It's said that Chiron created the constellation as a navigational aid.

It's a fairly large constellation, ranked 15th in size, that's also fairly conspicuous due to the number of bright stars within it. In particular, its brightest stars form a distinctive teapot shaped asterism that can help you to identify the constellation.

Unfortunately, it never rises very high above the horizon for much of the northern hemisphere, which is a shame for a number of reasons.

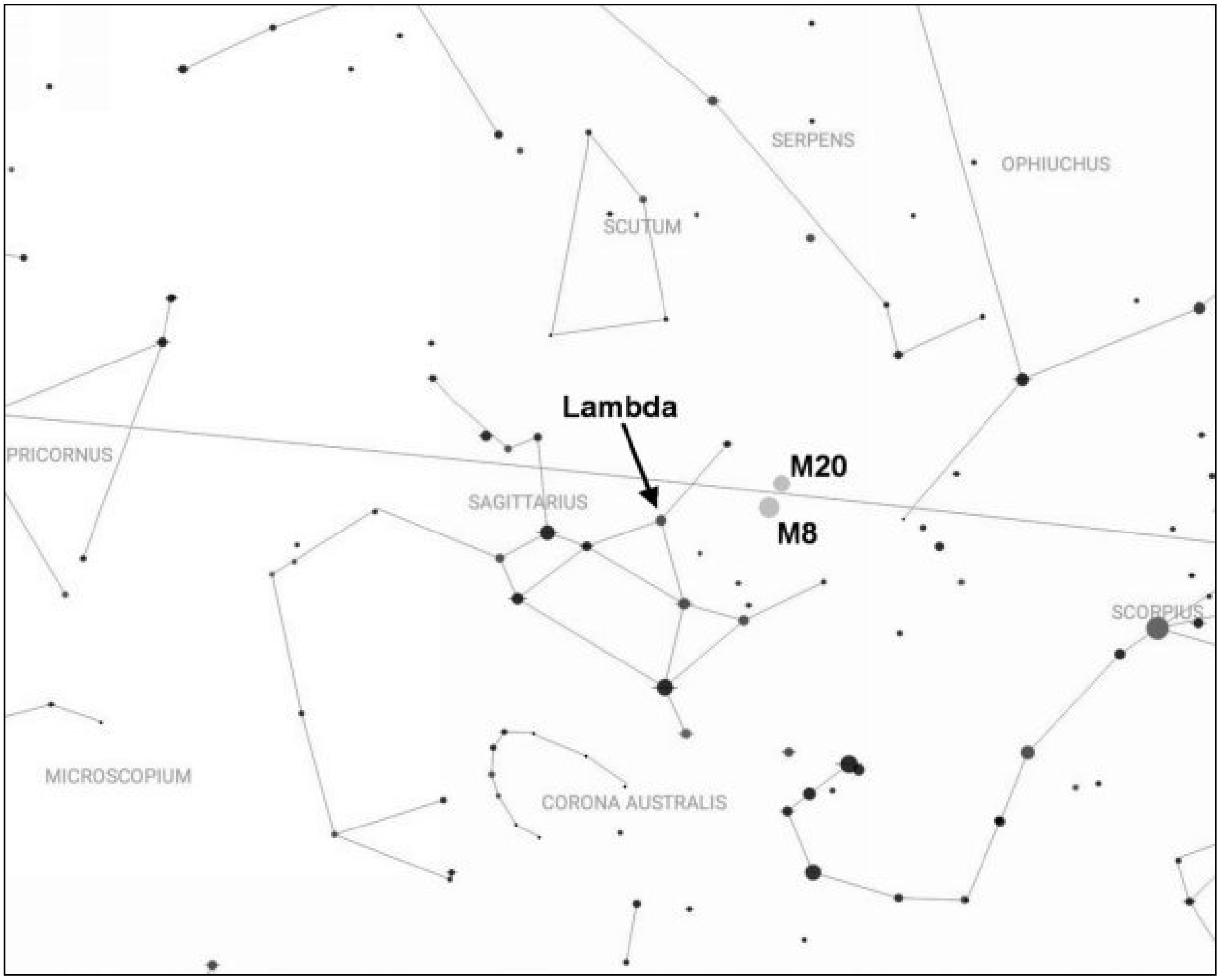
Firstly, as a sign of the zodiac, the Sun, Moon and planets all appear to pass through it. Consequently, there will be times when one or more of the planets will be poorly placed for observation, with some planets hindered for years. For example, Saturn will spend 2-3 years crawling among the stars of the constellation.

Secondly, and (arguably) more importantly, observers in the northern hemisphere are missing out on one of the splendors of the universe – our own Milky Way. If you look for the "steam" that appears to be drifting out of the teapot's spout, you'll be looking directly toward the very heart of the galaxy.

The Earth is about 26,000 light years from the center of our island of stars and astronomers believe it has a dark heart, in the form of a supermassive black hole.

Also take a few moments to consider this: we can see thousands of stars, clusters and nebulae in our skies – but there are thousands more that simply cannot be seen from our vantage point. What lies on the other side of the galaxy?

All the same, it's worth scanning the area with binoculars as a number of objects will stand out.

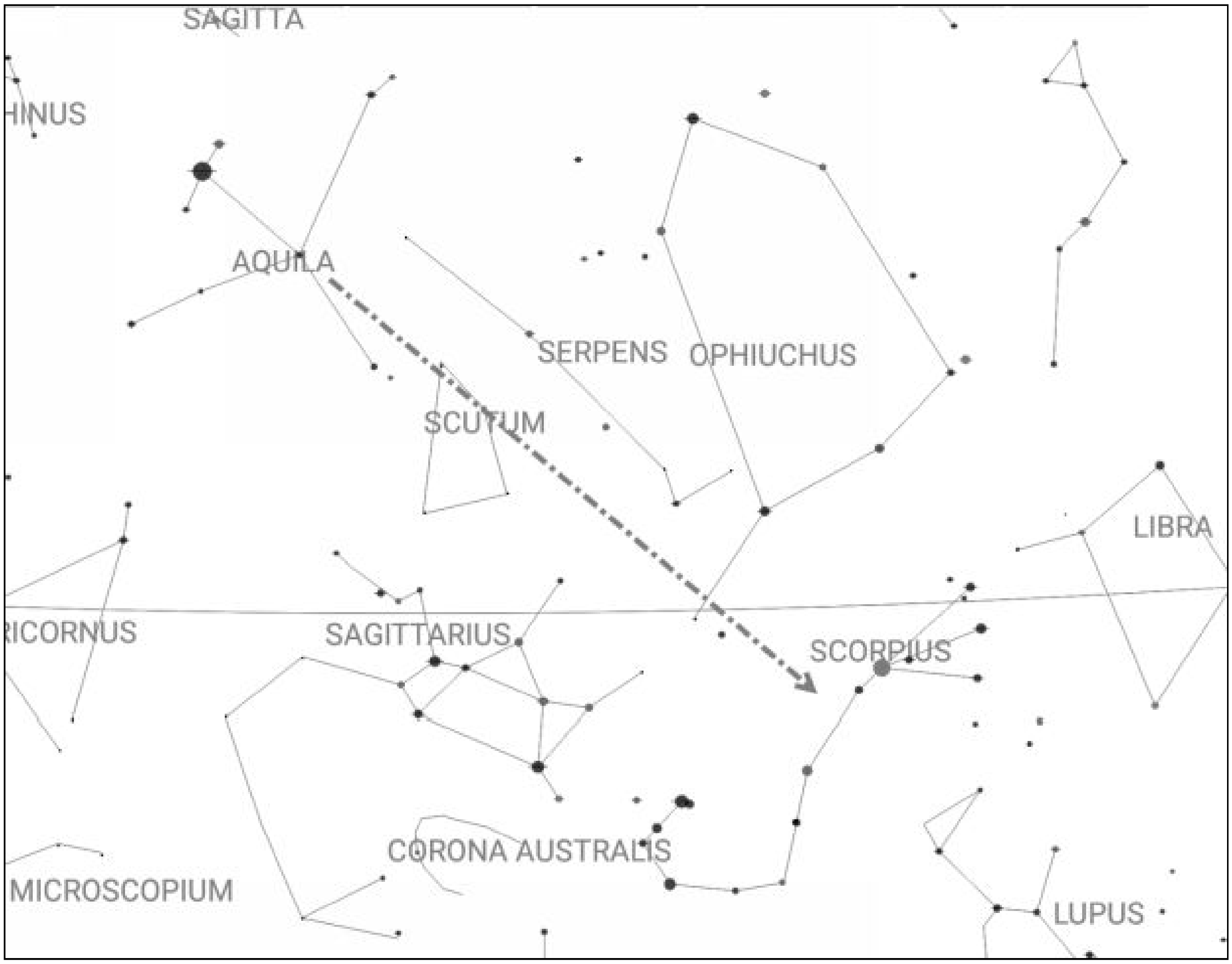


(Double-tap image to enlarge.)

If you have exceptional eyesight and you live under very dark skies, you may be lucky enough to glimpse Messier 8 (M8), the Lagoon nebula. This can be found within the same binocular field of view as Lambda Sagittarii and can be a very attractive sight in small telescopes at low power.

Messier 20 (M20), the Trifid Nebula, appears within the same field of view as the Lagoon but it’s smaller and fainter and, therefore, harder to spot. You’ll need dark skies to properly observe the nebula and it always seems better when observed with binoculars. However, a small telescope under suburban skies may show it as a small, misty patch with an associated open star cluster being more apparent.

Scorpius



There are no clear pointers to Scorpius but you can use [Aquila](#) to look toward the gap between the scorpion and [Sagittarius](#). Bright Antares should be easily visible toward the west. (Double-tap image to enlarge.)

Scorpius, another of the twelve zodiac signs, is said to represent the scorpion that killed Orion after the hunter boasted he could kill any living creature on Earth. Scorpius was then placed among the summer stars, far removed from Orion, who now dominates the winter skies.

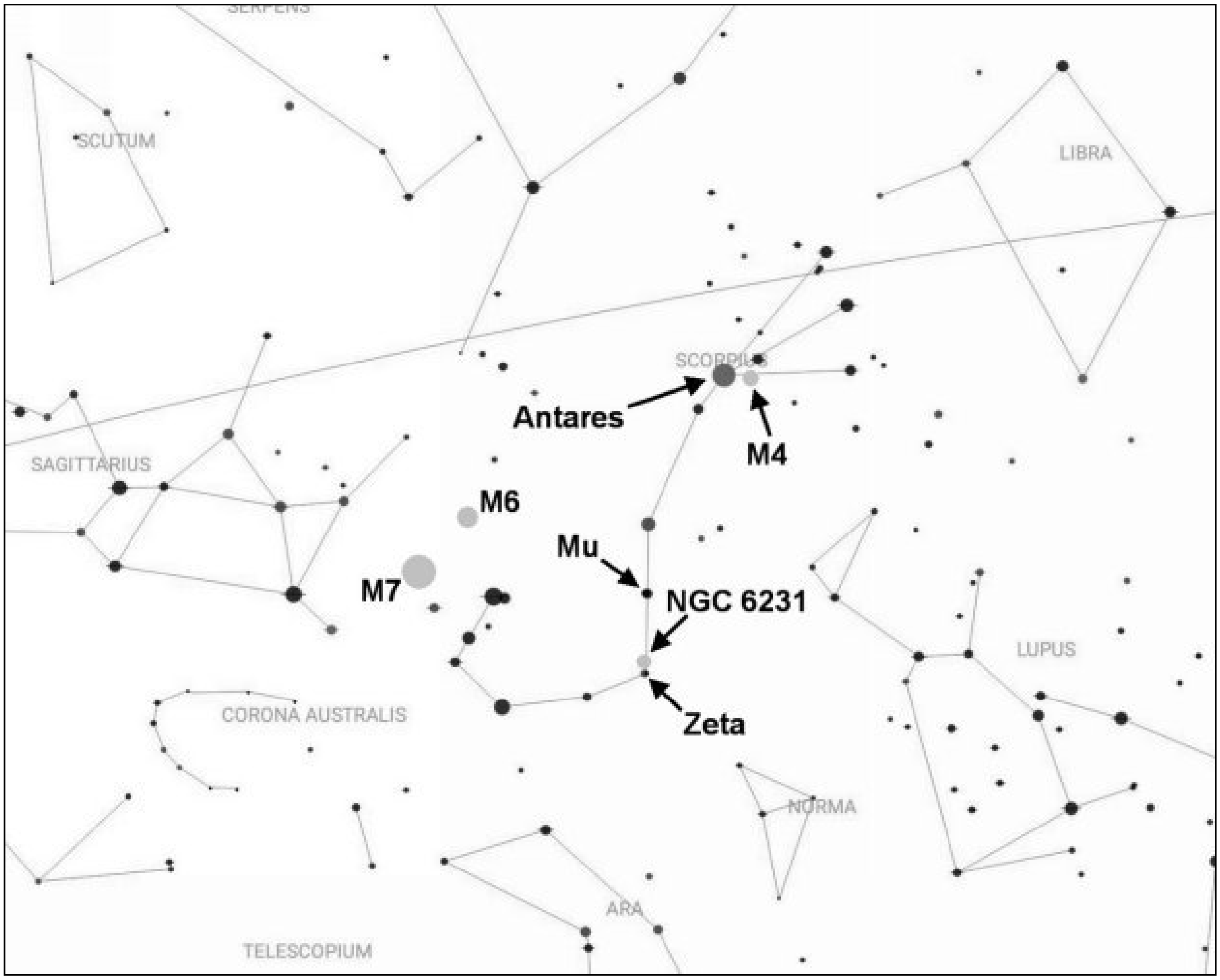
It's a mid-sized constellation, 33rd in size, with a number of bright stars that would normally make it easy to spot – if it wasn't so far south in the sky.

Unfortunately, like Sagittarius to the east, the constellation appears quite low on the horizon from the northern hemisphere and, for many, the scorpion’s tail never rises above the horizon at all. Again, like Sagittarius, this is a shame as it contains a number of deep sky objects that are well worth seeking out.

One thing that’s very easy to see is Antares, the heart of the scorpion and the constellation’s brightest star. It’s also the 15th brightest star in the sky and is known to be a red supergiant, some 900 times the size of the Sun. If you were to place it at the center of the solar system it would extend out beyond the orbit of Mars!

To the unaided eye it has a distinctive golden orange color and it’s no wonder that its name means “rival of Mars.” You’ll also want to keep your eyes on it for one other outstanding reason: it’s a prime candidate to become a supernova.

If that ever happens, it will temporarily outshine every other star in the sky and most likely be visible during the daylight hours. But don’t worry, at a distance of about 550 light years, the resulting debris poses no danger to the Earth!



(Double-tap image to enlarge.)

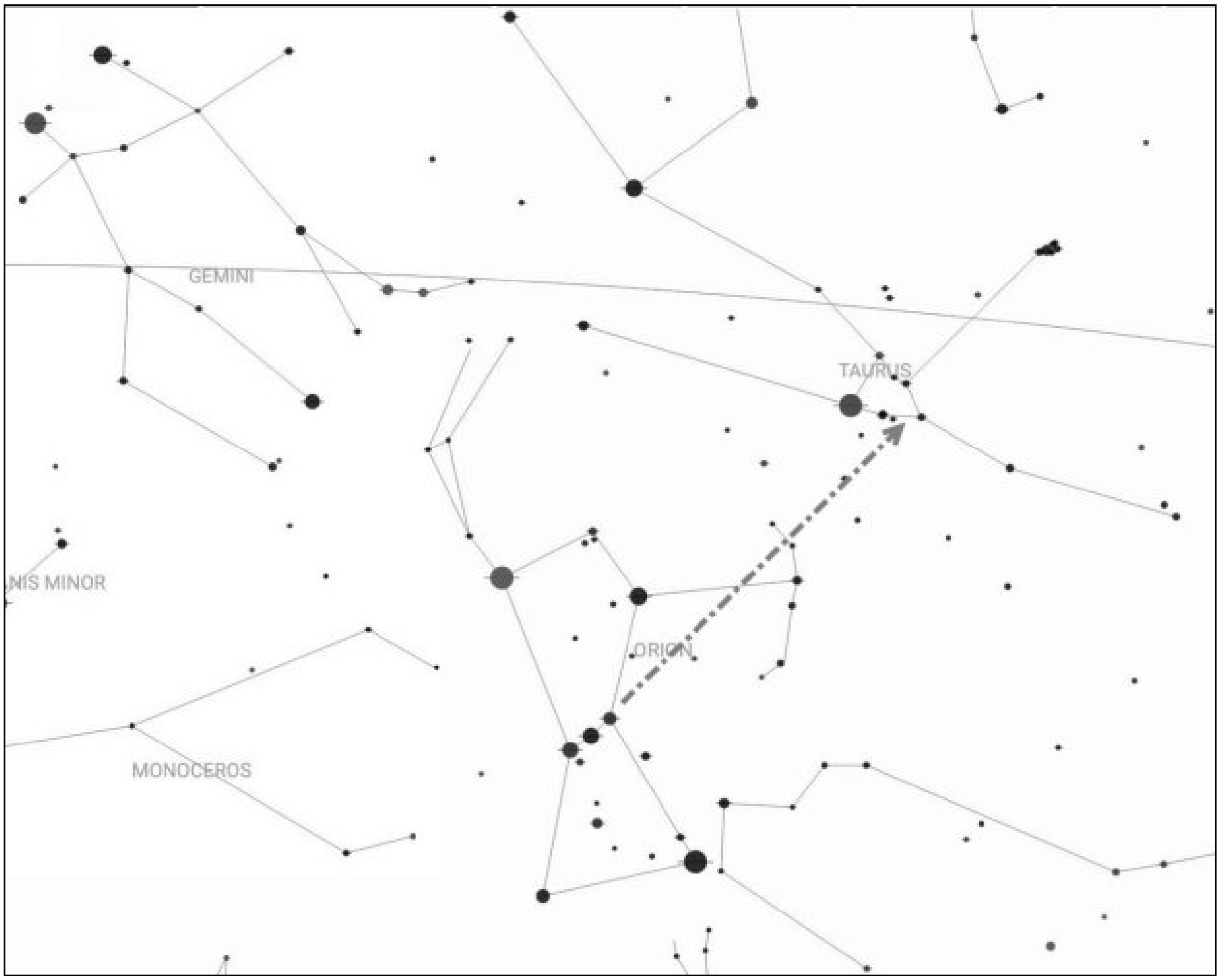
Close to Antares and within the same binocular or finder field of view is Messier 4 (M4), one of the closest globular clusters to the Earth. It can be a difficult object to spot with binoculars under suburban skies but a telescope may reveal it.

If you're using binoculars, you might prefer Mu^1 and Mu^2, a wide pair of white stars found midway along the scorpion's body.

A little further south is Zeta^1 and Zeta^2, a slightly closer pair consisting of a coppery primary and a slightly fainter white secondary. You'll also see NGC 6231, a compact group of stars that looks like a tiny Pleiades at low magnification.

Lastly, turn toward the east and the tail of the scorpion. Here you’ll find Messiers 6 and 7, two attractive open star clusters easily seen with binoculars. Of the two, Messier 7 is brighter but Messier 6, the Butterfly Cluster, is richer and provides a beautiful view through a small telescope.

Taurus



Taurus, a prominent constellation throughout the autumn and winter months, is easily found by drawing a line north-west through Orion's belt to Aldebaran and the Hyades open star cluster. (Double-tap image to enlarge.)

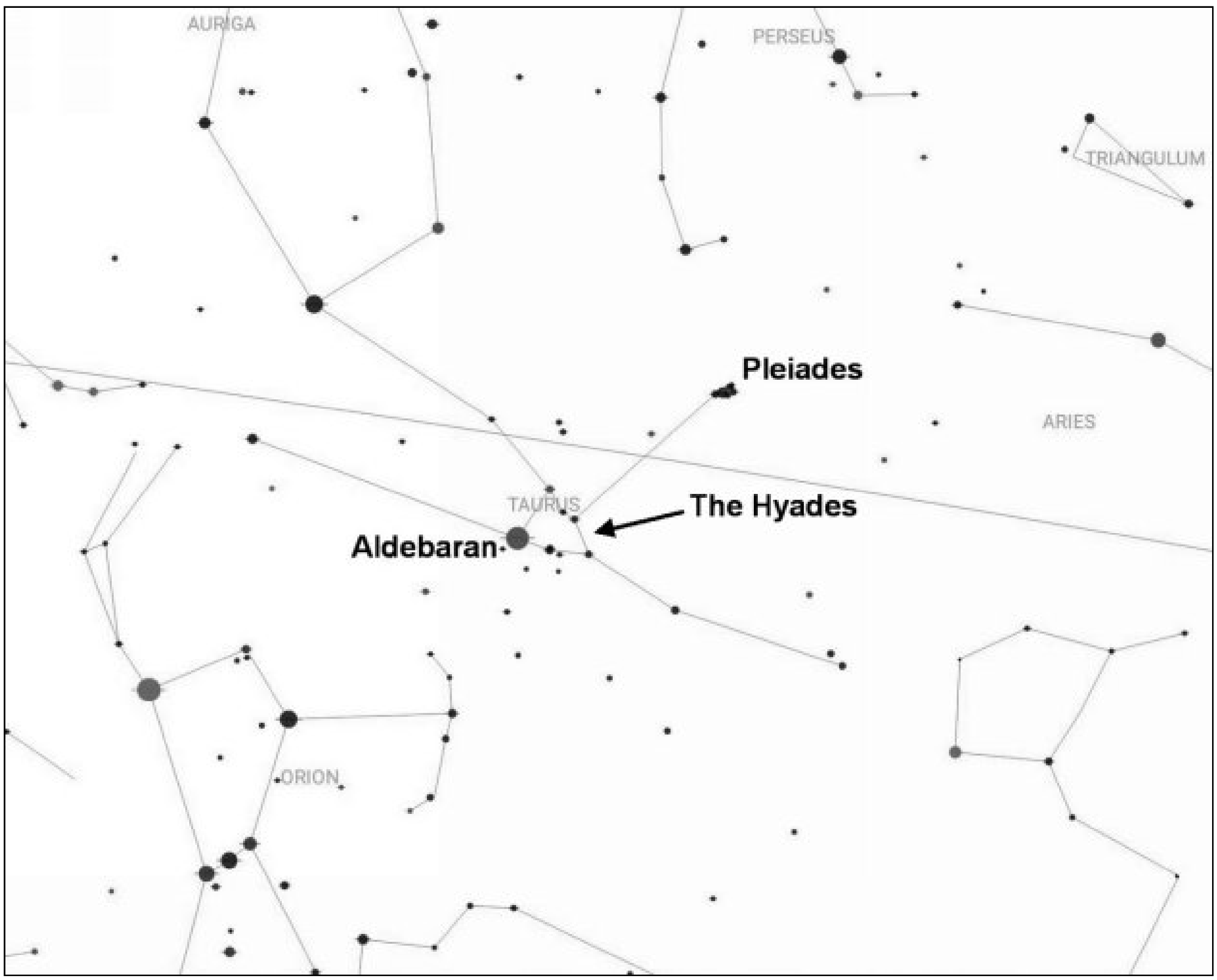
Taurus is, of course, another of the twelve signs of the zodiac and has been depicted as a bull for millennia.

The Greeks associated several myths to it. In one, the god Zeus fell in love with the princess Europa and transformed himself into a bull so he could hide amongst her cattle. When the princess discovered him there, she climbed onto his back and Zeus was able to carry her away.

In another, Taurus is said to represent the Cretan bull killed by Hercules as one of his twelve labors. Whichever myth you prefer, the constellation is often depicted as charging toward Orion, the hunter, who is seen raising his club and shield to defend himself against it.

Ranked 17th in size, it covers nearly 800 square degrees of sky. There's no denying that Taurus is a prominent constellation but it would be nothing without Aldebaran and the wonderful Hyades and Pleiades open star clusters.

Aldebaran is an orange giant star that marks the red eye of the bull. The 14th brightest star in the sky, it shines at magnitude 0.9 and lies only 65 light years away.



(Double-tap image to enlarge.)

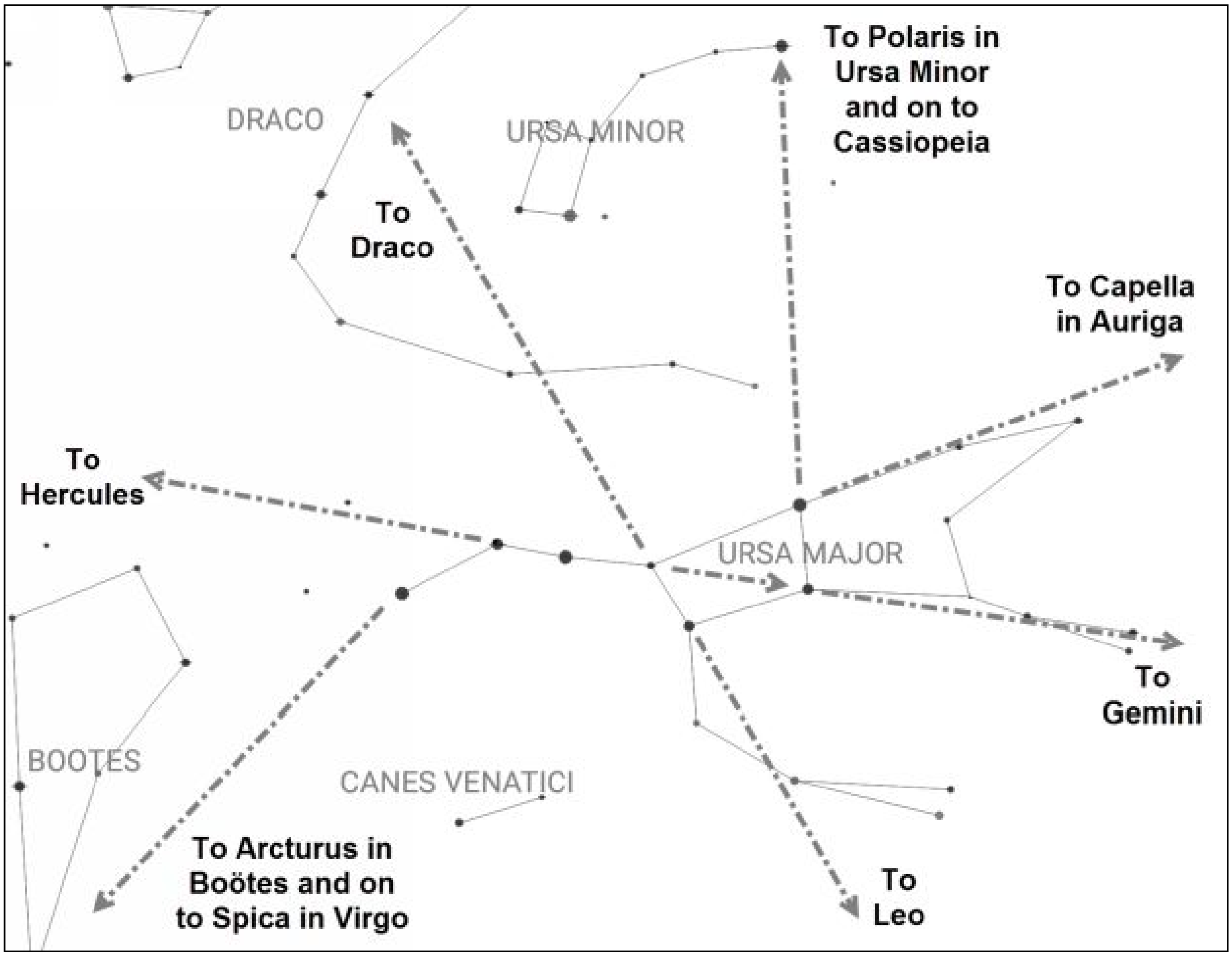
Aldebaran appears at one tip of a V shaped cluster of stars. This cluster is known as the Hyades and, despite appearances, Aldebaran is not a true member of the group as the Hyades themselves lie about 150 light years away. This is a fine cluster for the casual observer. Easily visible with the unaided eye, even from light polluted suburban skies, the Hyades can be quite spectacular when viewed through binoculars.

The cluster is large but comfortably fits within a binocular field of view. In fact, binoculars are best as the cluster cannot be seen in its entirety through a telescope, even at low magnification.

If you continue to draw the line from Orion through the Hyades and toward the north-west you'll come to the Pleiades star cluster. Another sight easily seen with your eyes (although a little trickier under light polluted skies) this cluster has been known across the world by different civilizations for millennia.

How many stars can you see with just your eyes? To the Greeks, the cluster was also known as the Seven Sisters, but many folks today can only count six stars. Binoculars will reveal many more and, like the Hyades, the cluster is a spectacular sight through 10x50's. Unlike the Hyades, a small telescope at very low power (eg, about 27x) can also provide an amazing view. Not to be missed!

Ursa Major



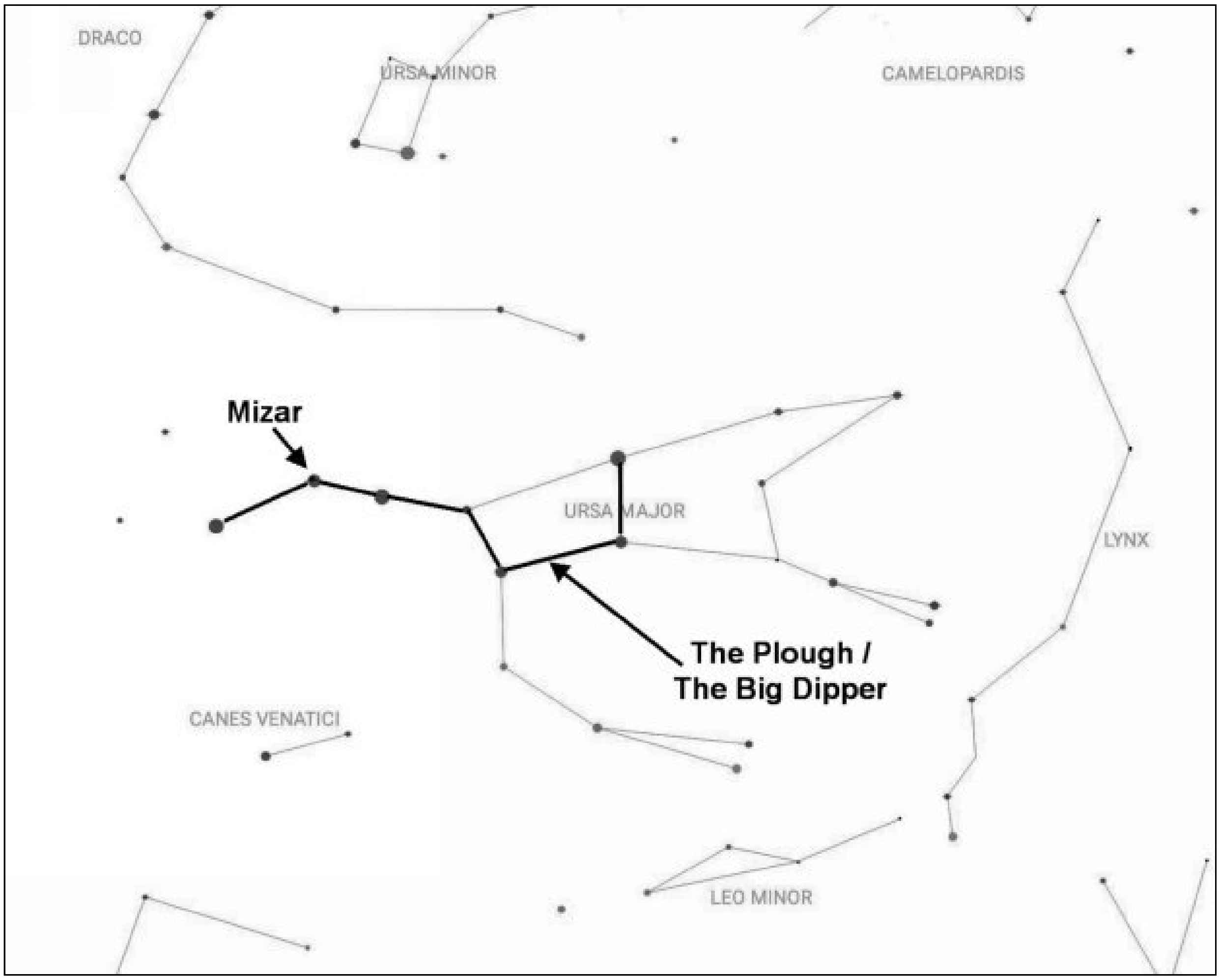
The seven brightest stars of Ursa Major are easily visible throughout most of the year and appear to circle Polaris, the north pole star. You can use these stars to locate other stars and constellations in the night sky. (Double-tap image to enlarge.)

Ursa Major, the Great Bear, is a large constellation, 3rd in size and covering nearly 1,300 square degrees of sky.

In Greek mythology, this constellation represents Callisto, a nymph with whom Zeus had fallen in love. Jealous Hera, the wife of Zeus, transformed Callisto into a bear in the hope this would prevent any romantic liason between the two.

Callisto’s son, Arcas, was unaware of his mother’s fate and was hunting in the woods when he came across the bear. Zeus quickly intervened by also transforming Arcas into a bear and throwing them both into the sky by their tails. Arcas then became Ursa Minor, the Little Bear.

(This story also explains the reason why both bears have such unnaturally long tails!)



(Double-tap image to enlarge.)

The seven brightest stars of Ursa Major have been known since antiquity across the world. For many folks in Europe, the stars are identified as a plough while observers in North America see a big dipper.

Not only are these stars bright, but they’re also easily visible as they’re circumpolar from much of the northern hemisphere. This means the stars never set for many observers and appear to circle Polaris, the north pole star instead.

Consequently, these stars can be used to locate other stars and constellations throughout the year. Most famously, you can draw a line through Merak and Dubhe toward Polaris in Ursa Minor. As that star lies close to the celestial pole, this allows you to always find north.

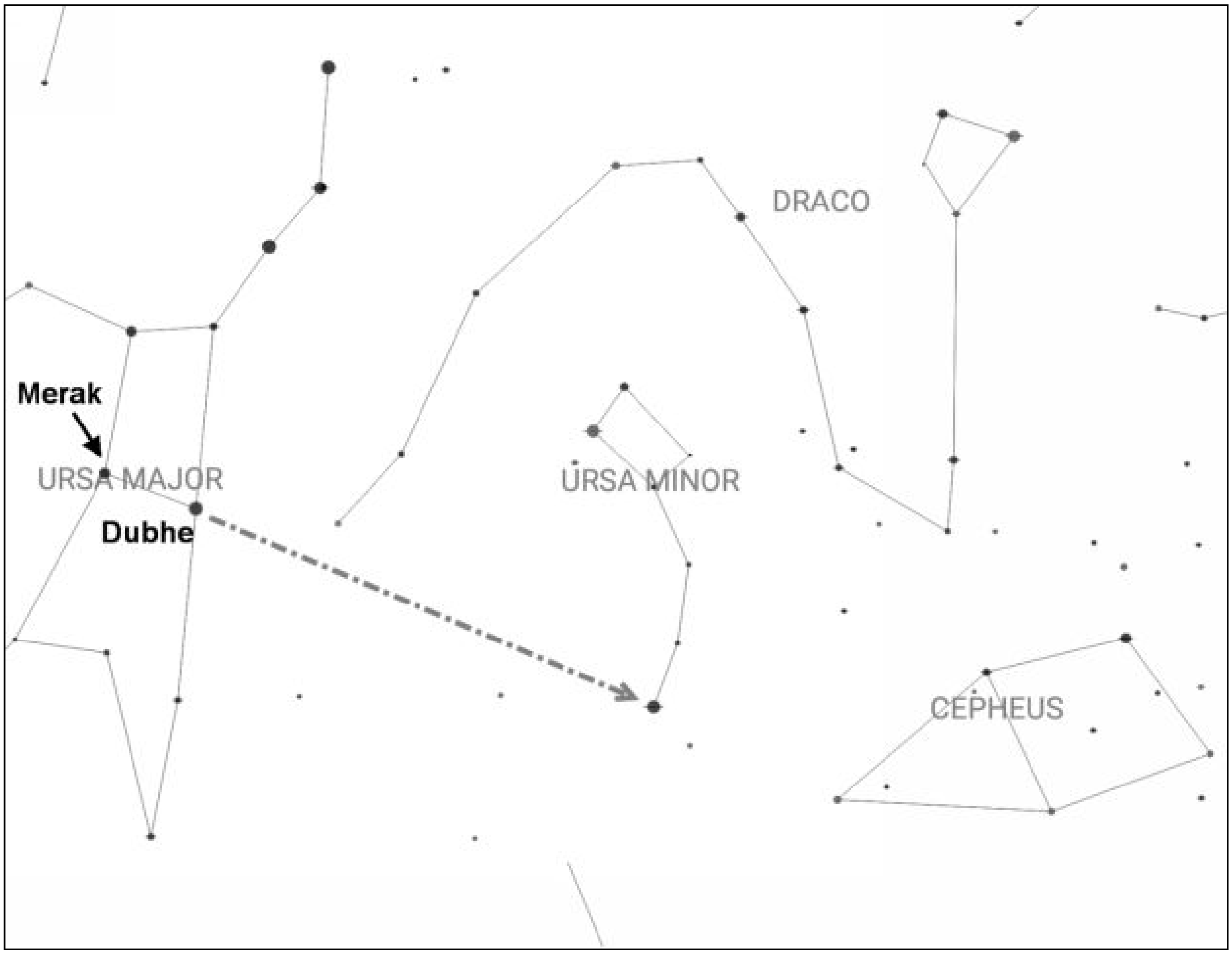
(Besides helping you find your way home when your GPS stops working, this information could literally save your life some day!)

Look out for Mizar, the middle star in the tail of the bear. If you have reasonably clear skies and eyesight you should be able to see a tiny star beside it. Known as Alcor, this tiny companion was once considered a test of the observer’s eyesight but astronomers today shouldn’t have any difficulty resolving the pair.

This is a famous optical double – in other words, the two stars are not a true multiple star system and only appear close to one another in the sky.

Binoculars provide a good view but the best view is reserved for observers with a small telescope. Even at a low power of just 27x you should easily be able to split Mizar into two blue-white stars.

Ursa Minor



Despite being a relatively faint constellation, Ursa Minor is easily found by drawing a line north through the pointer stars of Merak and Dubhe in nearby [Ursa Major](). (Double-tap image to enlarge.)

According to Greek mythology, Ursa Minor, the Little Bear, represents Arcas, the son of the nymph Callisto. His fate became intertwined with his mother's after she was transformed into a bear by the jealous goddess Hera. (See here for the rest of the story.)

Ursa Minor is not a particularly large constellation, ranking only 56th in overall size and covering little more than 250 square degrees of sky.

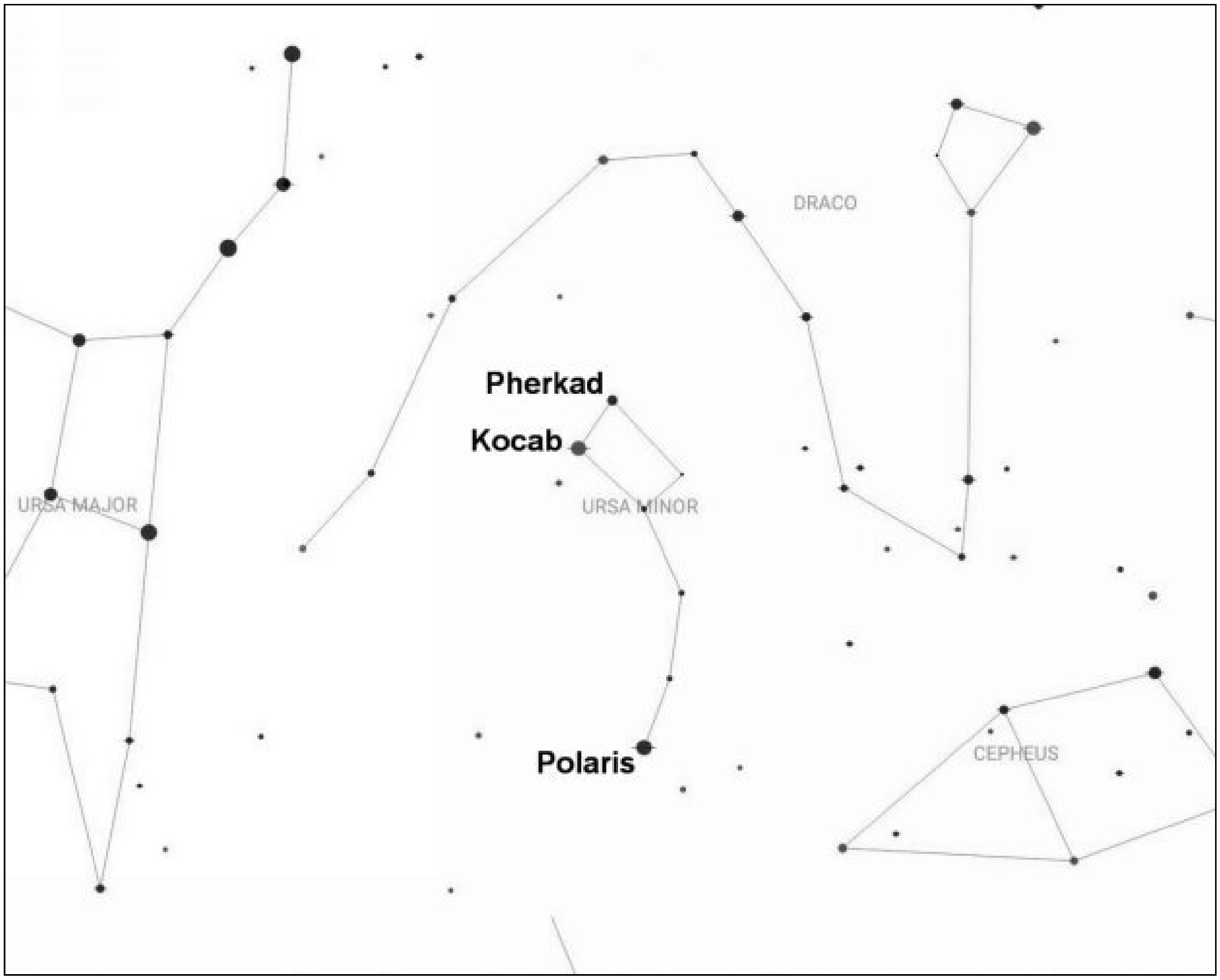
It’s also not particularly bright, which might come as some surprise to the non-astronomers who think its brightest star, Polaris, is also the brightest star in the heavens. (Quite where this idea comes from is something of a mystery.)

In fact, at magnitude 2.0, Polaris is not very remarkable at all and would be easily overlooked if it wasn’t for its special place in the sky. For, as many know, the star marks the northern celestial pole and makes for a convenient marker for due north.

It can be easily found by drawing a line through Merak and Dubhe, the “pointer stars” in Ursa Major and has been used as a navigational aid for millennia.

However, this is not a permanent arrangement as, due to the precession of the equinoxes, the pole star changes over the course of thousands of years. (See Draco for more information.)

That being said, we can comfortably rely on Polaris to guide our way throughout our lifetimes and the lifetimes of our children’s children.



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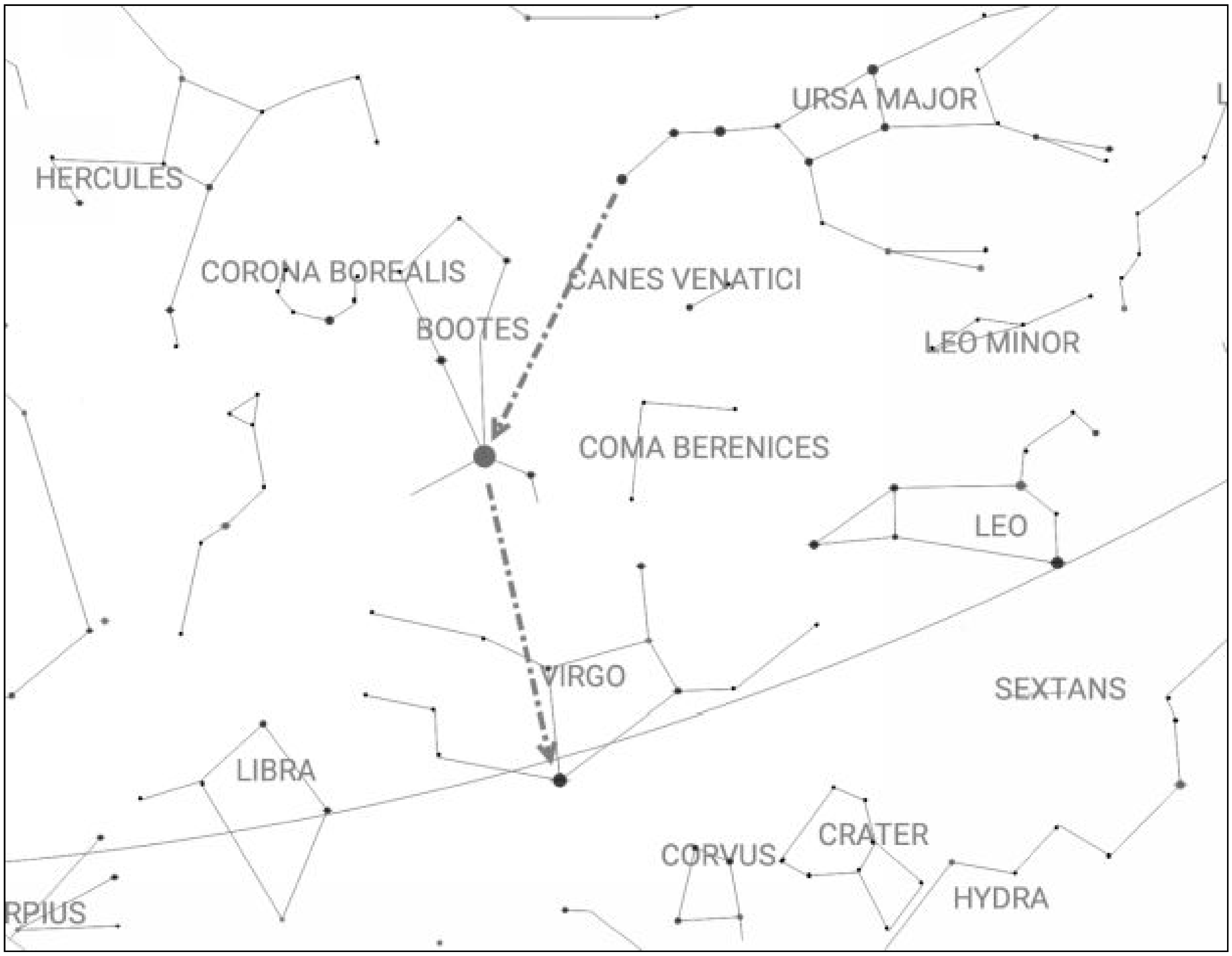
Polaris is not a solitary star. For starters, if you turn a pair of binoculars toward it you may see that it forms a circle of stars with a number of fainter companions.

This asterism is known as the Engagement Ring with Polaris, the brightest star in the group, taking the place of the shining diamond.

If you have a small telescope, try your hand at splitting Polaris in two. You'll probably need a magnification of about 75x or more to spot the faint, bluish companion. (The companion might prove to be elusive at first, especially if you're observing from the suburbs.)

Further on down the constellation are Pherkad and Kocab, also known as "the guardians of the pole." Both stars will fit within the same binocular field of view and you should also find a wide, unrelated, magnitude 5 companion to Pherkad.

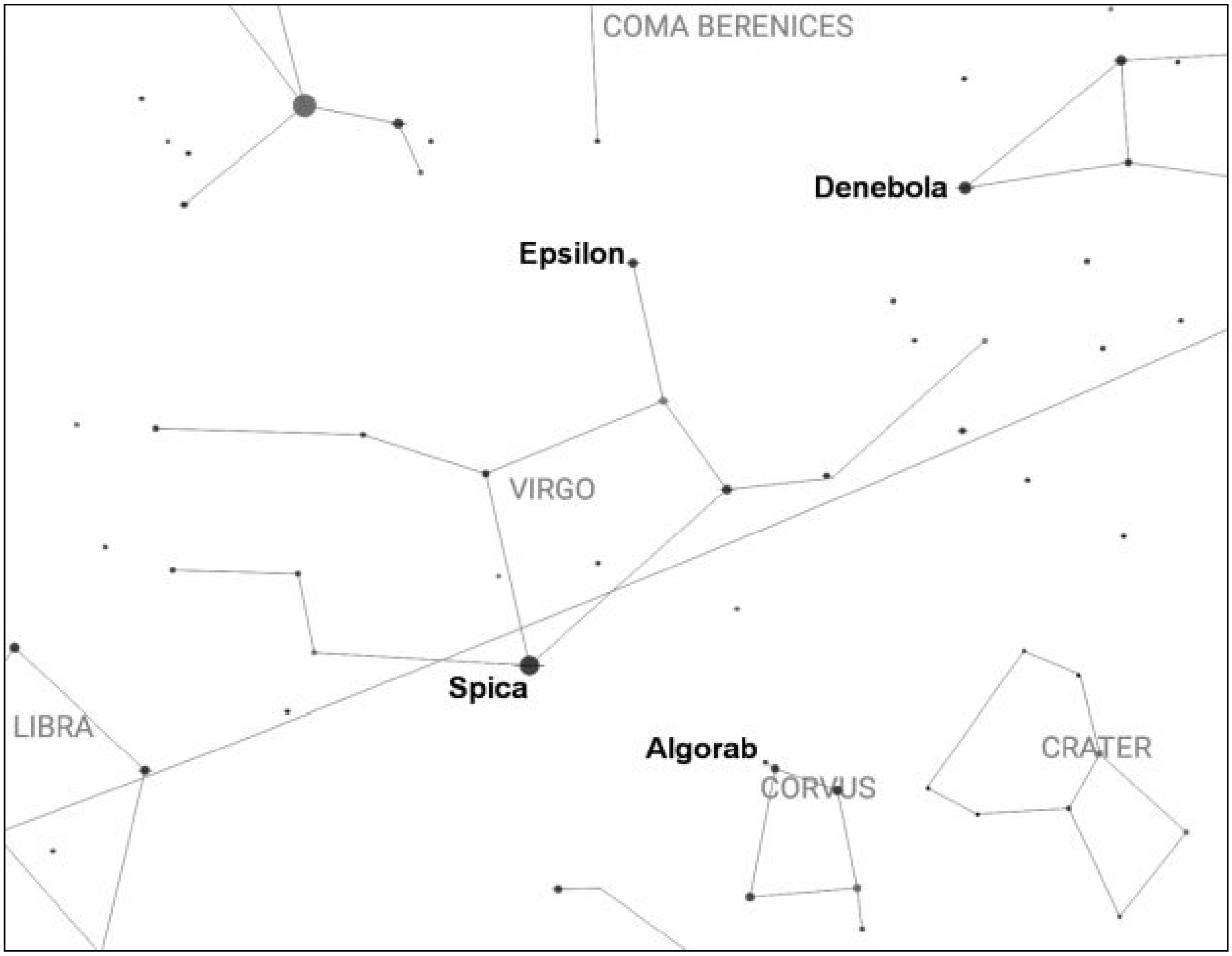
Virgo, Corvus and Crater



You can easily find Virgo by following the tail of [Ursa Major](), the Great Bear, south toward Arcturus and then continuing the curve to Spica – hence the expression "arc down to Arcturus and speed on to Spica!" (Double-tap image to enlarge.)

Virgo, the Virgin, is the largest of the twelve signs of the zodiac and, covering nearly 1,300 square degrees, is the 2nd largest constellation in the entire night sky. In fact the largest, Hydra, is only 9 degrees larger.

Despite having agricultural associations around the world for thousands of years, there are no clear myths and legends linked to it. The Greeks identified it as Demeter, the goddess of the harvest and the constellation is often depicted as a woman holding an ear of wheat.



(Double-tap image to enlarge.)

Spica, also known as Alpha Virginis, is the constellation’s brightest star and shines at just under magnitude 1.0. Its name is derived and abbreviated from the Latin for “the virgin’s ear of grain” and it appears as a fairly solitary star in this area of the sky.

The star itself is actually a binary system some 250 light years away. The two components orbit one another so closely that both stars are egg-shaped, having been distorted by the gravitational forces between them.

Despite the lack of other bright stars in the vicinity, the constellation is famed for the Virgo Cluster of galaxies, located between Epsilon and Denebola.

This group is thought to contain about 1,300 galaxies and is worth considering for a few moments – if most galaxies contains 100 billion stars there could be at least 1.3 *trillion* stars here.

Virgo provides a sharp contrast with Sagittarius. Specifically, when you look toward Sagittarius, you're looking toward the heart of our own Milky Way galaxy.

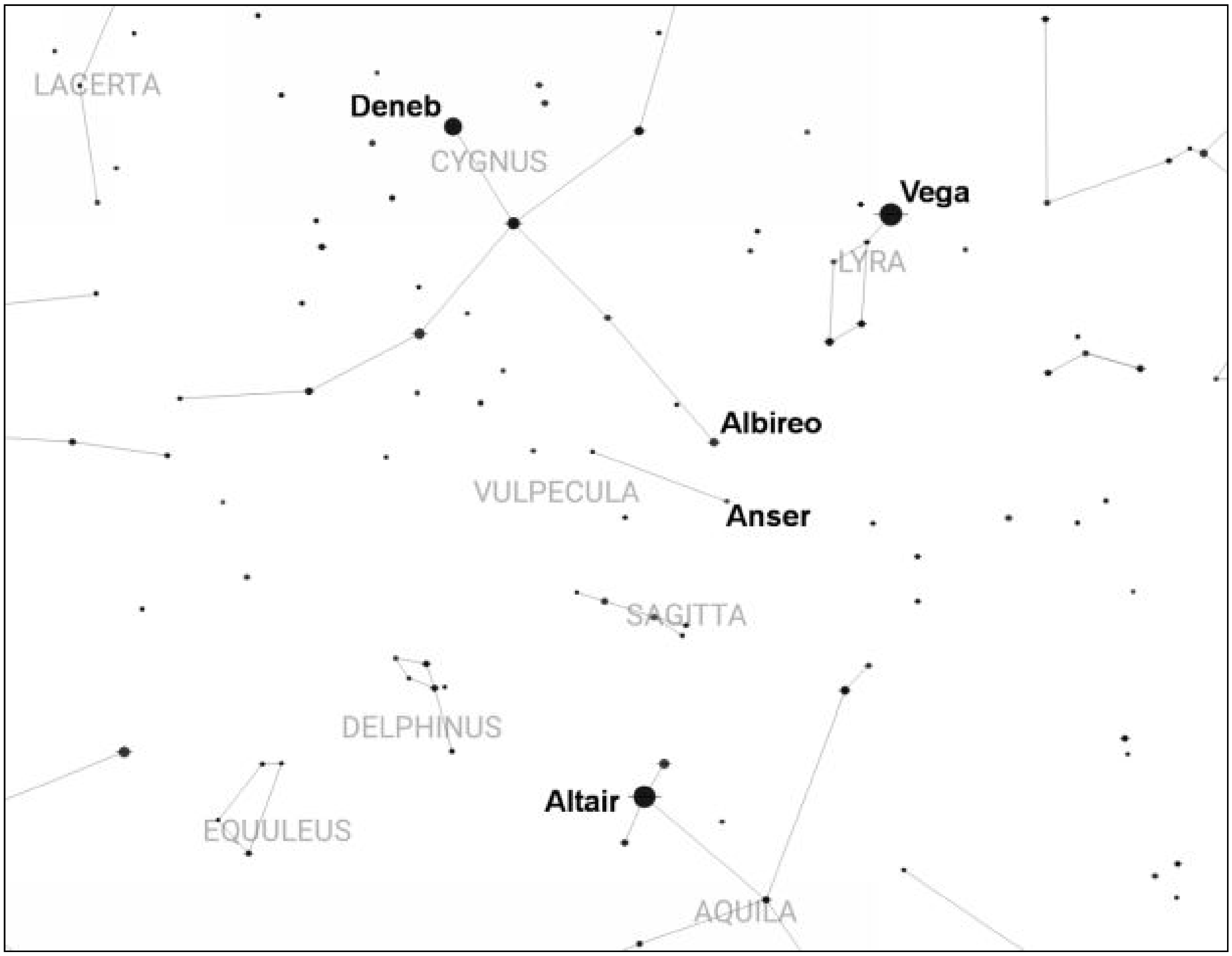
However, when you look toward the northern edge of Virgo, you're actually looking *away* from the Milky Way and deep into the infinite recesses of the universe.

Now turn toward the west - can you see the stars of Corvus the Crow and Crater the Cup?

According to Greek myth, the god Apollo sent the bird to fetch him a cup of water but the bird took too long. Instead of immediately returning with the water, the bird stopped to drink from the cup himself.

Delta Corvi, also known as Algorab, has a close companion that may be spotted by keen-sighted observers with just the naked eye. Binoculars will provide a better view while a small telescope at medium power (about 50x) will split Algorab itself into two components.

Vulpecula



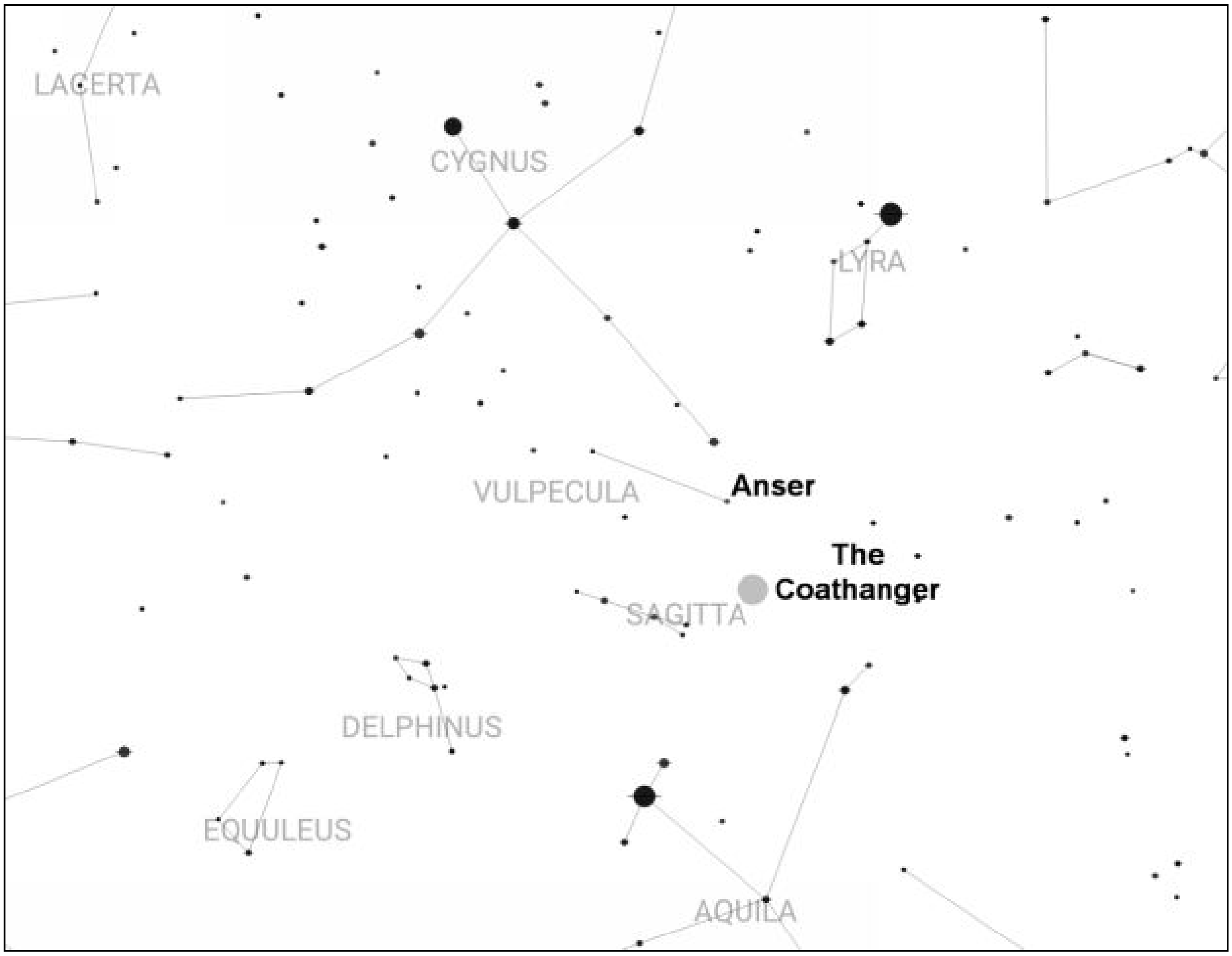
The easiest way to find Vulpecula is by first finding Deneb, the brightest star in [Cygnus]() the Swan and one of three stars of the Summer Triangle. At the southern tip of that constellation is Albireo. Now look just to the south-east for Anser, Vulpecula's brightest star. (Double-tap image to enlarge.)

Vulpecula, the Fox, is not an ancient constellation at all but is actually less than four hundred years old. It was created by the Polish astronomer Johannes Hevelius in the late 17th century and was originally known as the Fox and the Goose.

(Why Hevelius chose this imagery is something of a mystery. There are a number of stars in the area but it's hard to imagine them as depicting anything remotely like a fox *or* a goose.)

Over time, the goose was eventually lost, but it lives on, in a small way, through the name of the constellation's brightest star.

Vulpecula is not a conspicuous constellation at all. It's small, being ranked 55th in size, and only covers 268 square degrees of sky. It's also faint, with no stars brighter than magnitude four.



(Double-tap image to enlarge.)

Its brightest star, Anser, is a magnitude 4.4 star that lies within the same binocular field of view as Albireo, the second brightest star in Cygnus, the Swan. Albireo is your key to finding the constellation.

But if it's so small and faint, then why bother? Because there are a few objects here that are of interest to the casual observer.

Firstly, there’s Anser itself. Its name means “goose” and it’s a red giant star just under 300 light years from Earth.

By itself, it’s not very remarkable, but binoculars will show an unrelated magnitude 5.8 star just to the north-west. The primary has a creamy color and appears to be about 1½ times brighter than its white companion.

Now move your binoculars to the south a little so that Anser is close to the edge of your field of view. Look carefully and you might see something unexpected - a coathanger.

This group of stars has been known since ancient times and may be seen by the unaided eye under clear, dark skies. Also known as Brocchi’s Cluster, after the stellar cartographer who mapped it, this is a summer favorite for many and an easy target for binocular observers.

(In fact, even a small telescope may magnify the view too much. It’s a large group and is best enjoyed at low power.)

Once thought to be a true cluster, it’s now known to be merely an asterism - a chance alignment of stars that forms a familiar shape!

The Solar System

About the Planets

A lot of folks think you need a telescope to see the planets but, in fact, there are five that are visible with just your eyes. These worlds – Mercury, Venus, Mars, Jupiter and Saturn – have been known and observed for many thousands of years and have mystified astronomers for just as long.

The word *planet* is actually derived from the Greek for "wandering star" as these bright points of light can be seen to move across the sky. It therefore seems only natural for the ancients, who didn't know any better, to associate these wandering stars with their gods.

The worlds as we know them are named after Roman gods, which, in turn, each have their own original Greek equivalent. For example, Mars was the Roman god of war but the Greeks knew him as Ares.

Our ancestors observed the planets with only their eyes for thousands of years before the telescope became a popular astronomical tool in the 17th century.

The invention of the telescope changed everything. Galileo saw the four largest moons of Jupiter in 1610 and noted craters on our own Moon. The planet Uranus was discovered telescopically in 1781 while Neptune followed a scant sixty-five years later.

Now, in the 21st century, we've looked much further afield and discovered thousands of planets orbiting other distant stars. Despite the millennia staring at the stars, it seems we've barely begun to explore the cosmos that surrounds us.

Elongations and Oppositions

Before we talk about the planets themselves, there are two key terms you need to know and understand so you can be better observe them: elongations and oppositions.

Both Mercury and Venus orbit closer to the Sun than the Earth and, hence, they never stray far from the Sun in the sky. You'll never see either of these worlds high overhead at midnight but will, instead, glimpse them within the golden glow of the evening or pre-dawn twilight.

These planets are often at their best visibility when they're furthest from the Sun in the sky. At this point, astronomers say the planet has reached its *greatest elongation* from the Sun.

If the planet is at greatest eastern elongation (when it's furthest toward the east of the Sun in the sky) then it's actually visible in the west after sunset. If the planet is at greatest western elongation then the opposite is true. The planet is furthest west of the Sun in the sky and is visible in the east before sunrise.

The other planets – Mars, Jupiter, Saturn, Uranus and Neptune – all orbit further from the Sun than the Earth. Unlike Mercury and Venus, these worlds are not limited to appearing close to the Sun in the sky.

As a result, these planets are at their best when they appear opposite the Sun and they are said to be at opposition. At this time, they're visible throughout the night. They rise at sunset, appear roughly due south at midnight and then set at sunrise.

This is also when the planet is at its brightest and will appear largest when observed through a telescope.

Mercury

Mercury imaged by the MESSENGER space probe. Image credit: NASA/John Hopkins University Physics Laboratory/Carnegie Institution of Washington (Double-tap image to enlarge.)

The innermost planet, Mercury is named for the Roman messenger of the gods and is often depicted as wearing a winged helmet and shoes.

To the Greeks he was known as Hermes and was the son of Zeus and the Pleiad Maia. In both the original Greek and Roman traditions, he was also a trickster and the god who guided the souls of the deceased into the afterlife.

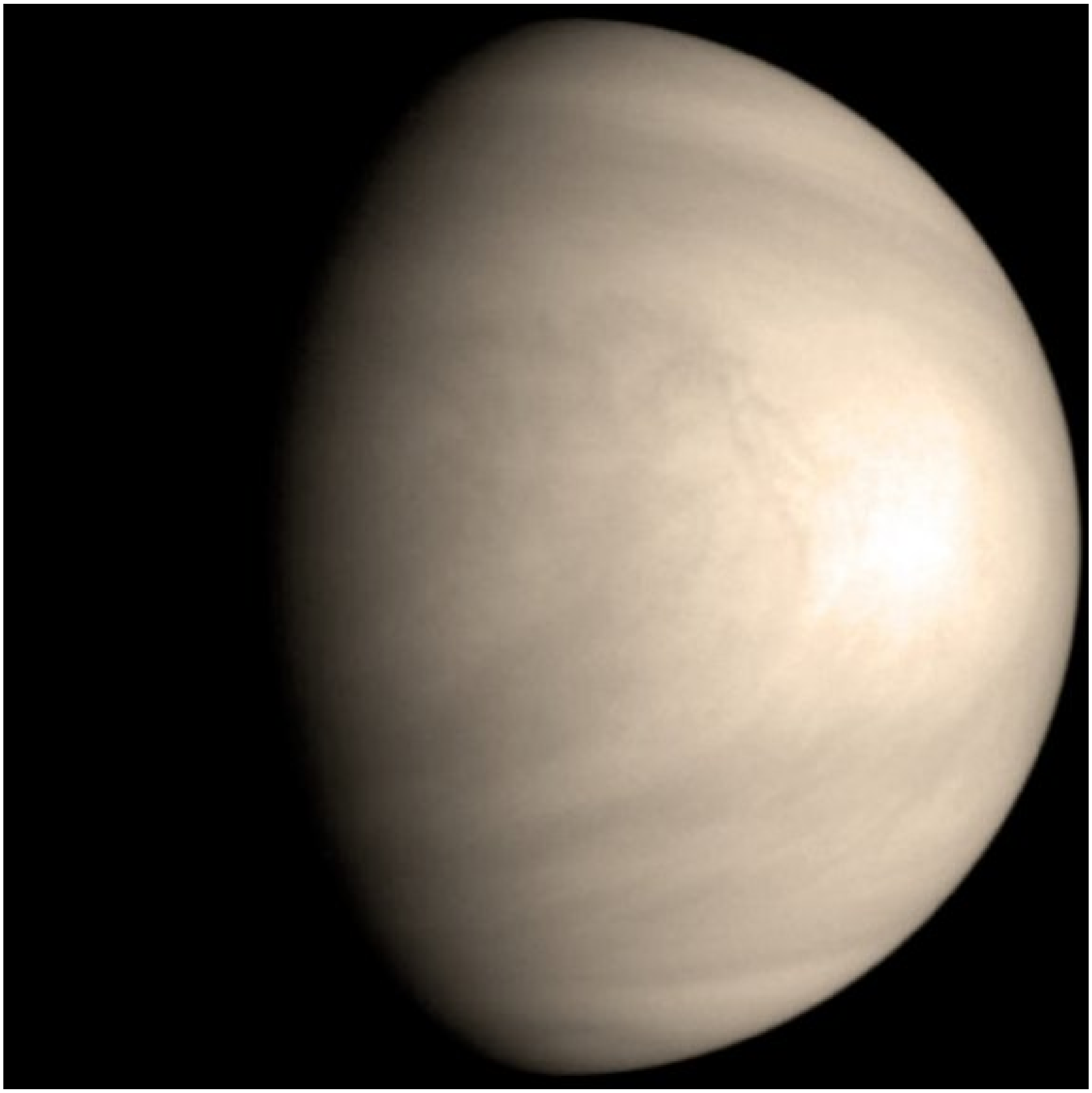
It seems only fitting then that this planet can be briefly glimpsed in the dying twilight after the sun has gone down. Watch him shimmer for a few fleeting weeks and then he’s gone again, only to reappear in the morning skies before the dawn.

Again, like the god, this world can be tricky to find and some may go their entire lives without ever seeing it at all. To the naked eye it appears as a pinkish-white star and not very prominent or bright against the glowing embers of the day.

Spotting the planet is not made any easier by the fact that it never appears very far from the Sun and, consequently, may remain close to the horizon. Your best bet is to wait until the thin crescent Moon appears close by and then try scanning the area with binoculars.

Small telescopes may show a tiny disc, but you’ll need to increase the magnification to over 100x to clearly see anything at all.

Venus



Venus imaged by the Galileo space probe. Image credit: NASA/JPL (Double-tap image to enlarge.)

The second planet from the Sun, this world was known to the Greeks as Aphrodite, the goddess of love. To the Romans she was Venus and, hence, the planet has become known by that name instead.

It's not hard to see why the ancients gave the world such a romantic name; it's the brightest object in the sky (after the Sun and Moon) and can often be easily seen shining brightly in the pre-dawn or evening twilight. With a crescent Moon nearby it can be a truly beautiful sight.

Like Mercury, the planet orbits closer to the Sun than the Earth and, as a result, always appears relatively close to the Sun in the sky. Unlike Mercury, it strays further afield and, at its best, can be visible high above the horizon for hours before sunrise or after sunset.

To the naked eye it appears as a brilliant white star but when it’s close to the horizon it can flash a myriad of colors.

Venus will easily show a disc when observed through a telescope. In particular, you’ll notice the planet shows phases at medium to high magnification, just as our own Moon does, and it’s worth coming back for repeated viewings over the course of several weeks to see how things have changed.

Mars

Mars, imaged by the Hubble Space Telescope. Image credit: NASA and the Hubble Heritage Team (STScI/AURA) (Double-tap image to enlarge.)

To the naked eye, Mars has a distinct coppery color that reminded the ancients of blood. Consequently, the planet was named for the Roman god of war while the Greeks knew it as Ares, their own god of war, violence and danger.

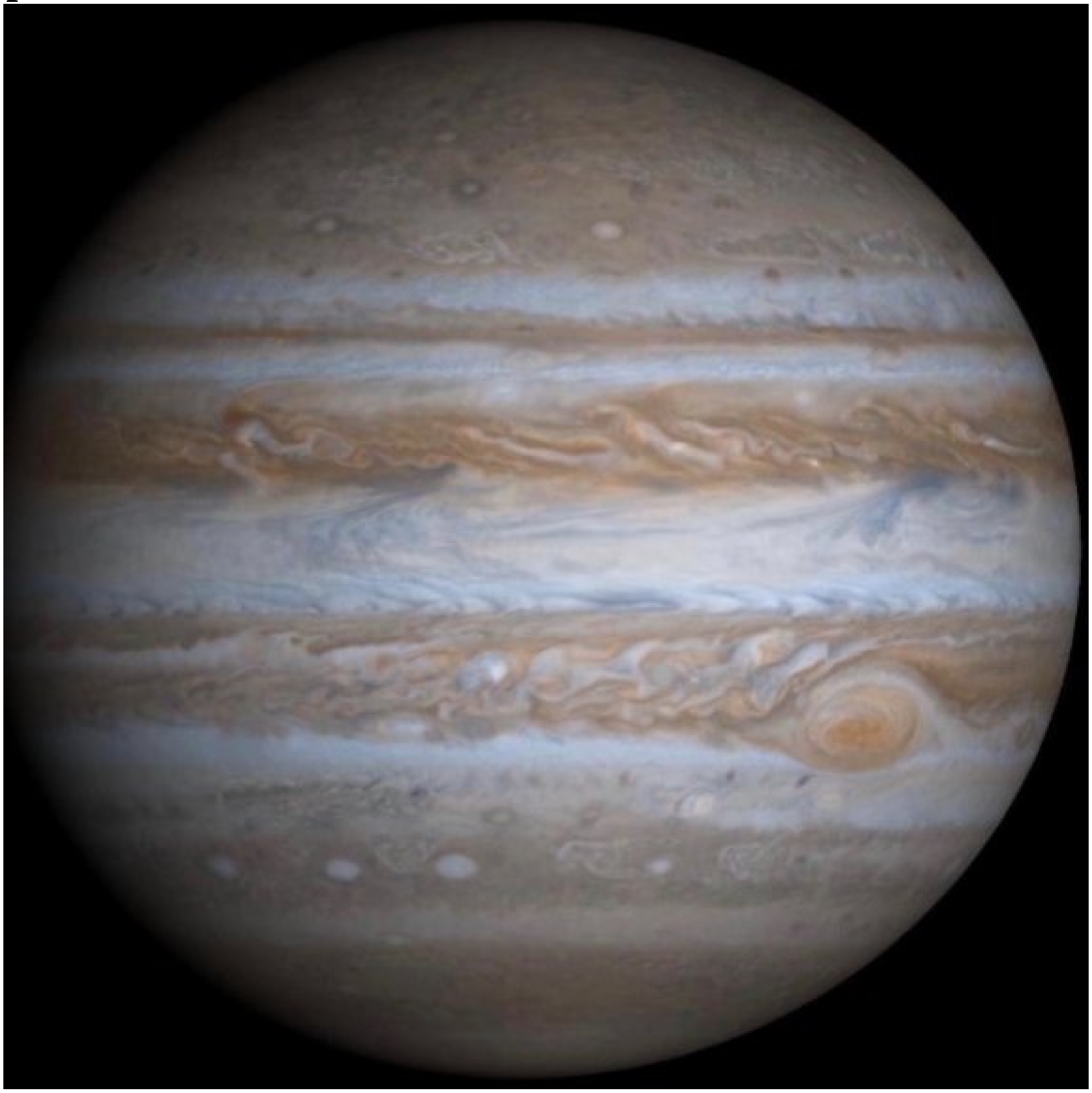
Fourth in line from the Sun, it's the first of the outer planets that orbit beyond the Earth. It takes nearly two years to complete a single orbit, which makes it a little problematic for astronomers here on Earth.

Jupiter and Saturn both reach opposition once a year but Mars is typically only at opposition in alternate years. This means that we have to make the most of our observational opportunities while Mars is still at its best.

That being said, Mars can be a disappointment to many. For one thing, despite what you might see online, Mars will never appear as large as the full Moon and, even through a telescope, it often only appears as a small, salmon colored disc.

But with a mid-sized telescope (typically a 4” scope is enough) and a high enough magnification (around 100x) you can see the polar ice caps and dark markings on its surface.

Jupiter



Jupiter, imaged by the Cassini space probe. Image credit: NASA/JPL/University of Arizona (Double-tap image to enlarge.)

The largest of all the planets, it has a very appropriate name as Jupiter was the king of the Roman gods. To the Greeks he was known as Zeus and although the ancients named the planets, there’s no way they could have known just how fitting the name was!

The fifth planet from the Sun, it appears as a pale white-gold “star” and is the fourth brightest object in the sky after the Sun, Moon and Venus.

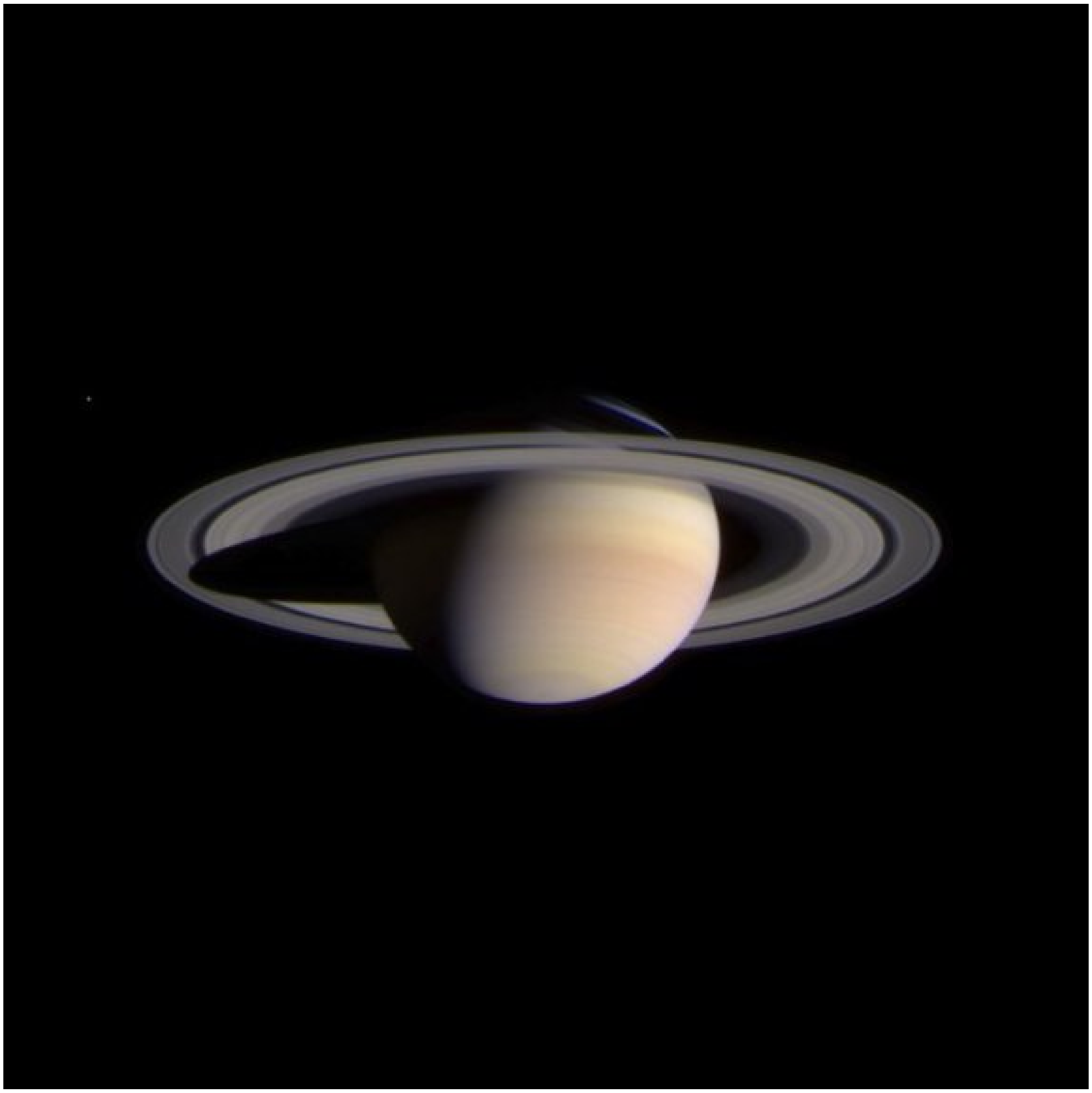
It takes almost twelve years to orbit the Sun so you’ll notice that it takes roughly a year to move from one zodiac sign to another. For example, this year you might notice it among the stars of Leo, but next year it’ll be moving through Virgo instead.

Jupiter, unlike the other planets, has something of interest to binocular observers. Even regular 10x50’s will show you its four largest moons strung out on either side of the planet.

These worlds are collectively named after Galileo Galilei, the Italian astronomer who first discovered them in January, 1610.

A small telescope can provide some stunning views, even at a reasonably low power. Just 15x may be enough to show the planet as a tiny circular disc and if you increase the magnification to 35x you’ll also be able to glimpse the dark bands in the planet’s atmosphere.

Saturn



Saturn, imaged by the Cassini space probe. Image credit: NASA/JPL/Space Science Institute (Double-tap image to enlarge.)

This, of course, is the famous ringed planet and the jewel of the solar system. Named for the Roman god of time, his Greek equivalent was Cronus, the last of the Titans and the father of Zeus.

Saturn is the most distant of the naked-eye planets, sixth in line from the Sun. It's therefore the slowest moving of those worlds, taking nearly thirty years to orbit the Sun and spending roughly 2½ years in each sign of the zodiac. To the naked eye, it appears as a bright star that's a very pale yellow and almost white in color.

Unfortunately, although you might be able to glimpse Titan, its largest moon, with binoculars (if you know where to look) the rings themselves require a telescope to be seen.

You'll need a magnification of about 35x to easily see them and it can be a sublime experience for first-time observers. Many describe the sight as being awe-inspiring, even a little overwhelming, as the planet appears to hang in space like an ornament hanging from a Christmas tree.

Besides the rings and a number of Saturn's brighter moons, there's not much else to see here through a small telescope. The rings will appear to widen and narrow as the planet orbits the Sun and our perspective changes, but the changes typically take a year or two to be noticeable.

Uranus, Neptune and Pluto

Uranus, imaged by the Voyager 2 space probe. Image credit: NASA/JPL (Double-tap image to enlarge.)

Uranus is a unique planet in our solar system for a number of reasons. Firstly, it's the only planet named after a Greek god (in this case, the god of the heavens) rather than its Roman equivalent. Its existence was unknown to the ancients as the planet is just a little too faint to be easily seen with the naked eye (although it can be identified if you know exactly where to look and the conditions are right.)

The planet is also unique in that it was the first to be discovered telescopically, several hundred years after the invention of the telescope itself. On March 13 1781 the British astronomer William Herschel spotted the planet but initially mistook it for a comet.

In fact, he wasn't the first to observe it as several earlier astronomers had recorded its position as a star. Historians have discovered potential observations dating back to ancient Greece but, of course, they had no idea that it was anything but a faint star.

Following its discovery, astronomers discovered another unique aspect of this world: it's the only one that lies on its side, rather than upright. It literally rolls around the Sun, making for some long and strange seasons as it completes its 84 year orbit.

Astronomers believe it may have been the victim of an interplanetary collision early in the solar system's formation, causing the planet to be tipped over.

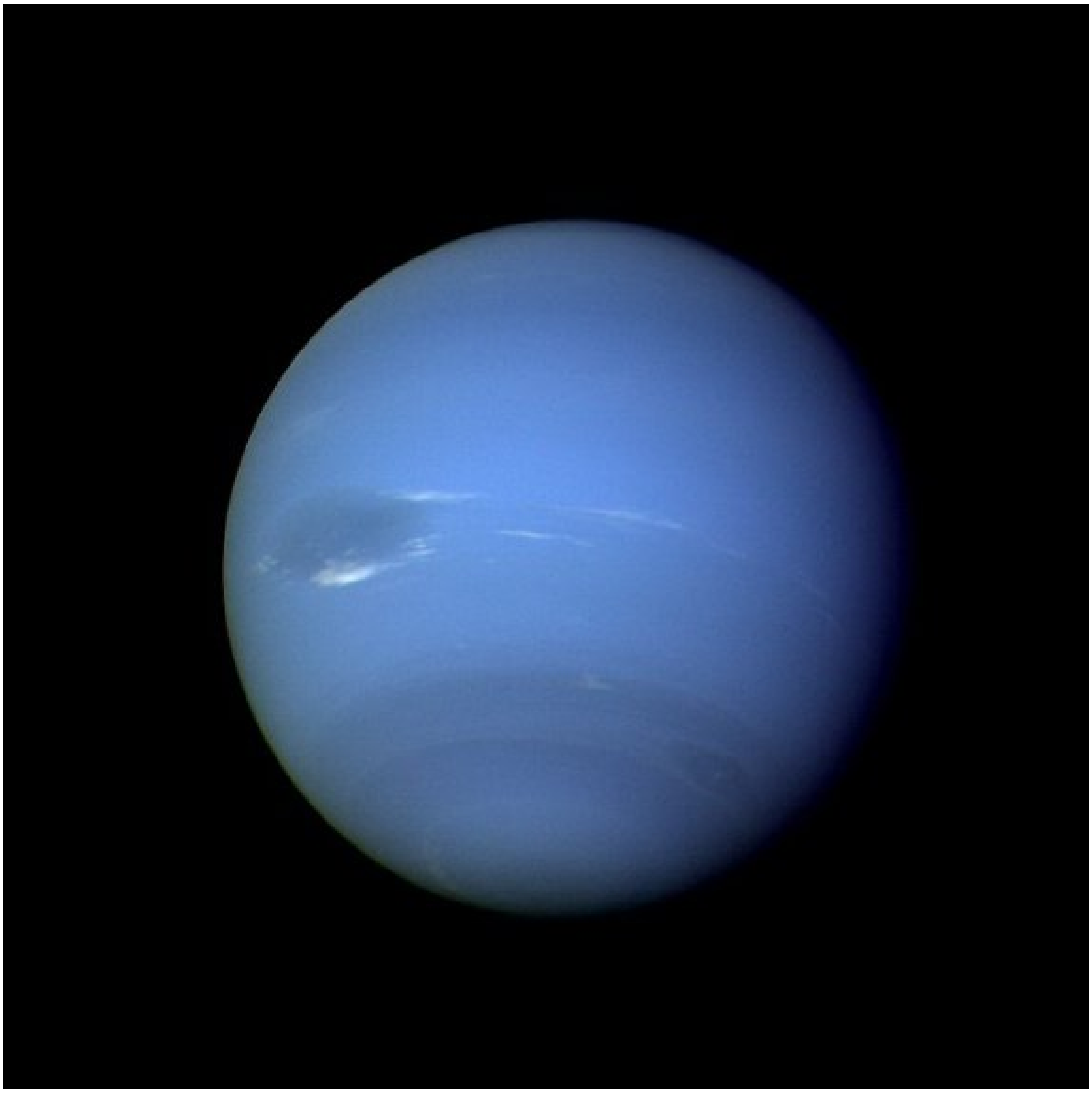
It can be seen as a starlike point through binoculars but a telescope at medium power will show a tiny, aquamarine disc. Unfortunately, that's about all you're likely to see!

Not long after its discovery, astronomers noticed that Uranus appeared to stray slightly from its predicted position. The reason seemed obvious: there must be an eighth, more distant world pulling on the planet.

The search was on and in 1846, Neptune became the first planet whose position was calculated and predicted ahead of its discovery.

Neptune is also the only planet whose discovery is accredited to two astronomers: Urbain Le Verrier and Johann Galle. Le Verrier had calculated its position while Galle, working at the Berlin Observatory, first observed the planet on September 23rd, 1846.

By the end of that year it had come to be known as Neptune, after the Roman god of the sea, with the original Greek equivalent being Poseidon.



Neptune, imaged by the Voyager 2 space probe. Image credit: NASA/JPL (Double-tap image to enlarge.)

Neptune, several magnitudes fainter than Uranus, is not visible to the unaided eye but it’s possible to glimpse the distant world with binoculars. (Like Uranus, you really need to know where to look.)

Binoculars will only show it as a faint star and most amateur telescopes won’t reveal much more. At low power it appears as a distinctly blue star-like point while high power (around 150x) will show a very tiny disc.

The discovery of Neptune did little to resolve the mystery of Uranus's apparent orbital discrepancies and, once again, astronomers speculated that a ninth planet lay beyond the orbit of Neptune.

The American astronomer Percival Lowell took it upon himself to locate the world, which he had dubbed "Planet X." Using his own observatory in Flagstaff, Arizona, Lowell searched for years and died in 1916 without any success.

The search faltered but then resumed, 13 years later, in 1929 when the task was given to a young astronomer named Clyde Tombaugh. Just one year later, after systematically photographing and studying the stars, he noticed one that appeared to have moved.

Pluto, imaged by the New Horizons space probe. Image credit: NASA/John Hopkins University Applied Physics Laboratory/Southwest Research Institute (Double-tap image to enlarge.)

Lowell’s Planet X had been discovered. Pluto, as it became known, was named for the Greek god of the Underworld – an appropriate name given the cold, dark space through which the tiny world moved. (Incidentally, Pluto has no clear Roman equivalent.)

Not only is Pluto far from the warm Sun, it’s also far beyond the reach of most amateur astronomers. It’s extremely faint, requires a fairly large telescope to see it and only ever appears as a dim point of starlike light.

However, Pluto is noteworthy for one unique reason: it’s the only world to be controversially downgraded from planet to dwarf planet status.

Pluto is a small world and it has an odd, elliptical orbit that sometimes takes it closer to the Sun that Neptune. This was something of a mystery to astronomers until the 1990’s when other, similar objects came to be discovered.

These objects shared a number of characteristics and orbited at great distances like Pluto. If Pluto was considered to be a planet, shouldn’t these newly discovered worlds be too? Or should astronomers redefine what it means to be a planet before the solar system became crowded with potentially hundreds?

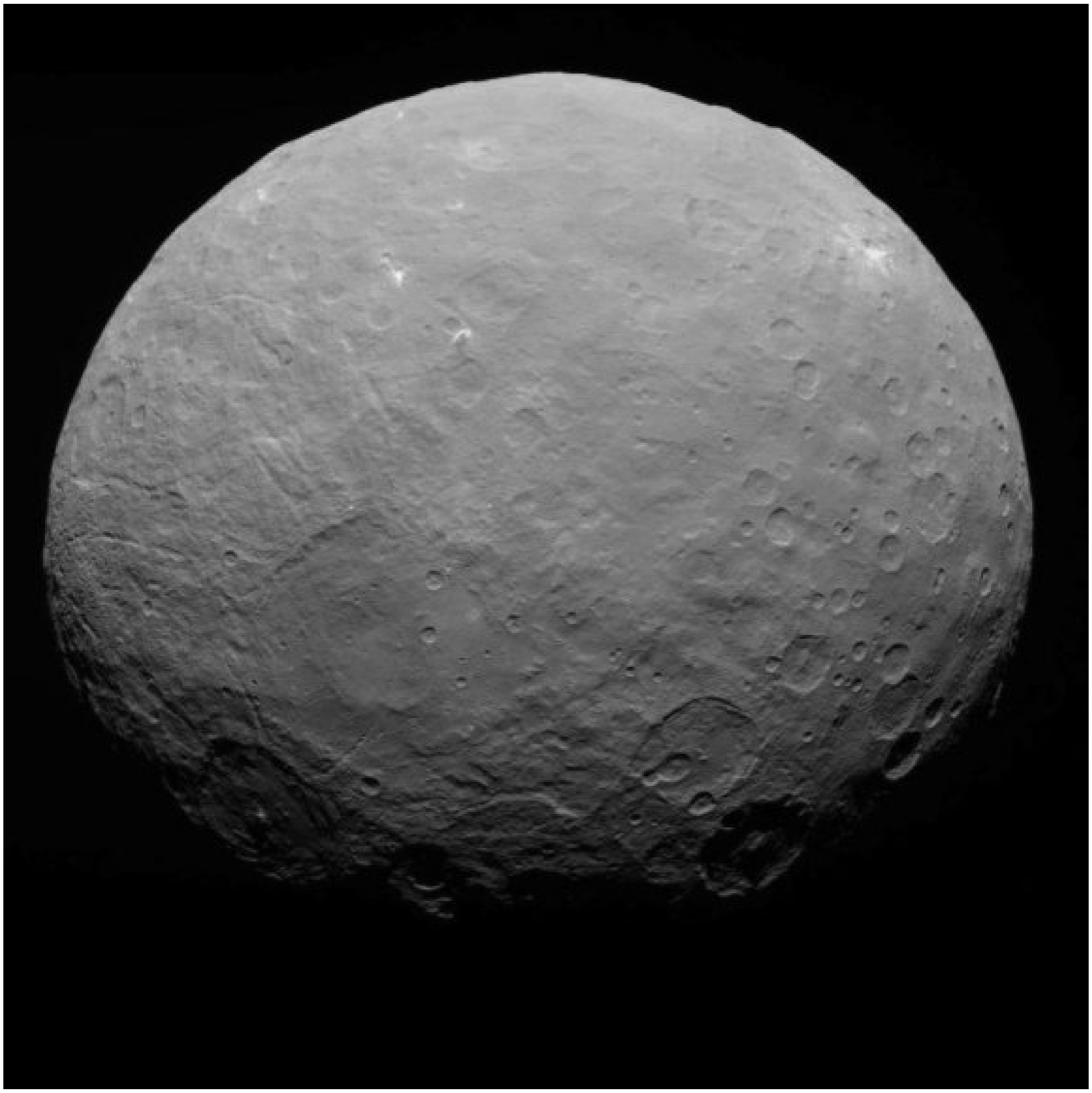
This was the dilemma facing the members of the International Astronomical Union (IAU) when they met in August 2006. The matter was debated and voted upon before a final decision was reached: Pluto would be demoted into a newly defined class known as a *dwarf planet*.

As a final footnote, it’s worth knowing that Pluto could not have any influence over the orbits of the planets. It’s simply too small for its gravity to have any effect. Astronomers now believe the discrepancies in the orbit of Uranus are due to the gravitational effects of Neptune alone.

Asteroids and Dwarf Planets

Pluto isn't the only world whose status has changed over the years and, like Pluto, it happened under very similar circumstances.

On January 1st 1801, the Italian astronomer Giuseppe Piazzi discovered Ceres, a small rocky world orbiting between the orbits of Mars and Jupiter.



Ceres, imaged by the Dawn space probe. Image credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA (Double-tap image to enlarge.)

Coming just twenty years after the discovery of Uranus in 1781, this world was initially thought to be a planet and, hence, the number of known planets in our solar system increased to eight.

But then, the following year, another world was discovered, Pallas, which also orbited between Mars and Jupiter. William Herschel, the famed discoverer of Uranus, quickly suggested the term “asteroid” (meaning “star-like”) to classify these objects as they only appeared as star-like points through a telescope.

By the end of 1851, fifty years after the discovery of Ceres, fifteen asteroids had been found and Ceres had ceased to be known as a planet.

Since then, nearly half a million asteroids (or minor planets, as they’re also sometimes known) have been discovered but the status of Ceres has changed once again.

When Pluto’s classification changed in 2006, the classification of Ceres changed as well. In essence, whereas Pluto was *de*moted, Ceres was effectively *pro*moted to the newly formed (and quite exclusive) group of dwarf planets.

It’s the only one of the asteroids to be promoted in this way and since it’s the largest of the asteroids, it’s unlikely that other bodies of a similar size will be discovered orbiting in that same part of the solar system as we surely would have discovered them by now!

As their classification suggests, you won’t see an asteroid as anything more than a star-like point. You can see the brightest through binoculars but unless you know what you’re looking for, your target will be lost among the background sea of stars.

The same is true of dwarf planets – even Ceres! In fact, there are only five confirmed dwarf planets and only Ceres is close enough and bright enough to be seen with binoculars. All the others lie far beyond the orbit of Neptune and require large telescopes to see them.

Comets

Comets are, in essence, dirty snowballs in space. They originate from the cold, outer reaches of the solar system and are thought to be the remaining building blocks of the solar system. (Which is why scientists are so keen to study them.)

Every now and then, it's thought a passing celestial body (like a star) will gravitationally disturb these icy chunks and send one spinning in toward the inner solar system.

As it comes closer, the snowball begins to melt and the icy debris is illuminated by sunlight. This matter is then blown back by the solar wind, a stream of electromagnetically charged particles emanating from the Sun, and forms a tail streaming behind the comet.

(In fact, if you're lucky enough to see a cometary tail, you might notice that it always points *away* from the Sun in the sky.)

Comet Hale-Bopp in 1997. Image credit: Franz Haar (Double-tap image to enlarge.)

What happens next really depends on a number of things, such as the comet's size, composition and, perhaps most importantly, its trajectory through the solar system.

Some comets approach the inner solar system and get pulled in toward the Sun. They'll either collide with the Sun or simply won't survive the encounter because they'll fragment and break apart.

Others will form a highly elliptical orbit about the Sun and will someday return, but only after thousands of years. These are known as long period comets.

Others form less elliptical orbits and will periodically return within our own lifetimes. The most famous of these short period comets is Comet Halley, named for the astronomer who correctly predicted the comet's return.

More rarely, a comet will be perturbed by one of the planets (most commonly Jupiter) and may even collide with a planet or moon. For example, comet Shoemaker-Levy 9 was a comet that actually orbited the giant planet Jupiter.

In 1992, it passed too close to the planet and was broken apart by Jupiter's gravity. Two years later it returned and the fragments smashed into the planet's atmosphere, leaving huge dark scars that were visible for months.

The problem with comets is that they're unpredictable. You never know when a new one is going to be discovered and, even with known short-period comets, you never quite know how bright they'll appear.

For example, Comet Halley, which passes by the Earth every 76 years, returned in 1985/6 and was greatly anticipated (and publicized) by the astronomical community. Unfortunately, it under-performed, was barely visible to the naked eye and disappointed many.

Conversely, Comet Hale-Bopp was an easy naked eye object for 18 months in 1996/7 and was seen by millions of people around the world.

Despite the unpredictable nature of the comets themselves, comet hunting is a branch of astronomy in which you can make substantial contributions, including discovering a comet for yourself.

Hale-Bopp was independently discovered by two amateurs in the United States, Alan Hale and Thomas Bopp. Hale discovered it from his driveway in New Mexico while Bopp was observing with friends in Arizona (he didn't even own a telescope at the time!)

Proof that, despite the amazing advances in astronomy since Edmund Halley predicted the return of the comet that would bear his name, amateurs can still go outside, discover a comet and have their names recorded in history!

Meteor Showers

Everyone has seen a meteor and many of us have wished upon one. Some folks call them “shooting stars” or “falling stars” but the reality is a little more mundane.

What is a meteor? Often nothing more than cosmic dust and typically nothing larger than an apple seed. They appear to shoot brilliantly across the sky because of the speed with which they enter the atmosphere and burn up.

But where do they come from? The answer might surprise you – comets – and each meteor shower is thought to have originated with a specific comet.

As the comet orbits the Sun it leaves behind a trail of dust in its wake; the Earth then passes through that trail and we see shooting stars across our sky. Of course, over time these comet trails become depleted but some comets make regular returns and the trail is renewed.

A Perseid meteor streaks close to the summer Milky Way. Image credit: Matthias Loiseau (Double-tap image to enlarge.)

This is why we have reliable meteor showers at specific times throughout the year. Some (for example, the Perseids) are more reliable than others. A shower's Zenith Hourly Rate (ZHR) can give you an idea of how many you might see overhead on the peak date.

Reliable or not, all are subject to one major observational obstruction: light pollution.

Whether it’s from a bright Moon or the lights of a nearby town or city, observers ideally need clear, dark skies to see the most meteors during any given shower. Just as moonlight can brighten the sky and drown out the light from the fainter deep sky objects, so meteors can also be lost within the glare of the Moon.

Therefore, shooting stars are best seen when the Moon is less than half full and, ideally, in the evening sky as meteor showers are usually best seen in the pre-dawn skies.

Why is this? As the Earth orbits the Sun, the leading edge of the planet is the side that moves through the dust cloud head-on. This is also the pre-dawn side of the planet. Think of it like a car driving through a snow storm – you’ll see a lot more flakes hitting the windshield at the front of the car than on the back window.

Lastly, meteors originate from a point in the sky called the *radiant*. Each shower originates from a different point in the sky and the shower’s name will typically reflect the constellation from which it originates.

See here for a complete list of meteor showers.

Appendix

The Greek Alphabet

Alpha	α
Beta	β
Gamma	γ
Delta	δ
Epsilon	ε
Zeta	ζ
Eta	η
Theta	θ
Iota	ι
Kappa	κ
Lambda	λ
Mu	μ
Nu	ν
Xi	ξ
Omicron	ο
Pi	π
Rho	ρ
Sigma	σ
Tau	τ
Upsilon	υ
Phi	φ
Chi	χ
Psi	ψ
Omega	ω

Elongations of Mercury, 2017-2026

2017

January 18th	Morning Sky
March 31st	Evening Sky
May 17th	Morning Sky
July 29th	Evening Sky
September 11th	Morning Sky
November 23rd	Evening Sky

2018

January 1st	Morning Sky
March 14th	Evening Sky
April 28th	Morning Sky
July 11th	Evening Sky
August 26th	Morning Sky
November 5th	Evening Sky
December 14th	Morning Sky

2019

February 26th	Evening Sky
April 11th	Morning Sky
June 23rd	Evening Sky
August 9th	Morning Sky
October 19th	Evening Sky
November 27th	Morning Sky

2020

February 9th	Evening Sky
March 23rd	Morning Sky

June 3rd	Evening Sky
July 21st	Morning Sky
September 30th	Evening Sky
November 9th	Morning Sky

2021

January 23rd	Evening Sky
March 5th	Morning Sky
May 16th	Evening Sky
July 4th	Morning Sky
September 13th	Evening Sky
October 24th	Morning Sky

2022

January 6th	Evening Sky
February 16th	Morning Sky
April 28th	Evening Sky
June 15th	Morning Sky
August 26th	Evening Sky
October 8th	Morning Sky
December 20th	Evening Sky

2023

January 29th	Morning Sky
April 11th	Evening Sky
May 28th	Morning Sky
August 9th	Evening Sky
September 21st	Morning Sky
December 3rd	Evening Sky

2024

January 11th	Morning Sky
March 24th	Evening Sky
May 9th	Morning Sky
July 21st	Evening Sky
September 4th	Morning Sky
November 15th	Evening Sky
December 24th	Morning Sky

2025

March 7th	Evening Sky
April 20th	Morning Sky
July 3rd	Evening Sky
August 18th	Morning Sky
October 29th	Evening Sky
December 7th	Morning Sky

2026

February 18th	Evening Sky
April 3rd	Morning Sky
June 15th	Evening Sky
August 1st	Morning Sky
October 11th	Evening Sky
November 20th	Morning Sky

Elongations of Venus, 2017-2026

2017

January 11th	Evening Sky
June 2nd	Morning Sky

2018

August 16th	Evening Sky

2019

January 5th	Morning Sky

2020

March 24th	Evening Sky
August 12th	Morning Sky

2021

October 29th	Evening Sky

2022

March 19th	Morning Sky

2023

June 3rd	Evening Sky
October 23rd	Morning Sky

2024

Venus does not reach elongation in 2024.

2025

January 9th	Evening Sky
May 31st	Morning Sky

2025

August 14th	Evening Sky

Oppositions of Mars, 2017-2026

2017

Mars does not reach opposition in 2017.

2018

July 26th	Capricornus

2019

Mars does not reach opposition in 2019.

2020

October 13th	Pisces

2021

Mars does not reach opposition in 2021

2022

December 7th	Taurus

2023

Mars does not reach opposition in 2023.

2024

Mars does not reach opposition in 2024.

2025

January 15th	Gemini

2026

Mars does not reach opposition in 2026.

Oppositions of Jupiter, 2017-2026

2017

April 7th	Virgo

2018

May 8th	Libra

2019

June 9th	Ophiuchus

2020

July 14th	Sagittarius

2021

August 19th	Capricornus

2022

September 26th	Pisces

2023

November 2nd	Aries

2024

December 7th	Taurus

2025

Jupiter does not reach opposition in 2025.

2026

January 9th	Gemini

Oppositions of Saturn, 2017-2026

2017

June 14th	Ophiuchus

2018

June 27th	Sagittarius

2019

July 8th	Sagittarius

2020

July 14th	Sagittarius

2021

July 20th	Capricornus

2022

August 1st	Capricornus

2023

August 27th	Aquarius

2024

September 7th	Aquarius

2025

September 20th	Pisces

2026

October 3rd	Cetus

Recommended Resources

Facebook Groups

- Astronomy for Beginners (A4B)
- Astronomy for Fun
- Astronomy Workfile
- Online Astronomy Society
- Space Science and Astronomy for Home Educators
- Telescope Addicts – Astronomy & Astrophotography
- UK Astronomy

Websites

(If anyone has a website they would like for me to add, please feel free to email me at astronomywriter@gmail.com)

- Online Astronomy Society Academy
- The Astronomical Year

Books

- *365 Starry Nights* – Chet Raymo
- *Astronomy Hacks* – Robert Bruce Thompson & Barbara Fritchman Thompson
- *Binocular Highlights* – Gary Seronik
- *Celestial Harvest* – James Mullaney
- *Celestial Sampler* – Sue French
- *Cosmic Challenge* – Philip S. Harrington
- *Deep Sky Observing with Small Telescopes* – David J. Eicher
- *Deep-Sky Wonders* – Sue French
- *Deep Sky Wonders* – Walter Scott Houston
- *Double Stars for Small Telescopes* – Sissy Haas
- *Illustrated Guide to Astronomical Wonders* – Robert Bruce Thompson & Barbara Fritchman Thompson
- *Observer's Sky Atlas, The* – E. Karkoschka

- *Observing Handbook and Catalogue of Deep-Sky Objects* – Christian B. Luginbuhl and Brian A. Skiff
- *Planet Observer's Handbook, The* – Fred W. Price
- *Pocket Sky Atlas* – Roger W. Sinnott
- *Star-Hopping for Backyard Astronomers* – Alan M. MacRobert
- *Star Names – Their Lore and Meaning* – Richard Hinckley Allen
- *Star Watch* - Philip S. Harrington
- *Touring the Universe Through Binoculars* – Phillip S. Harrington
- *Turn Left at Orion* – Guy Consolmagno and Dan M. Davis

Software

- *Mobile Observatory* by Wolfgang Zima (http://zima.co)
- *Sky Tools* by Greg Crinklaw (http://www.skyhound.com)
- *Stellarium* (Open Source software – http://www.stellarium.org)