

## MESSIER 31, THE ANDROMEDA GALAXY

next door to our Milky Way

The Andromeda galaxy is the closest spiral galaxy to our Milky Way and the most distant thing you can see with your eye alone.

Although a couple of dozen minor galaxies lie closer to our Milky Way, the Andromeda galaxy is the closest major galaxy to ours. Excluding the Large and Small Magellanic Clouds, which can't be seen from northerly latitudes, the Andromeda galaxy – also known as M31 – is the brightest galaxy in all the heavens. It's the most distant thing you can see with your unaided eye, at 2.3 million light-years. **To the eye, it appears as a smudge of light as large as a full moon.**

From mid-northern latitudes, you can see the Andromeda galaxy – for at least part of every night, all year long. But most people see the galaxy first in northern autumn, when it's high enough in the sky to be seen from nightfall till daybreak. In late September and early October, the Andromeda galaxy shines in your eastern sky at nightfall, swings high overhead around midnight and stands rather high in the west at the onset of morning dawn. Winter evenings are also good for viewing the Andromeda galaxy.

If you are far from city lights, and it's a moonless night – and you're looking on an autumn or winter evening – it's possible you'll simply notice the galaxy in your night sky. It looks like a hazy patch in the sky, as wide across as a full moon.

But if you look, and don't see the galaxy – yet you know you're looking at a time when it's above the horizon – you can star-hop to find the galaxy in one of two ways. First, you can use the Great Square of Pegasus, and second, in the Northern Hemisphere, use the constellation Cassiopeia.

**Using the Great Square of Pegasus to find the Andromeda Galaxy.** The Great Square of Pegasus looks, just like it says, a great big square in the eastern sky. We, in the Southern Hemisphere, have the advantage of seeing Pegasus actually the “right way” up, and Andromeda lies near what looks like the two hind legs of the flying horse. These stars actually belong to the constellation Andromeda, the Princess. From Alpheratz, the bottom right star of the Square, go two stars down (northward) to the stars Mirach and Mu Andromedae. Draw a line from Mirach through Mu Andromedae, go again the Mirach/Mu Andromedae distance and you've just landed on the Andromeda galaxy. It looks like a smudge of light to the unaided eye. If you can't see the Andromeda galaxy with the eye alone, by all means use binoculars.

**Finding the Andromeda Galaxy using the constellation Cassiopeia.** Many people use the Cassiopeia to find the Andromeda galaxy, because Cassiopeia itself is so easy to spot. It is shaped like the letter M or W, prominent in the Northern Hemisphere. If you can recognize the north star, Polaris – and if you know how to find the Big Dipper – be aware that the Big Dipper and Cassiopeia move around Polaris like the hands of a clock, always opposite each other. To find the Andromeda galaxy via Cassiopeia, look for the star Schedar (Arabic for breast) in the W and see how it points to Andromeda.

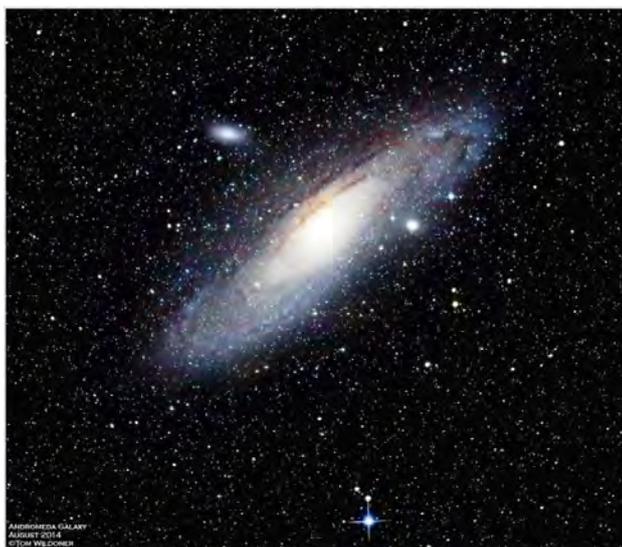
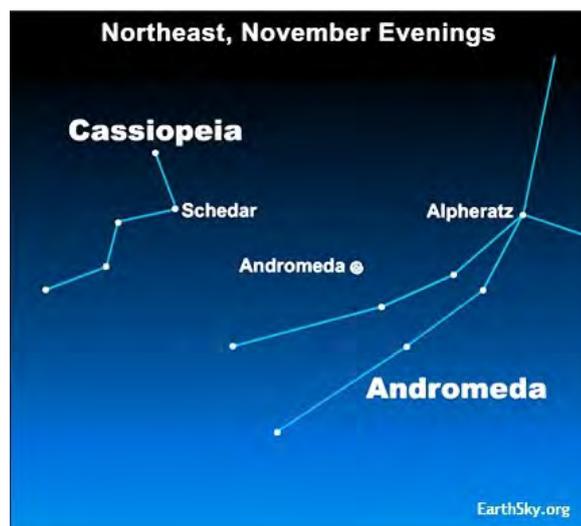


Image of the Andromeda galaxy captured in August 2014



To find Andromeda galaxy use the Square of Pegasus



## HISTORY OF THE ANDROMEDA GALAXY.

At one time, the Andromeda galaxy was called the Great Andromeda Nebula. Astronomers thought this patch of light was composed of glowing gases, or was perhaps a solar system in the process of formation.

It wasn't until the 20<sup>th</sup> century that astronomers were able to resolve the Andromeda spiral nebula into individual stars. This discovery led to a great controversy about whether the Andromeda spiral nebula, as well as other spiral nebulae, lie within or outside the Milky Way.

In the 1920s Edwin Hubble finally put the matter to rest, when he used Cepheid variable stars within the Andromeda galaxy to determine that it is indeed an island universe residing way beyond the bounds of our Milky Way galaxy.

## ANDROMEDA AND MILKY WAY IN CONTEXT.

The Andromeda galaxy and our Milky Way galaxy reign as the two most massive and dominant galaxies within the Local Group of Galaxies. Both are some 100,000 light-years across, containing enough mass to make billions of stars.

**The Andromeda Galaxy is the largest galaxy of the Local Group, which, in addition to the Milky Way, also contains the Triangulum Galaxy, and about 30 smaller galaxies.**

Both the Milky Way and the Andromeda galaxies lay claim to about a dozen satellite galaxies. The Andromeda Galaxy has 14 known dwarf galaxy satellites. The best known and most readily observed satellite galaxies are M32 and M110. Based on current evidence, it appears that M32 underwent a close encounter with the Andromeda Galaxy in the past. M32 may once have been a larger galaxy that had its stellar disk removed by M31, and underwent a sharp increase of star formation in the core region, which lasted until the relatively recent past.

M110 also appears to be interacting with the Andromeda Galaxy, and astronomers have found in the halo of the latter a stream of metal-rich stars that appear to have been stripped from these satellite galaxies. M110 does contain a dusty lane, which may indicate recent or ongoing star formation.

In 2006 it was discovered that nine of the satellite galaxies lie in a plane that intersects the core of the Andromeda Galaxy; they are not randomly arranged as would be expected from independent interactions. **This may indicate a common tidal origin for such satellites.**

**Astronomers have discovered that our Local Group is on the outskirts of a giant cluster of several thousand galaxies – which astronomers call the Virgo Cluster.**

We also know of an irregular Supercluster of galaxies, which contains the Virgo Cluster, which in turn contains our Local Group, which in turn contains our Milky Way galaxy and the nearby Andromeda galaxy. At least 100 galaxy groups and clusters are located within this Virgo Supercluster. Its diameter is thought to be about 110 million light-years. **The Virgo Supercluster is thought to be only one of millions of such superclusters in the observable universe.**

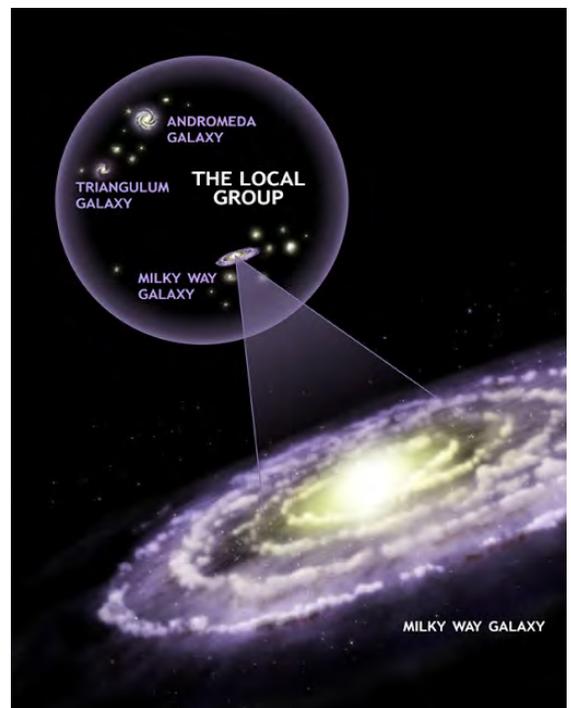
AK, with EarthSky and Wikipedia Notes



The Great Andromeda Nebula, photographed in the year 1900. At this point, astronomers could not discern individual stars in the galaxy. Many thought it was a cloud of gas within our Milky Way – a place where new stars were forming.



Andromeda as depicted in Urania's Mirror, a set of constellation cards published in London c. 1825



Artist's illustration of our Local Group