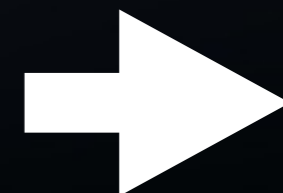


PENN DIXIE SITE

ASTRONOMY NIGHT

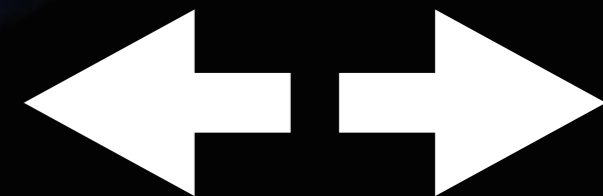


Image: NASA



MAIN MENU

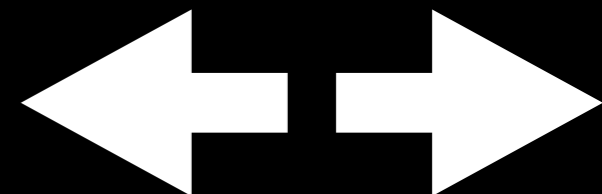
- [About Penn Dixie](#)
- [About Images Used in this Presentation](#)
- [About the Astrophotographers](#)
- [Observing Targets: Our Solar System](#)
- [Observing Targets: Deep Space Objects \(DSO's\)](#)
- [Interested in Getting a Telescope](#)
- [Astronomy Related Links](#)



ABOUT PENN DIXIE



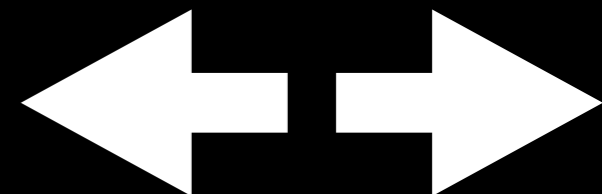
- Penn Dixie Paleontological and Outdoor Education Center
- Owned and Operated by the Hamburg Natural History Society, Inc.
- Founded to Protect and Promote Education about our Natural Resources
- Check out penndixie.org to find out more
- Like us on [Facebook](#)



ABOUT IMAGES



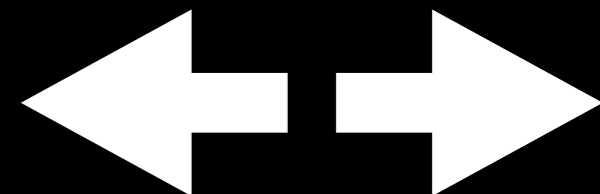
- Images used in this presentation were provided by Alan Friedman and Gary Gonnella. [Click here](#) for more info on these talented astrophotographers.
- Some of the images shown are short exposure images with minimal processing. These images were chosen to more closely resemble the view thru an eyepiece.
- A few of the images used come from NASA and some are mine.



THE ASTROPHOTOGRAPHERS



- **Alan Friedman:** Mr. Friedman is a world renowned astrophotographer from right here in Western New York. He is most well known for his images of the Sun. His images have been widely published and he is very involved in the Buffalo Astronomical Association. You can see more of Mr. Friedman's work at *Averted Imagination*.
- **Jim Maroney:** Jim is Penn Dixie's resident astrophotographer. Jim is from Springville, NY and has been volunteering at Penn Dixie for the last few years. Come out to an Astronomy Night and you can learn what it takes to produce these amazing images. Jim is a veteran of the Buffalo Police department and a member of the Buffalo Astronomical Association. You can check out Jim's work at www.thegreatbigsky.com.
- **Gary Gonnella:** Mr. Gonnella is a talented deep space astrophotographer from Los Angeles, California. I was first exposed to his work on The Virtual Star Party (check this out on YouTube). In fact many of the short exposure/minimal processing images used come from Virtual Star Part Episodes. You can see more of Mr. Gonnella's work on Google+.



OBSERVING TARGETS



- Our Solar System:

- Our Sun

- Mercury

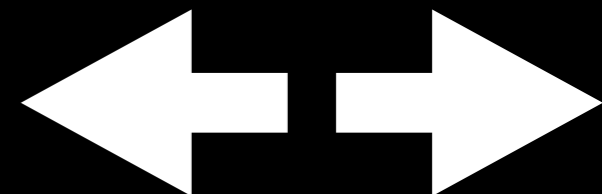
- Venus

- The Moon

- Mars

- Jupiter

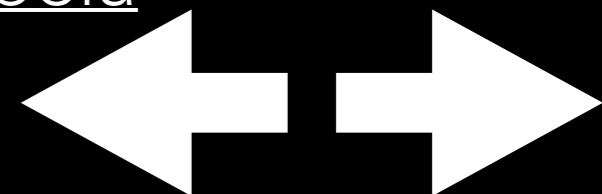
- Saturn



OBSERVING TARGETS CONT'D



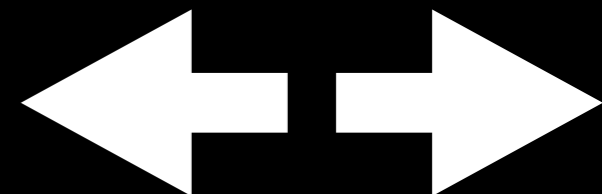
- Deep Sky Objects:
 - Star Clusters:
 - M13 - The Great Cluster in Hercules
 - M44 - The Cluster in Cancer
 - M45 - The Pleiades
 - NGC 869 & 884 - The Double Cluster in Perseus
 - NGC 457 - The Owl or The ET Cluster in Cassiopeia



OBSERVING TARGETS CONT'D



- Nebulae:
 - M27 - The Dumbbell Nebula
 - M42 - The Great Orion Nebula
 - M57 - The Ring Nebula
- Galaxies & Double Stars
 - M31 - The Andromeda Galaxy
 - Mizar
 - Albireo



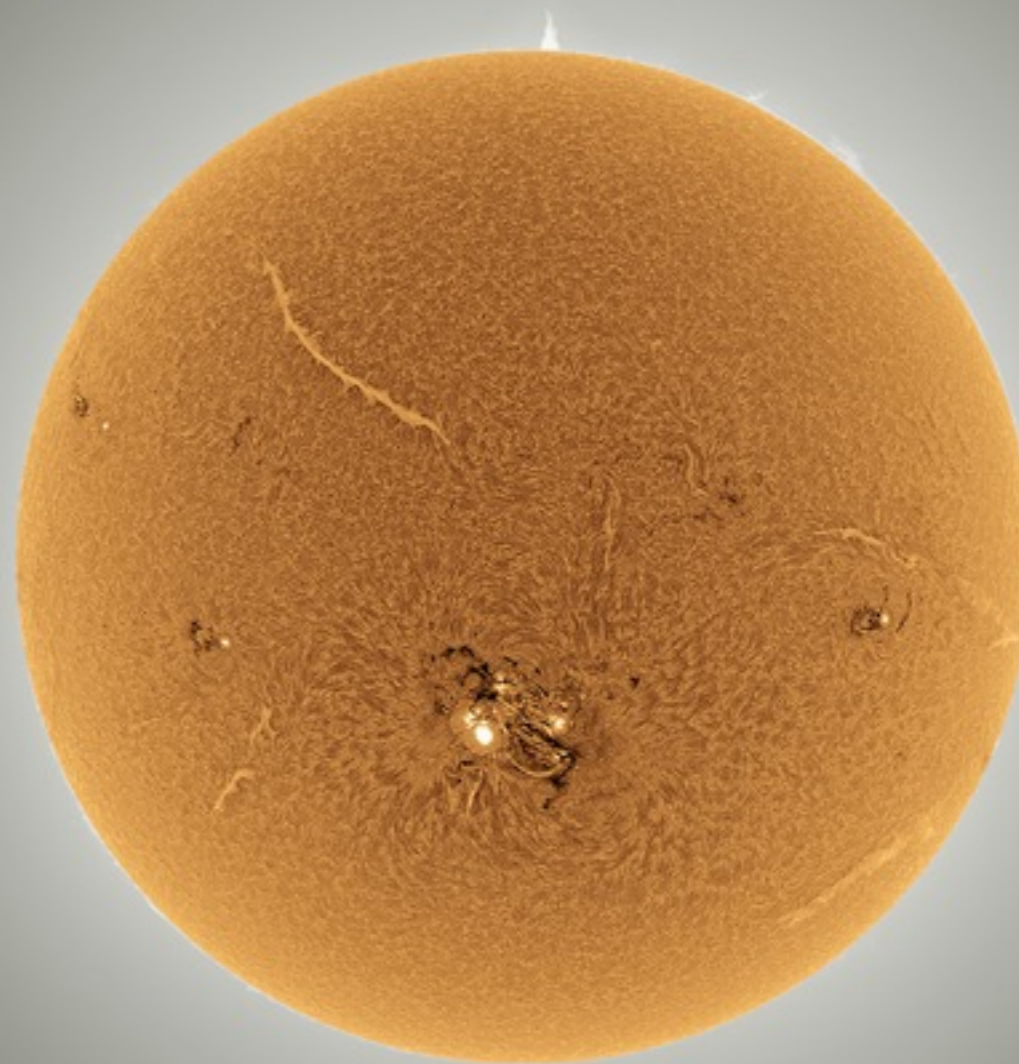
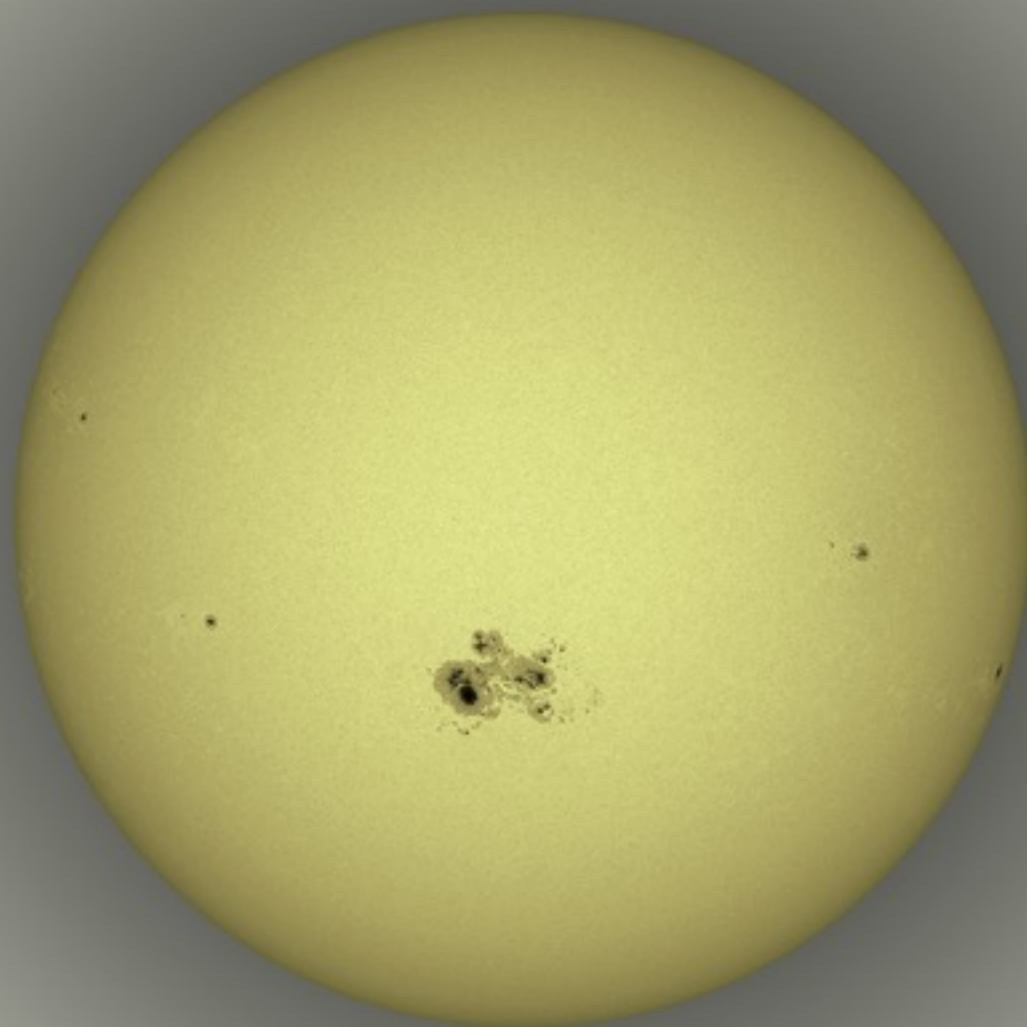
OUR HOME IN THE MILKY WAY GALAXY
THE SOLAR SYSTEM



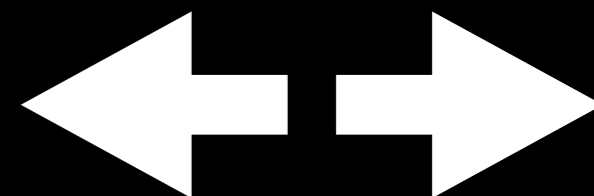
Image: NASA



OUR HOME STAR
THE SUN



Images: Alan Friedman



THE SUN



What is it?

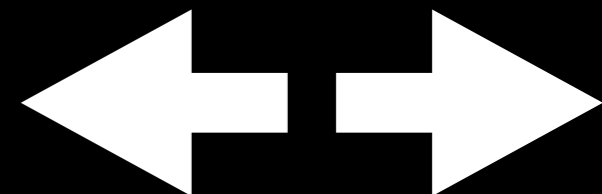
- The Sun is our home Star and provides us with the energy required for life.
- The Sun is a giant burning ball of gas (plasma) made up of 92.1% Hydrogen and 7.8% Helium.

How Big is it?

- The Sun has a diameter of about 1.4 Million km (900,000 miles). **That's 109.2 x's bigger than the Earth!**
- Our star makes up 99.8% of the mass of the entire solar system.

How far away?

- The Sun is located about 150 million km (93 million miles) or 1 AU from the Earth.

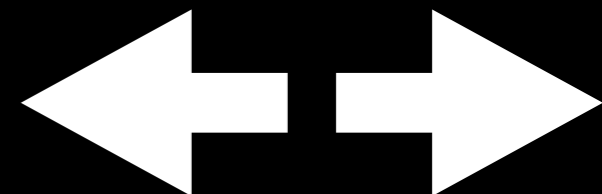


THE SUN



Other Facts:

- The Sun is not solid and therefore different parts rotate at different rates. The equator takes 25 Earth days to complete one revolution and the Poles take 36 Earth days.
- The Sun is about 15 million degrees C (27 million degrees F) at its core and about 5,500 degrees C (10,000 degrees F) on its surface
- The Sun is located about 26,000 Light Years from the center of our home galaxy, The Milky Way.
- The Sun is about 4.6 billion years old.



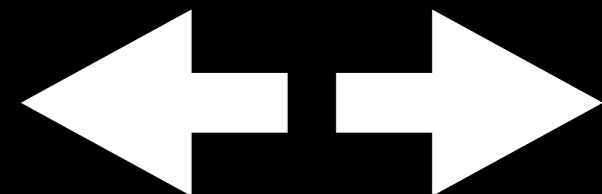
THE SUN



!!!Warning!!!

Never Look at the Sun Directly or Point a Telescope, Binoculars, Camera etc.. at the Sun without special filters. The Damage will be Instant and Permanent.

We have special filters for our scopes that allow safe viewing of The Sun.



THE SUN



This is what The Sun will look like in our Scopes.



Images: Ernie Jacobs



THE SUN

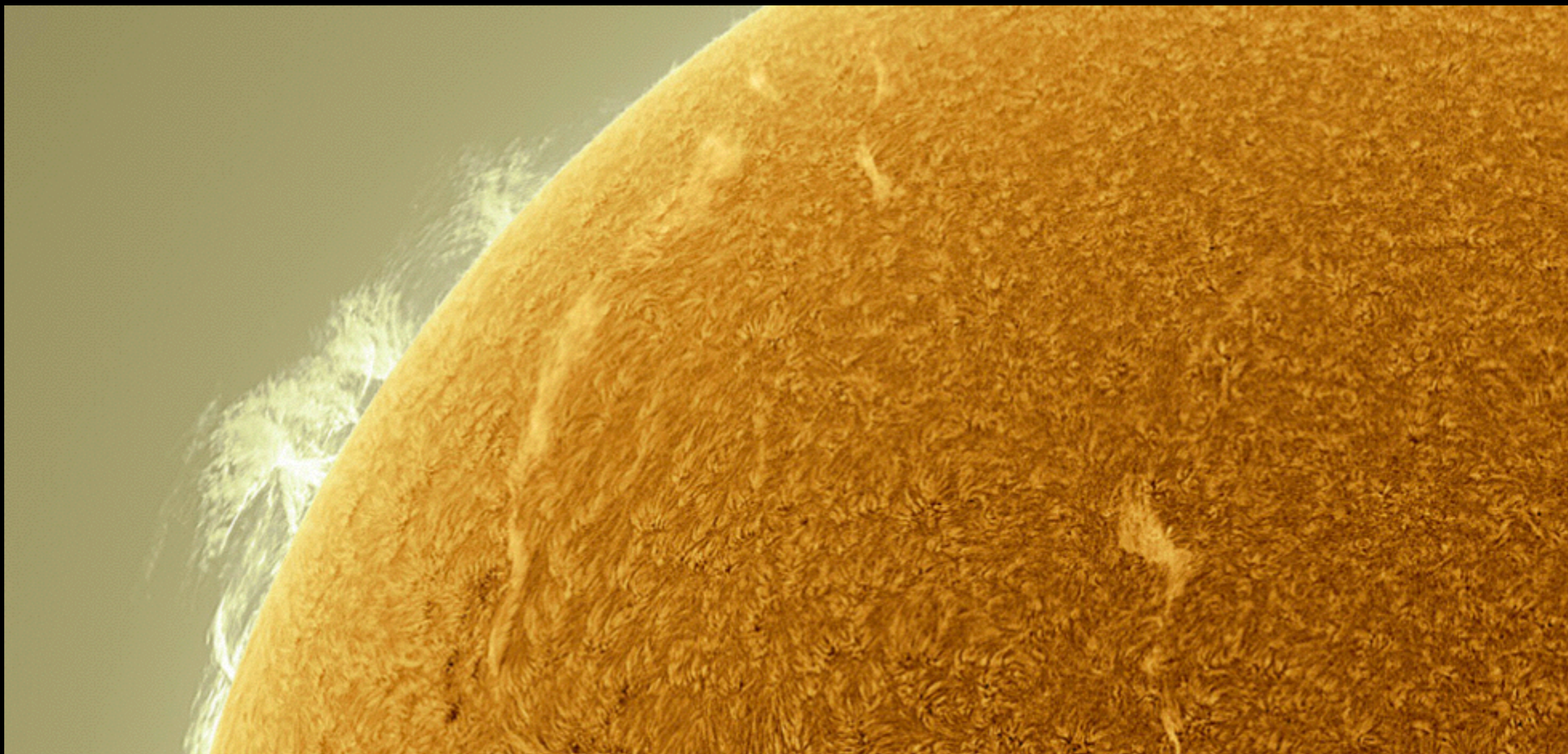
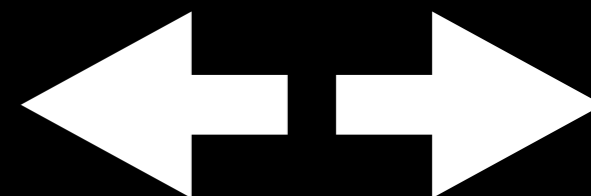


Image: Alan Friedman

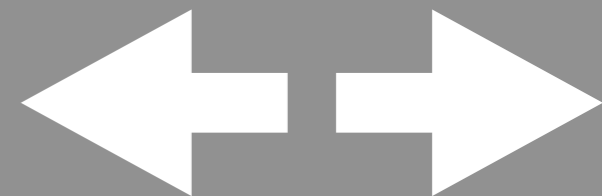


THE SUN



Image of the Earth added to show scale.

Image: Alan Friedman

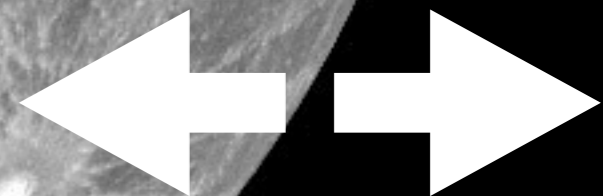


1ST PLANET FROM SUN

MERCURY



Image: NASA



MERCURY



What Is It?

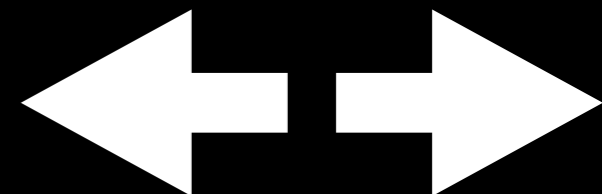
- Mercury is the closest planet to the Sun, one of the four inner or terrestrial (rocky) planets.

How Big Is It?

- Mercury has a diameter of about 5,000 km (3,000 miles).
- Mercury is the smallest planet (a little larger than Earth's Moon).

How Far Away?

- It orbits the Sun at about 58 million km (36 million miles) or 0.39 AU.

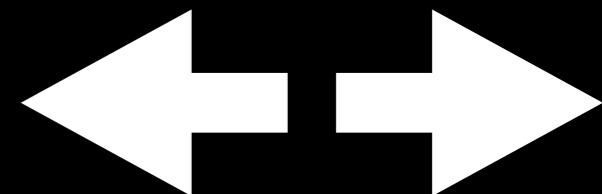


MERCURY



Other Facts:

- 1 day on Mercury lasts 59 Earth days.
- It takes Mercury 88 Earth days to complete 1 orbit around the Sun.
- Standing on the surface of Mercury the Sun would appear 3 times bigger than it does on Earth.
- During the day Mercury reaches temperatures of 430 degrees C (800 degrees F) and drops to -180 degrees C (-290 degrees F) at night.
- Mercury is named after the Messenger of the Roman gods.



MERCURY



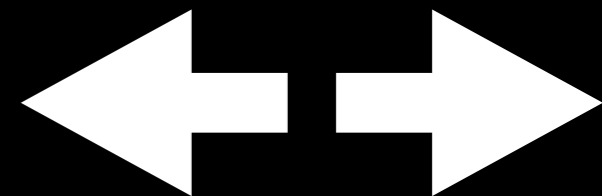
Jupiter

Mercury

Venus

3 Planet Conjunction - 5/25/2013

Image: Ernie Jacobs



THE MORNING AND EVENING STAR

VENUS

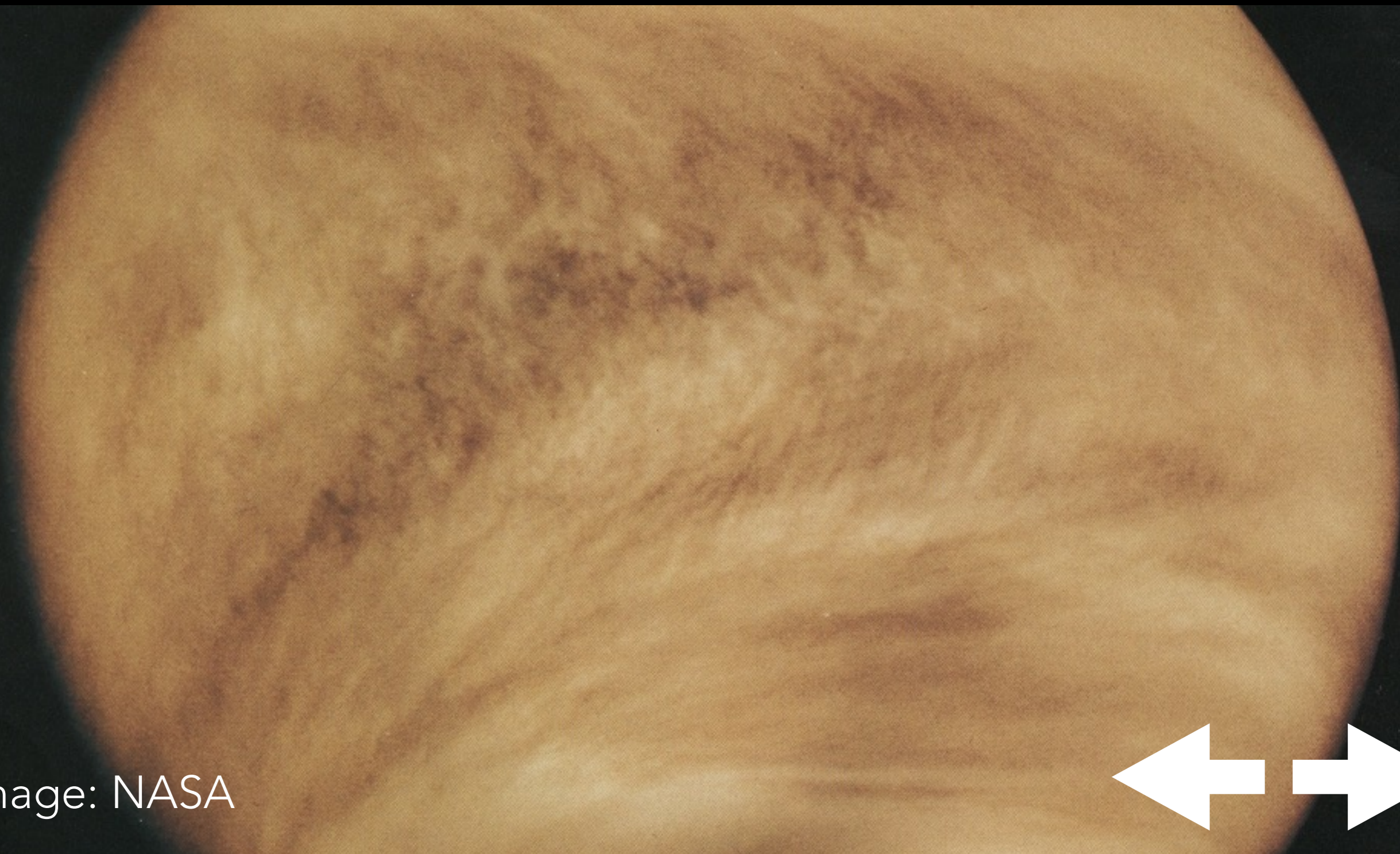


Image: NASA



VENUS



What Is It?

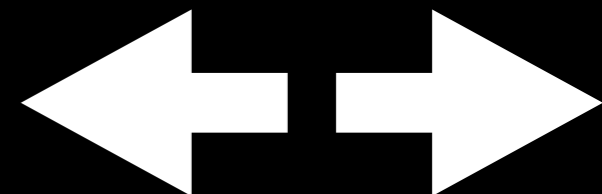
- Venus is the second planet from the Sun, one of the four inner or terrestrial (rocky) planets.

How Big Is It?

- Venus has a diameter of about 12,000 km (7,500 miles).
- Venus is often referred to as Earth's twin as it is so close in size to our planet (Venus is approx. 95% the size of Earth).

How Far Away?

- It orbits the Sun at about 108 million km (67 million miles) or 0.72 AU.

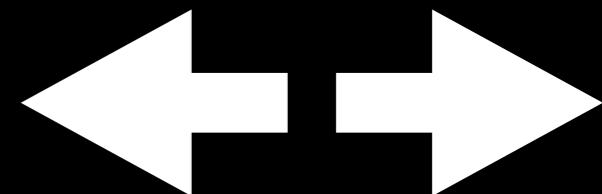


VENUS



Other Facts:

- Appears in the morning or evening sky when visible (typically the second brightest object in the sky behind the Sun and the Moon).
- 1 day on Venus lasts 243 Earth days .
- Venus spins backward (retrograde rotation) compared the other planets in the solar system.
- Venus takes about 225 Earth days to complete 1 orbit around the Sun.
- Venus has a thick toxic atmosphere and is about 480 degrees C (900 degrees F).
- Venus is named after the Roman goddess of Love and Beauty.



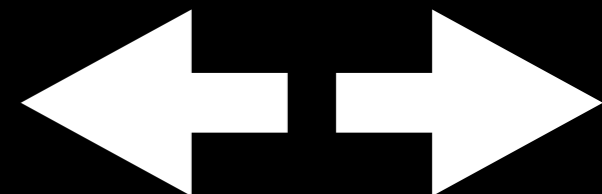
VENUS



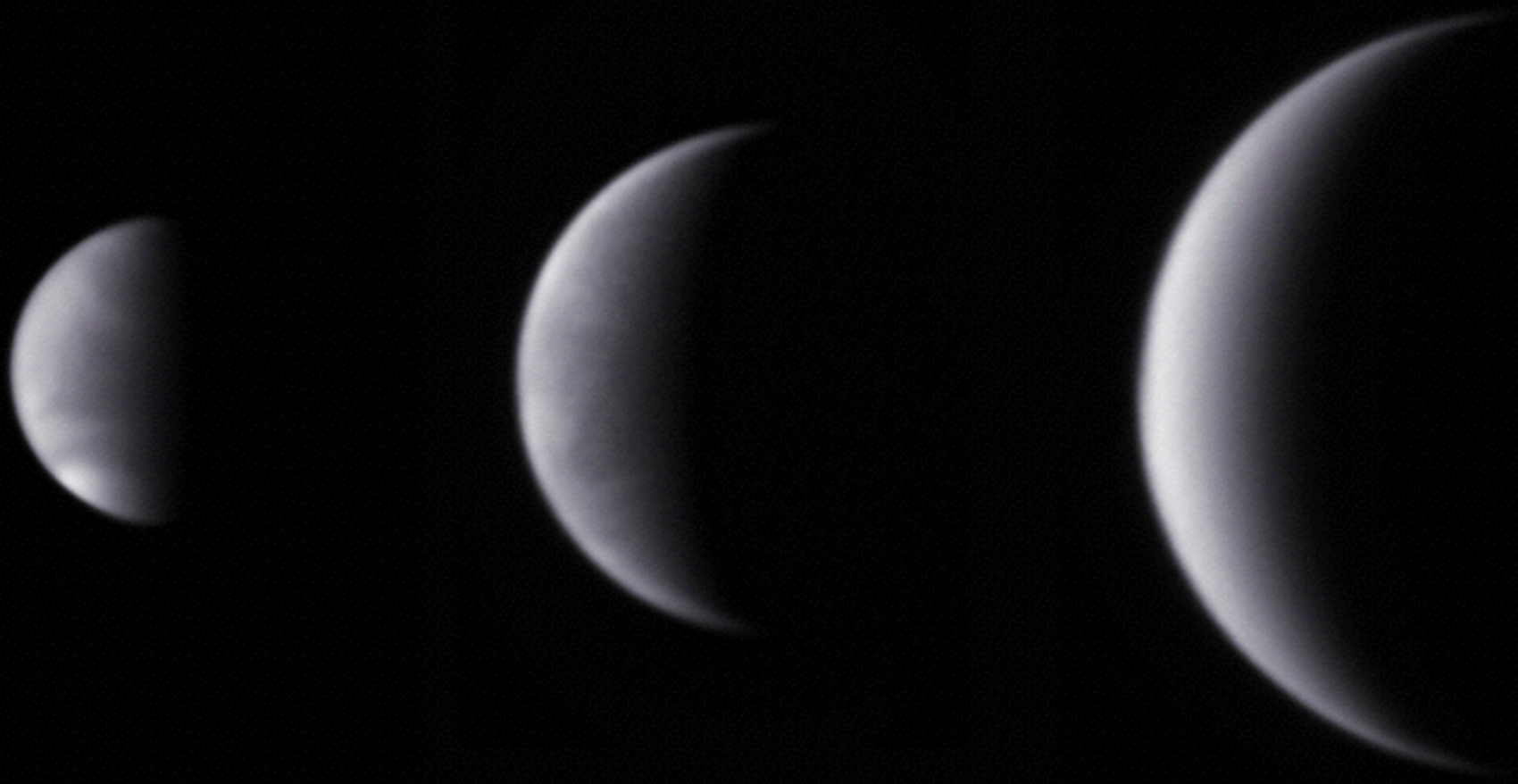
Image from the Surface of Venus taken by the Venera 13
lander in March, 1982



Image: NASA



VENUS



Venus

3 November 2007
near UV (395nm)
distance: 110 million km
brightness: mag -4.35

4 October 2007
near UV (395nm)
distance: 77 million km
brightness: mag -4.52

19 September 2007
full visible spectrum
distance: 60 million km
brightness: mag -4.54

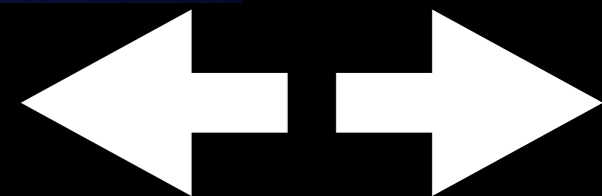
Image: Alan Friedman



OUR CLOSEST COMPANION
THE MOON



Image: Ernie Jacobs



THE MOON



What Is It?

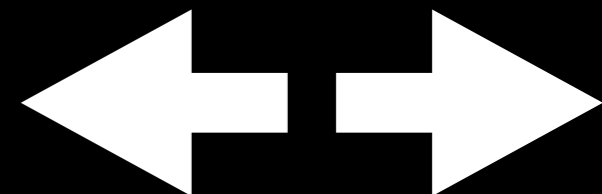
- The Moon is a natural satellite of the Earth.

How Big Is It?

- The Moon has a diameter of about 3,400 km (2,100 miles).
- The Moon is about 1/4 the size of the Earth.

How Far Away?

- The Moon orbits the Earth at about 384 thousand km (239 thousand miles) or 0.00257 AU.

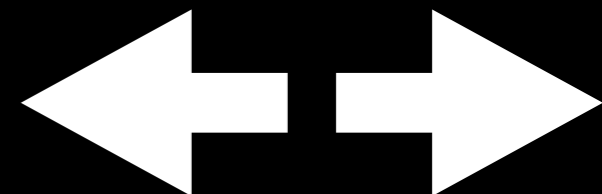


THE MOON



Other Facts:

- The Moon orbits the Earth in about 27 days and it takes the Moon about the same time to complete 1 revolution around its axis (this is why 1 side of the Moon always faces the Earth).
- The Moon has been visited by over 100 spacecraft.
- The Moon is the only celestial body beyond Earth that humans have visited (12 Americans walked on the Moon during the Apollo program).
- Surface features that create the face known as the "Man in the moon" are impact basins on the moon that are filled with dark basalt rocks.

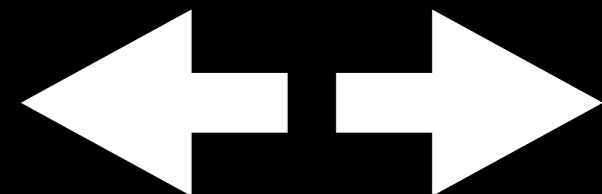


THE MOON



Lucy in the Moon:

- Several years ago Penn Dixie Astronomer Rich Switzer was showing Penn Dixie Astronomy Night attendees how to find the Lady in the Moon. One of the attendees exclaimed, "That's no lady, that's Lucille Ball".



THE MOON

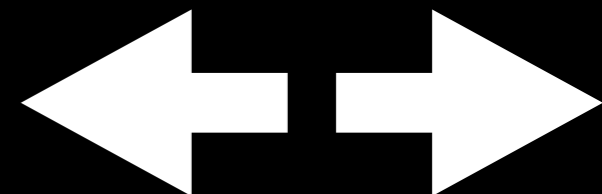


Images: Jim Maroney



September 27th 2015 Lunar Eclipse:

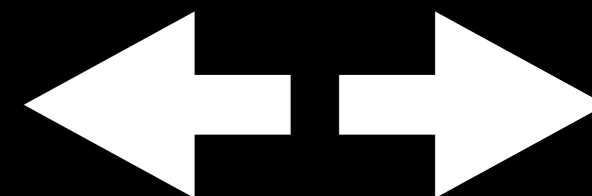
- The images of the moon were taken at Penn Dixie by Jim Maroney. The image on the right is a composite image with Buffalo City Hall added.



THE MOON



Image: Alan Friedman



THE RED PLANET
MARS

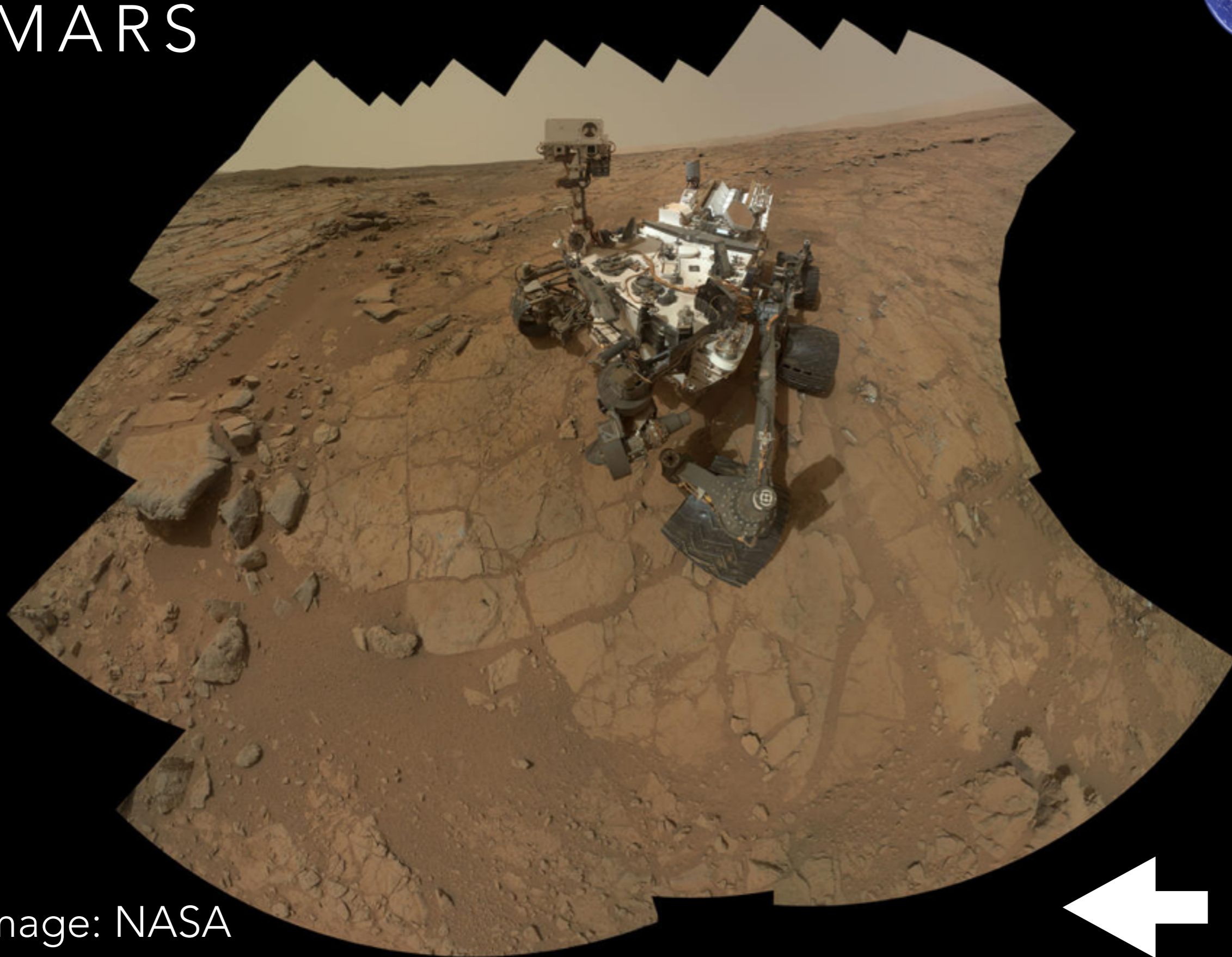
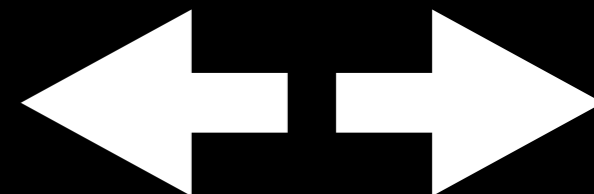


Image: NASA



MARS



What Is It?

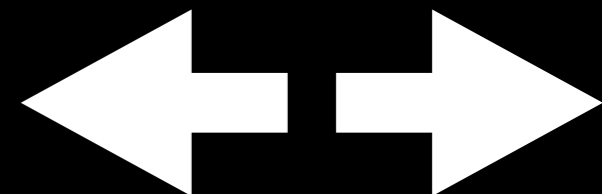
- Mars is the 4th planet from the Sun.

How Big Is It?

- Mars has a diameter of about 6,800 km (4,200 miles).
- Mars is a little more than 1/2 the size of the Earth.

How Far Away?

- Mars orbits the Sun at about 228 million km (142 million miles) or 1.52 AU.

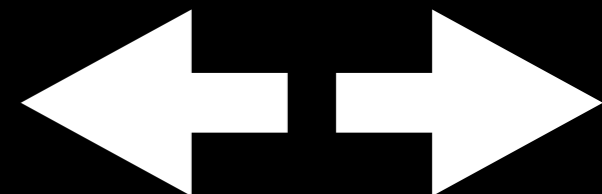


MARS



Other Facts:

- Mars has 2 moons (Phobos & Deimos).
- 1 day on Mars is about 24 hours.
- It takes Mars 687 Earth Days to complete 1 orbit around the sun.
- More than 40 spacecraft have been launched for Mars, from flybys and orbiters to rovers and landers that touched surface of the Red Planet. The first true Mars mission success was Mariner 4 in 1965.
- Mars is named after the Roman god of war.



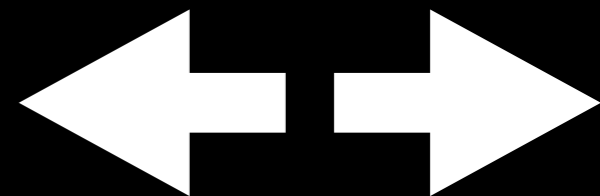
MARS



Mars near opposition

Alan Friedman/ www.avertedimagination.com

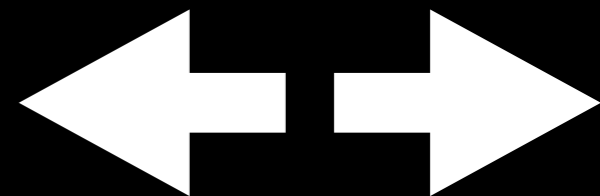
Image: Alan Friedman



THE KING OF THE PLANETS
JUPITER



Image: Alan Friedman



JUPITER



What Is It?

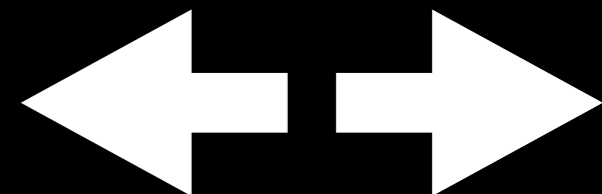
- Jupiter is the 5th planet from the Sun.

How Big Is It?

- Jupiter has a radius of about 70,00 km (43,400 miles) at it's equator.
- It is the most massive planet in the Solar System (317.828 x Earth).

How Far Away?

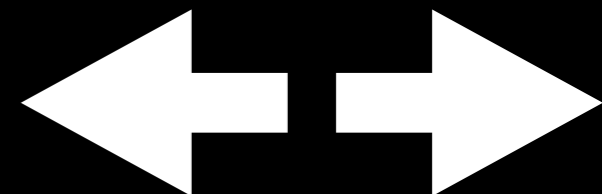
- Jupiter orbits the Sun at about 778 million km (484 million miles) or 5.2 AU.



JUPITER



- Jupiter has 67 Moons and 3 faint rings.
- 1 day on Jupiter is about 10 hours long.
- The Great Red Spot is a large storm more than twice the size of Earth and has been observed for more than 300 years. Recent observations indicate the GRS is shrinking in size.
- It takes Jupiter about 12 earth years to complete 1 orbit around the Sun.
- The 4 Galilean Moons (discovered by Galileo Galilei) and observable in small telescopes are: Io, Europa, Ganymede, & Callisto.
- Jupiter is named after the King of the Roman Gods and is often referred to as the King of the Planets.



JUPITER



Image: Jim Maroney

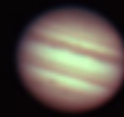


JUPITER & GALILEAN MOONS



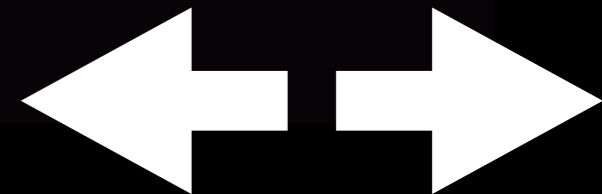
Callisto

Io Europa



Ganymede

Greenhawk Observatory : Image by: Chanan Greenberg September 5, 2009 Jupiter & Galilean Moons
4 Sec C-9.25" SCT Orion Deep Space Pro with MaxIm DL PHD Guiding, CCDStack and Photoshop CS3



THE ORIGINAL LORD OF THE RINGS
SATURN

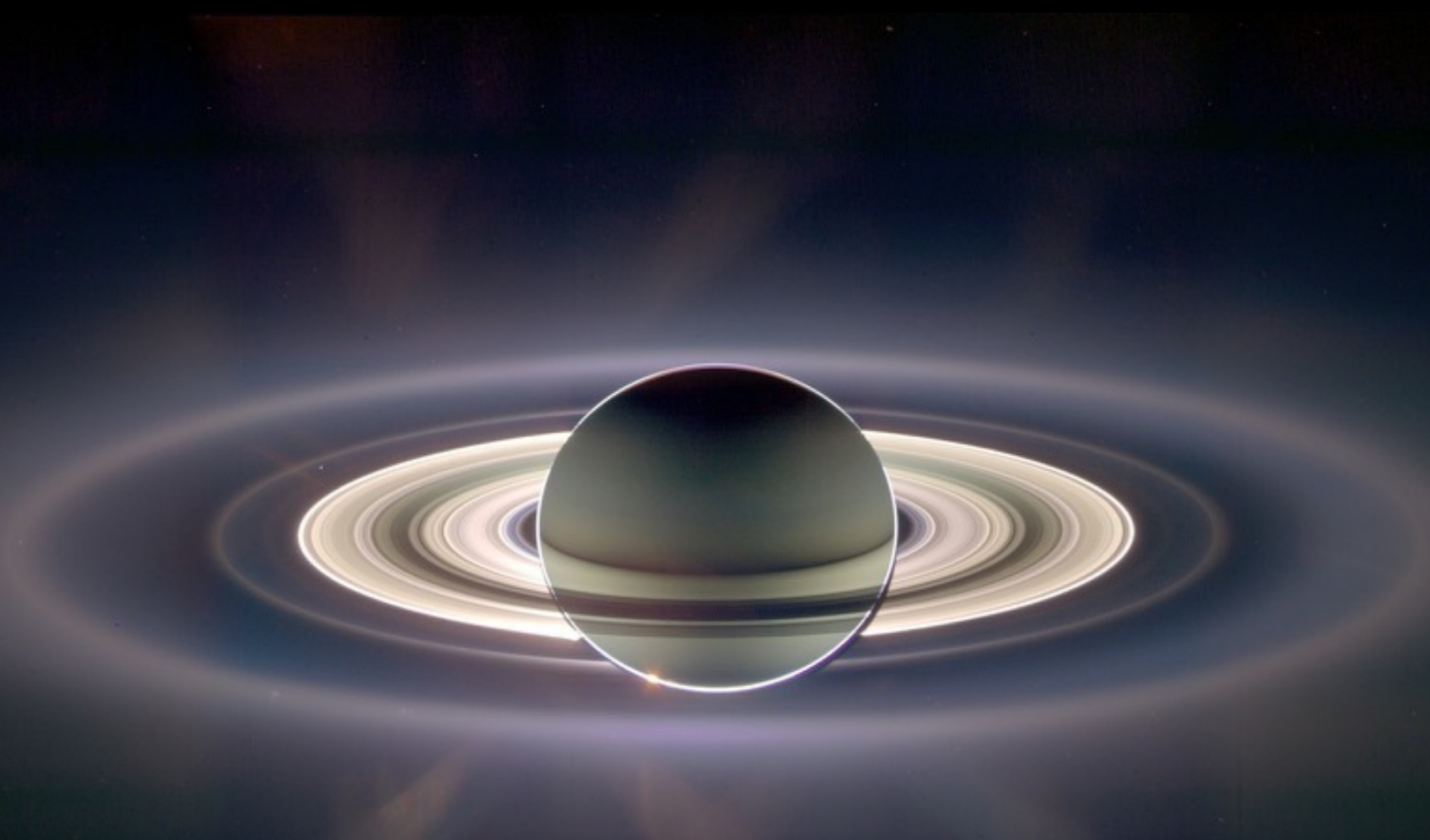


Image: NASA





SATURN

What Is It?

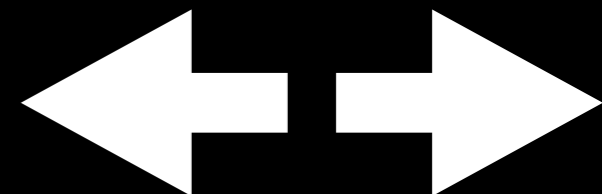
- Saturn is the 6th planet from the Sun.

How Big Is It?

- Jupiter has a radius of about 58,000 km (36,000 miles) at its equator (about 9 x's the Earth).

How Far Away?

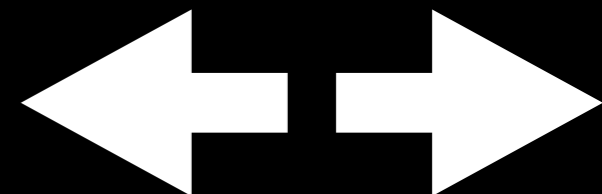
- Distance from the Sun about 1.4 billion km (886 million miles) or 9.5 AU.



SATURN



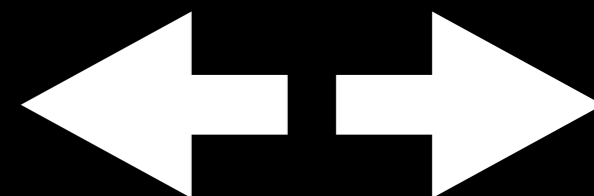
- Saturn has 62 named moons .
- Saturn is often referred to as the Jewel of the Solar System due to it's majestic rings.
- 1 day on Saturn is 10.7 hours.
- It takes 29 Earth Years for Saturn to complete 1 orbit around the Sun.
- Saturn is less dense than water (it would float).
- Saturn is named for the Roman god of agriculture.



SATURN



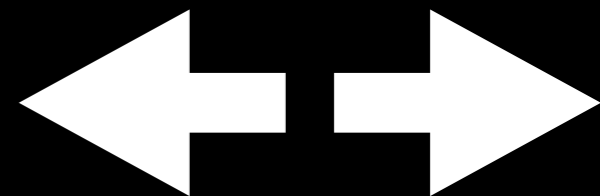
Image: NASA



SATURN



Image: Alan Friedman



SATURN

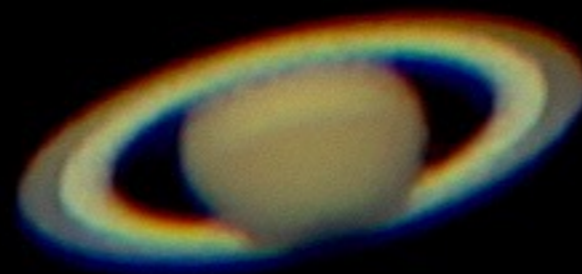
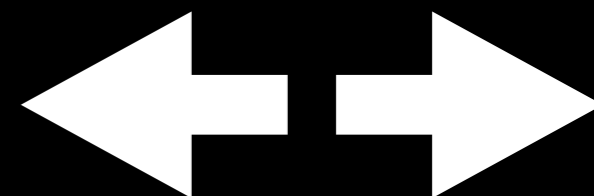
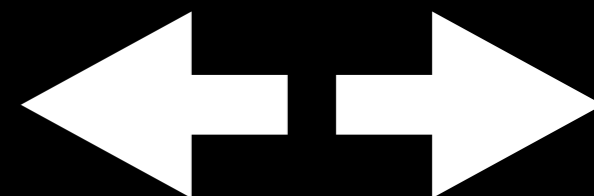


Image: Jim Maroney



DEEP SPACE OBJECTS

STAR CLUSTERS

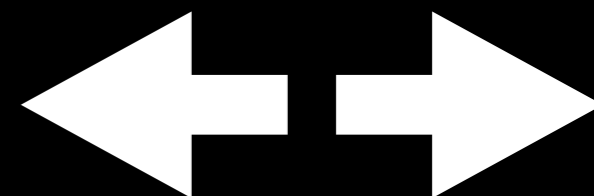


THE GREAT CLUSTER IN HERCULES

M13



Image: Gary Gonnella



M 1 3



What Is It?

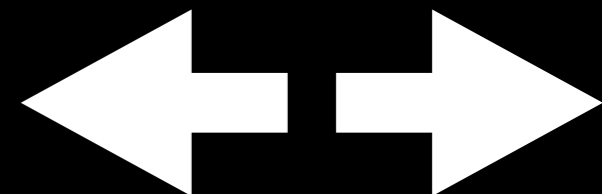
- M13 is a Globular Star Cluster - A spherical collection of stars that orbits a galactic core. Globular clusters are very tightly bound by Gravity.

How Big Is It?

- M13 is about 145 light-years across and contains several hundred thousand stars.

How Far Away?

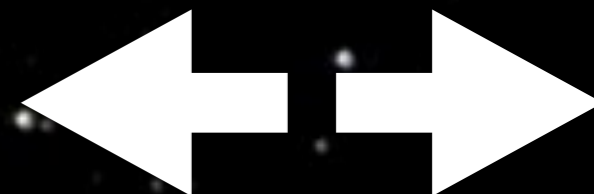
- M13 is Located in the Constellation Hercules and is about 25,100 light-years from Earth.



M 13



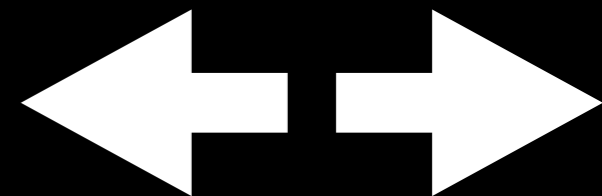
Image: Jim Maroney (image taken at Penn Dixie)



M13



Image: Stellarium

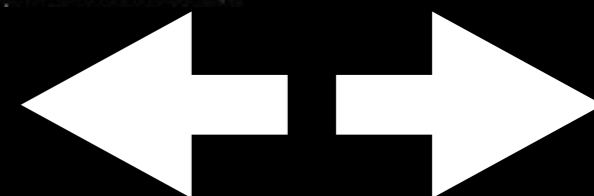


THE BEEHIVE CLUSTER

M44



Image: Gary Gonnella



M44



What Is It?

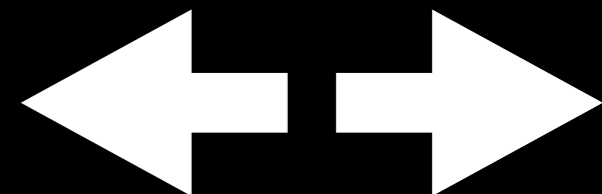
- Open Star Cluster - A group of up to a few thousand stars that were formed from the same giant molecular cloud and have roughly the same age.
- Also known as Paesepe, NGC 2632, Cr 189.

How Big Is It?

- M44 is about 15 light-years across and contains about 1,000 stars.

How Far Away?

- M44 is Located in the Constellation Cancer and is about 600 light-years from Earth. Therefore, M44 is one of the closest star clusters to our solar system.



M44



Image: Jim Maroney



M44 (PRAESEPE)

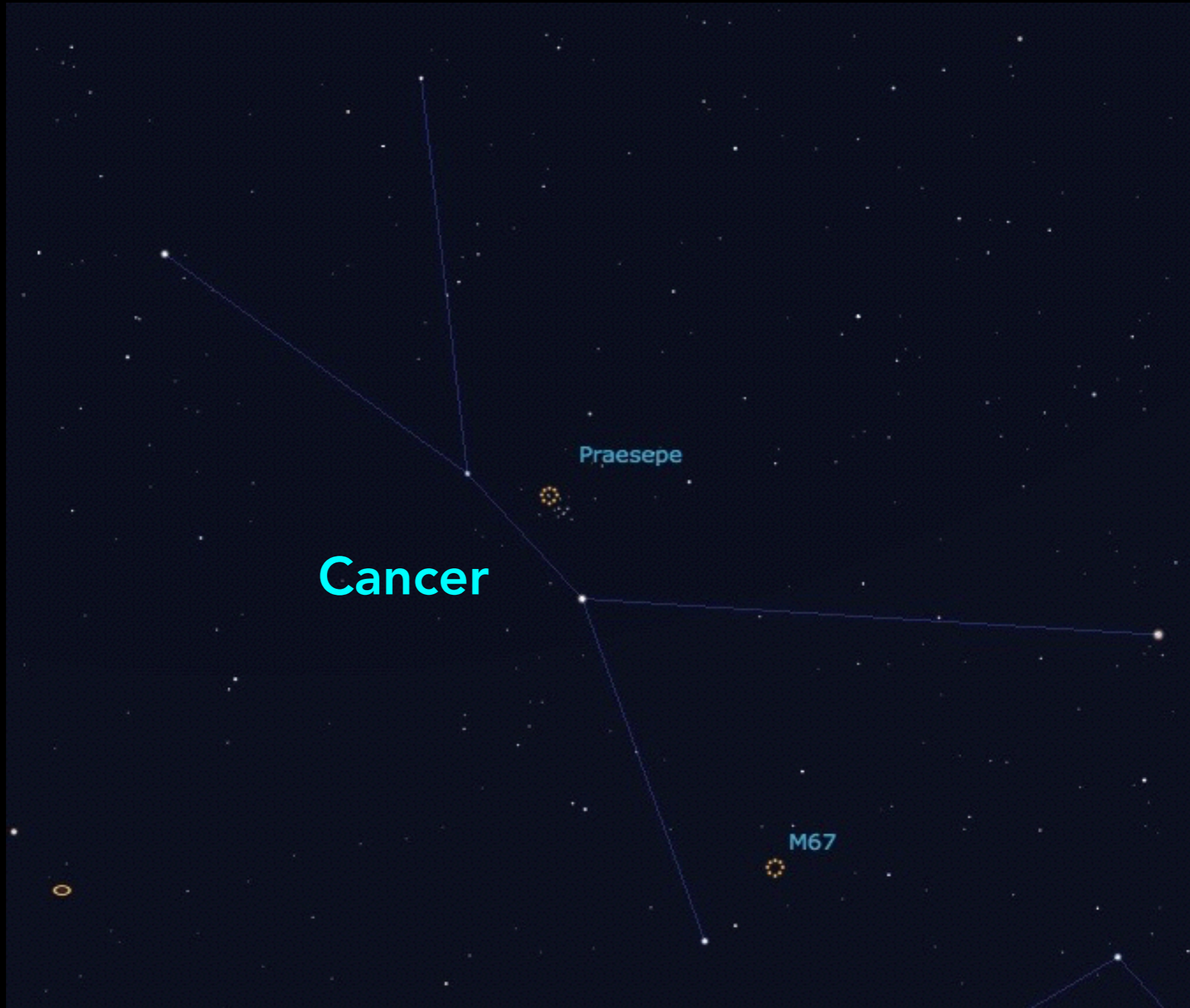
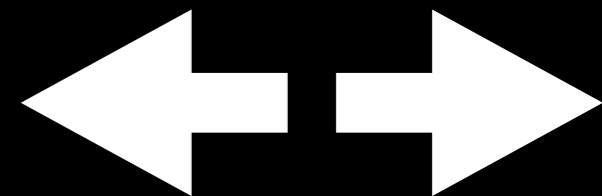


Image: Stellarium



THE PLEIADES

M45



Image: Gary Gonnella



M45



What Is It?

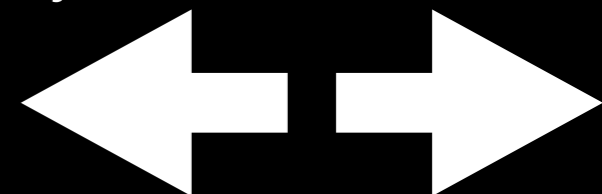
- Open Star Cluster - A group of up to a few thousand stars that were formed from the same giant molecular cloud and have roughly the same age.
- Also known as the Seven Sisters and in Japan it's called Subaru (look at the car logo carefully).

How Big Is It?

- M45 is Located in the Constellation Taurus and is about 400 light-years from Earth and is therefore one of the closest star clusters to our solar system.

How Far Away?

- M45 is Located in the Constellation Taurus and is about 400 light-years from Earth and is therefore one of the closest star clusters to our solar system.



M45



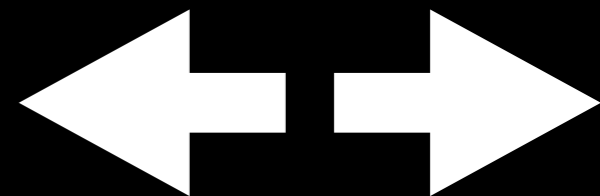
Image: Jim Maroney



M45



Image: Stellarium



THE DOUBLE CLUSTER IN PERSEUS

NGC 869 & 884



Image: Jim Maroney





NGC 869 & 884

What Is It?

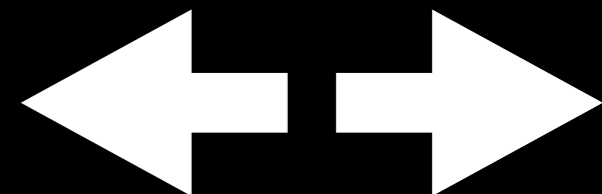
- Two Open Star Clusters - Each a group of up to a few thousand stars that were formed from the same giant molecular cloud and have roughly the same age.

How Big Is It?

- The Double Cluster covers a field of view of about 3.5 degrees. The full moon covers 1/2 degree, so the Double Cluster covers a field of view equal to roughly 7 full moons.

How Far Away?

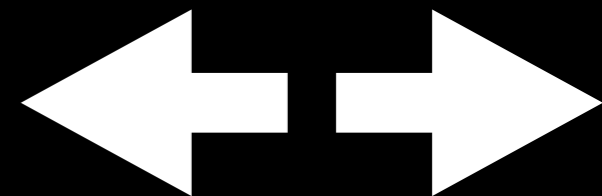
- The Double Cluster is located between the constellations Perseus and Cassiopeia at a distance of about 7,500 light-years from Earth.



DOUBLE CLUSTER

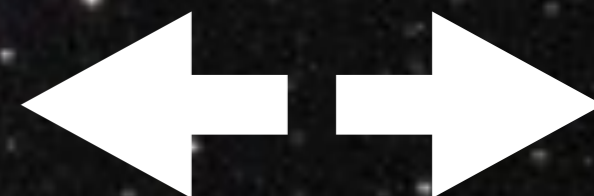


Image: Stellarium



THE "OWL", "ET", OR "DRAGONFLY" CLUSTER

NGC 457



NGC 457



What Is It?

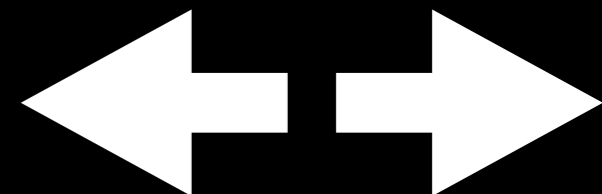
- Open Star Cluster - A group of up to a few thousand stars that were formed from the same giant molecular cloud and have roughly the same age.
- Also known as the ET Cluster, Owl Cluster, or Dragonfly Cluster.

How Big Is It?

- NGC 457 covers a field of view about $1/3$ of a degree. For reference, the full moon covers a field of view of about $1/2$ degree.
- NGC 457 contains about 200 stars.

How Far Away?

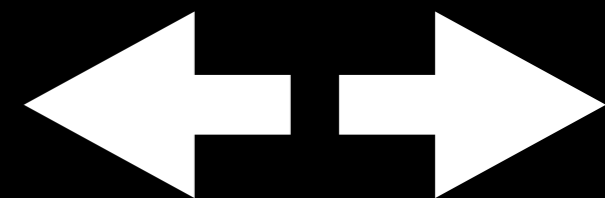
- NGC 457 is Located in the Constellation Cassiopeia and is about 8,000 - 10,000 light-years from Earth.



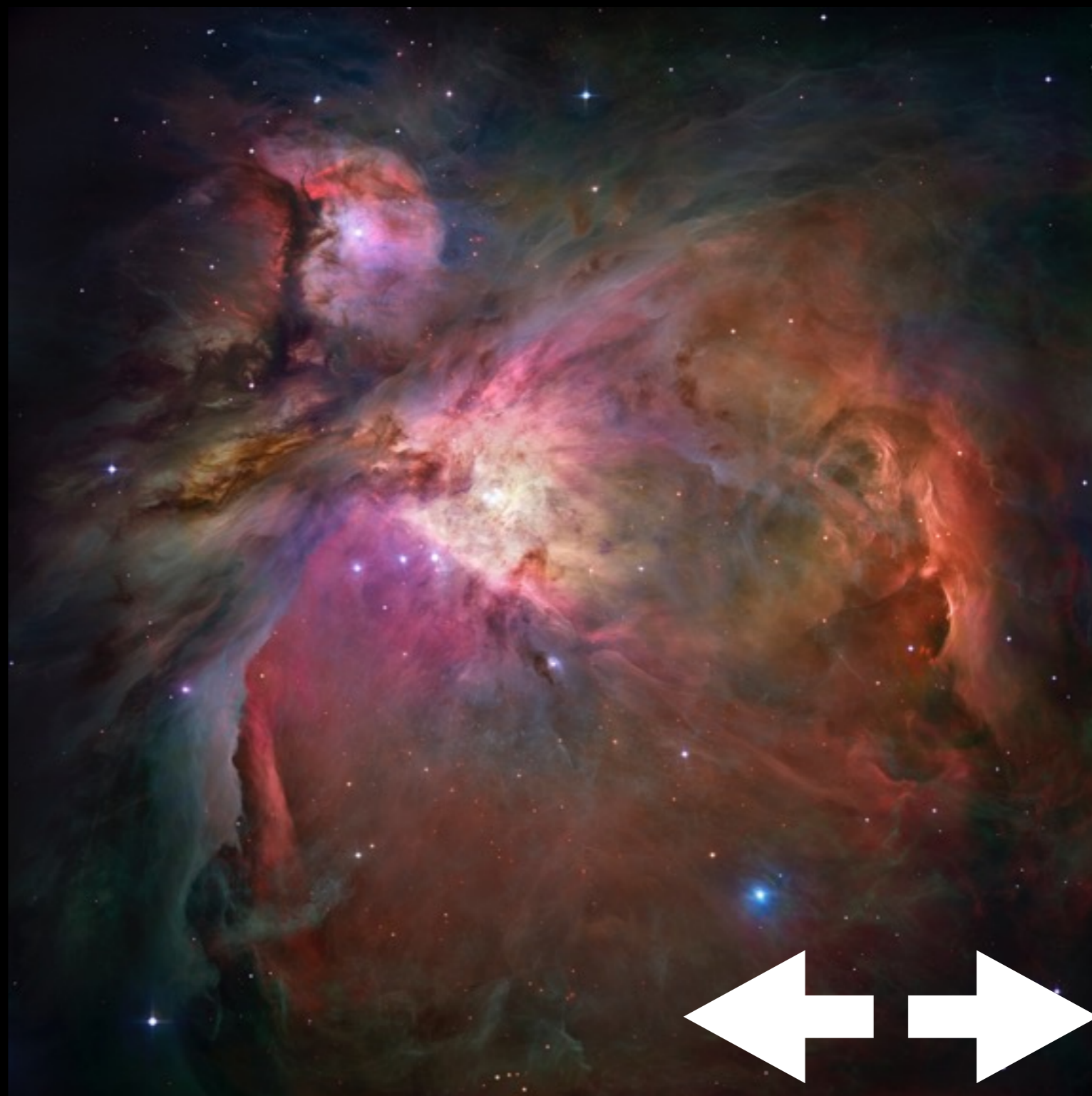
DRAGONFLY CLUSTER



Image: Stellarium



DEEP SPACE OBJECTS
NEBULAE



THE DUMBBELL NEBULA

M27



Image: NASA



M27



What Is It?

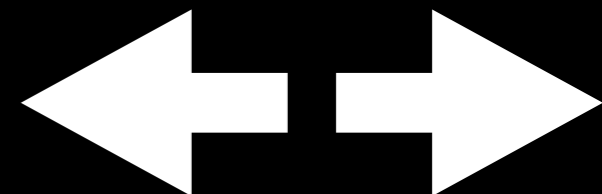
- Planetary Nebula - An emission nebula comprised of expanding, glowing shell(s) of ionized gas ejected from old Red Giant stars in the late in their lives.

How Big Is It?

- M27 covers an angular distance of arc minutes and has a radius of 1.44 light years.

How Far Away?

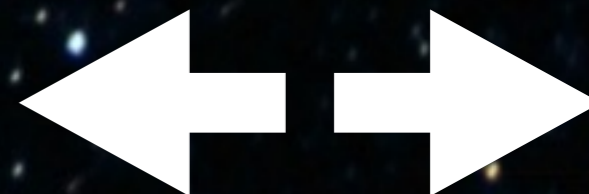
- M27 is Located in the Constellation Vulpecula and is about 1,360 light-years from Earth.



M27



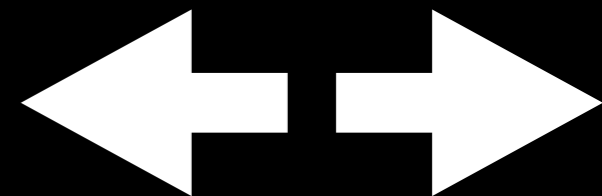
Image: Jim Maroney



M27



Image: Stellarium



THE GREAT ORION NEBULA

M42



Image: Jim Maroney (image taken at Penn Dixie)



M42



What Is It?

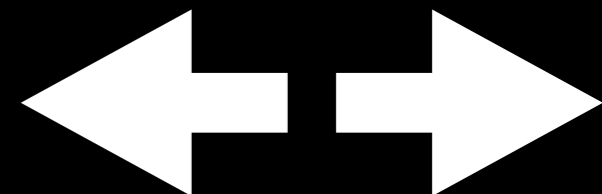
- Diffuse Nebula - An interstellar cloud of dust, hydrogen, helium, and other ionized gasses. M42 is a stellar nursery and contains the Trapezium Star Cluster.

How Big Is It?

- M42 covers an angular distance of about 1 degree and is about 24 light years across.

How Far Away?

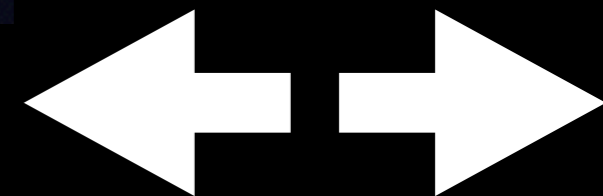
- M42 is Located in the Constellation Orion and is about 1,344 light-years from Earth (The closest area of Star formation to the Earth).
- M42 is the middle "star" in the Sword below Orion's belt.



M42



Image: Stellarium



THE RING NEBULA

M57

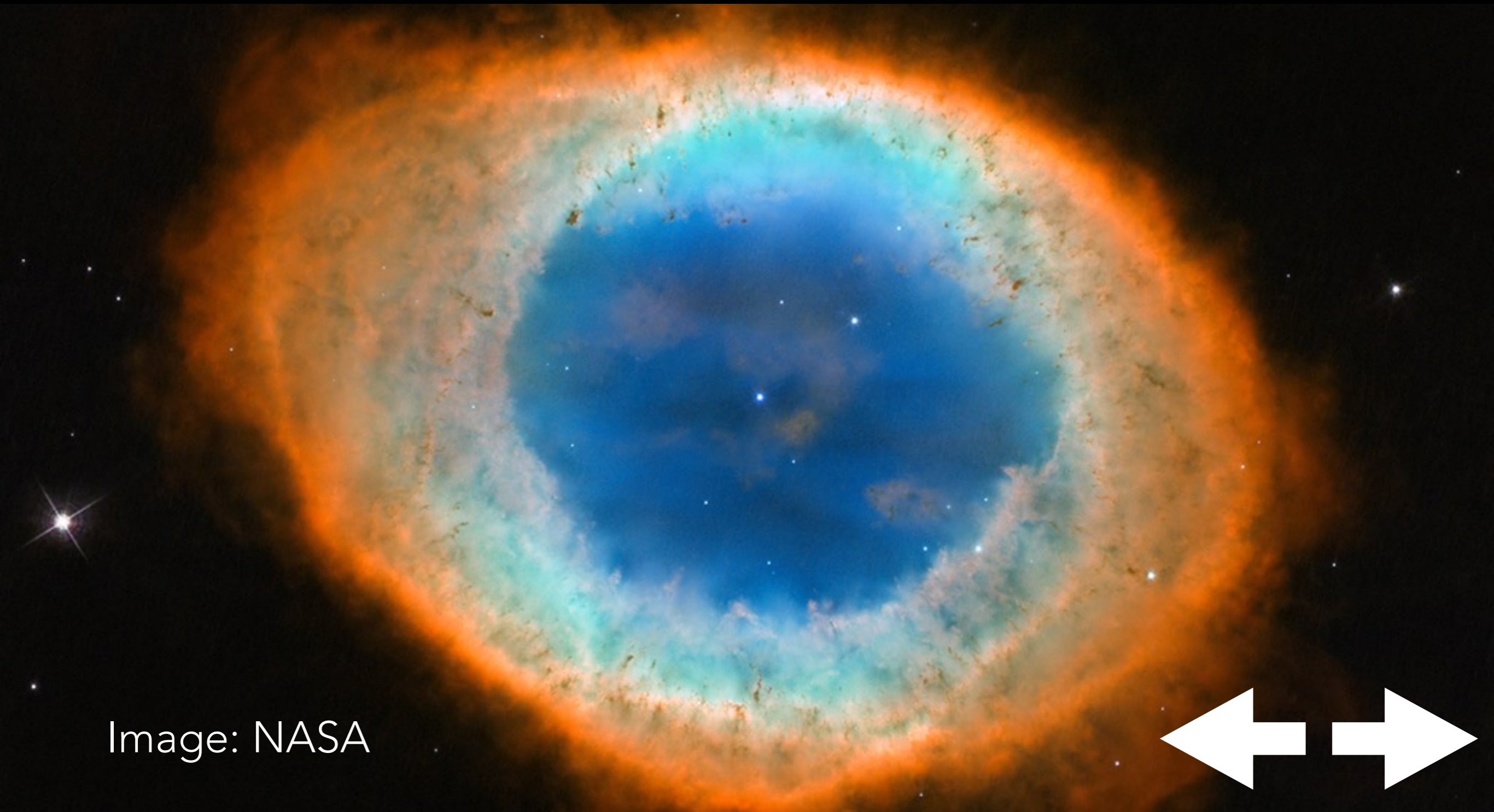
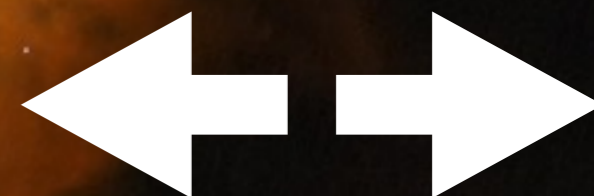


Image: NASA





M57

What Is It?

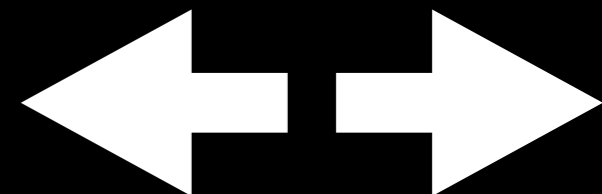
- Planetary Nebula - An emission nebula comprised of expanding, glowing shell(s) of ionized gas ejected from old Red Giant stars in the late in their lives.

How Big Is It?

- M57 covers an angular distance of about 1.5 arc minutes and has a radius of 1.3 light years.

How Far Away?

- M57 is Located in the Constellation Lyra and is about 2,300 light-years from Earth.



M57



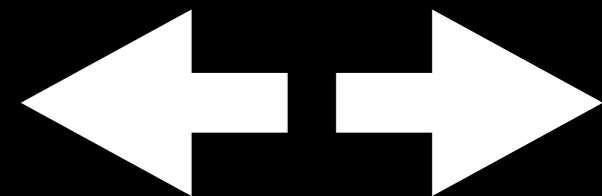
Image: Jim Maroney



M57

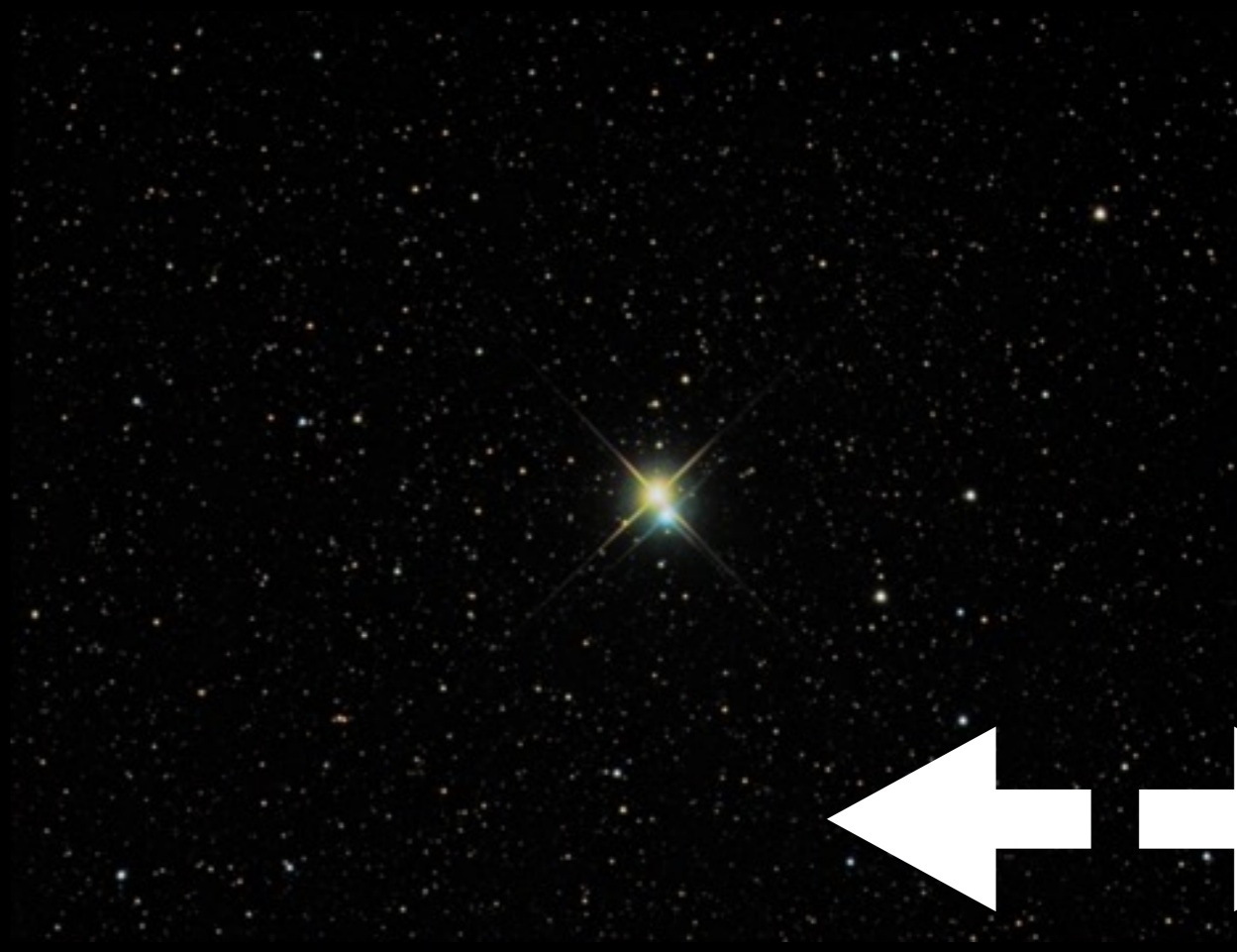


Image: Stellarium



DEEP SPACE OBJECTS

GALAXIES & DOUBLE STARS



THE GREAT NEBULA (GALAXY) IN ANDROMEDA

M31



Image: Gary Gonnella



M31



What Is It?

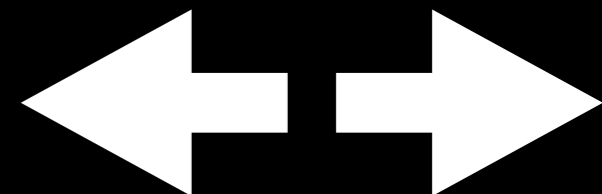
- A Spiral Galaxy - M31 is a Spiral Galaxy, an island universe of stars like our Milky Way. Andromeda is in our local group and is gravitational bound to the Milky Way. Our galaxies will merge to form a large elliptical galaxy in 4 or 5 years from now.

How Big Is It?

- M31 covers an angular distance of 3 degrees (note: the full moon covers an angular distance of 1/2 degree) and approximately 220,000 light years across.

How Far Away?

- M31 is Located in the Constellation Andromeda and is about 2.5 million light-years from Earth. In dark skies, M31 is visible to the naked eye, making it the most distant object that can be seen with the naked eye.



M31



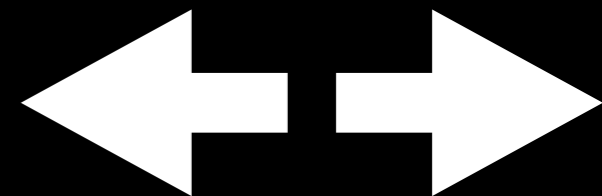
Image: Jim Maroney



M31

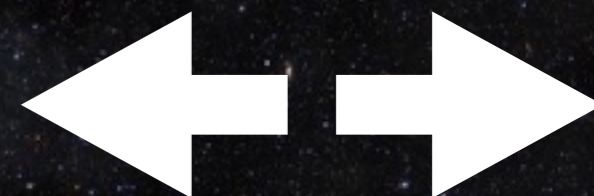


Image: Stellarium



FAMOUS DOUBLE STAR IN THE BIG DIPPER

MIZAR AND ALCOR





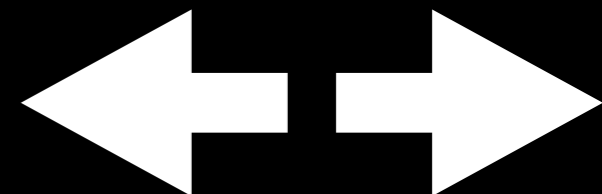
MIZAR AND ALCOR

What Is It?

- A Multiple Star System - Mizar and Alcor form a Naked eye double star. Mizar is actually a quadruple star system and Alcor is a binary system. Together they form a sextuple star system.

How Far Away?

- Mizar and Alcor are located in the handle of the Big Dipper asterism in the Constellation Ursa Major and are about 83 light-years from Earth.



MIZAR AND ALCOR

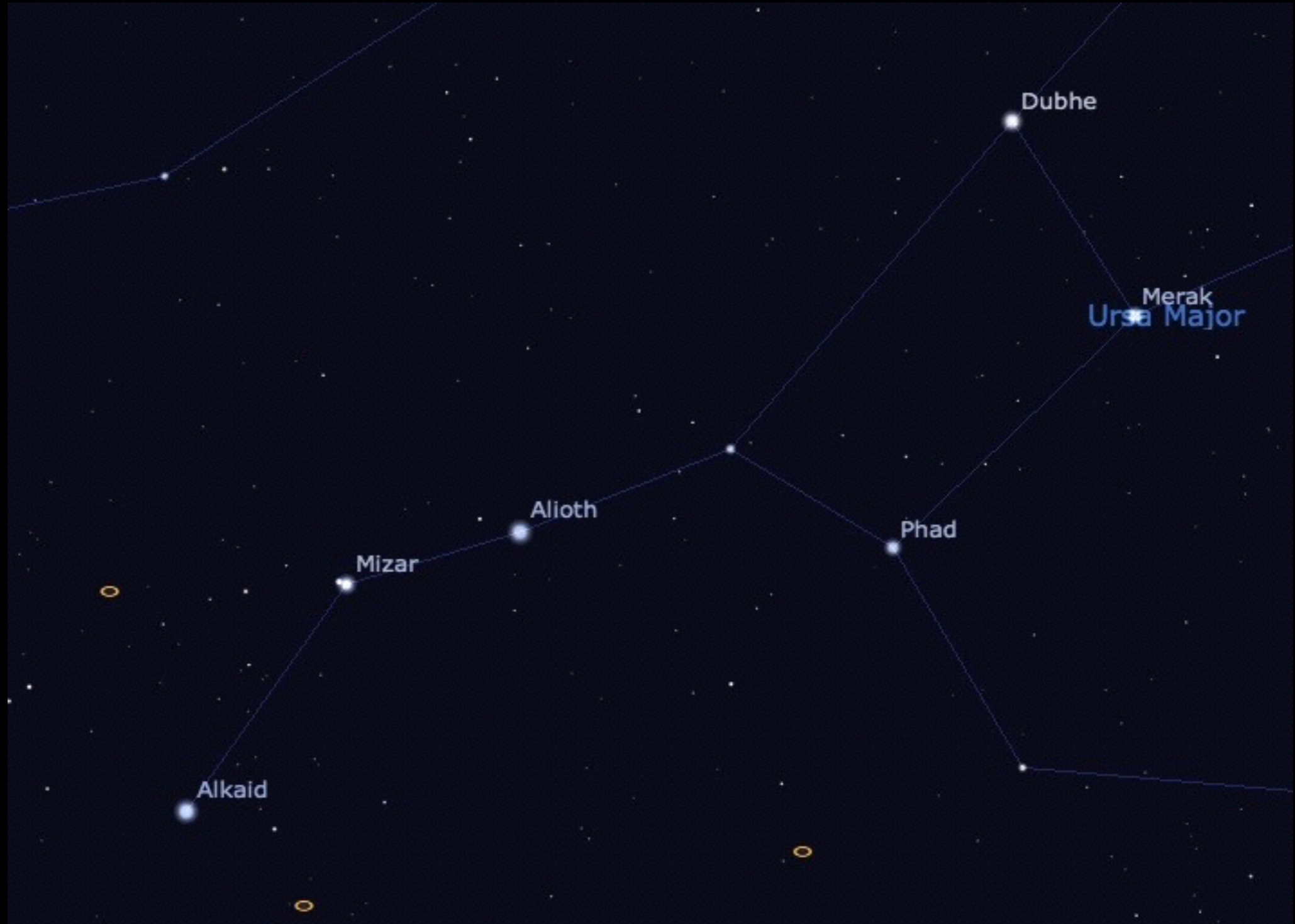
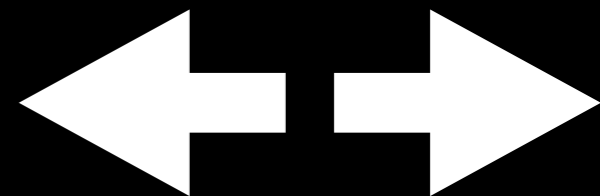


Image: Stellarium

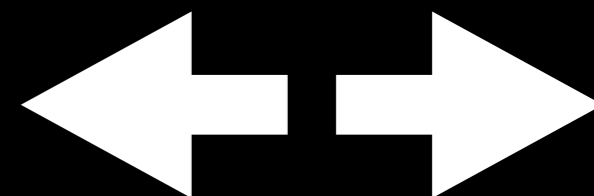


DOUBLE STAR IN CYGNUS

ALBIREO



Image: NASA



ALBIREO

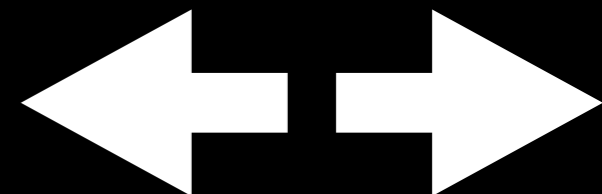


What Is It?

- A Multiple Star System - Albireo appears to the naked eye as a single star. In telescopes it resolves into a striking double star. The pair is comprised of two stars, a brighter yellow star, itself a close binary, and blue star. It is not known if they actually orbit one another or if they are just a visual double.

How Far Away?

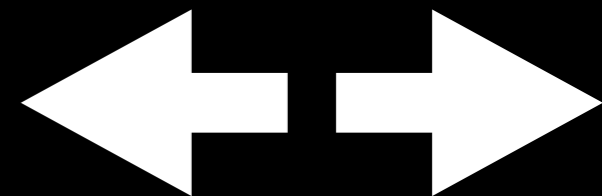
- Albireo is located in the Constellation Cygnus and is about 430 light-years from Earth.



ALBIREO



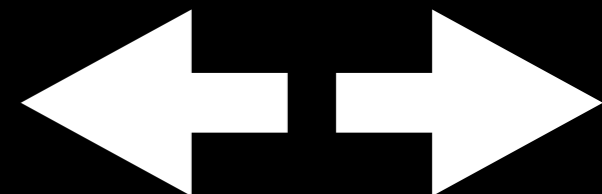
Image: Stellarium





BUYING A TELESCOPE

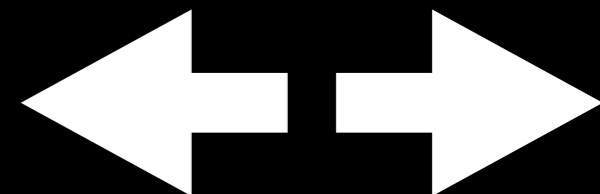
- Avoid Department or Big Box Stores.
- Attend Star Parties or Public Astronomy Nights and **Ask Questions**.
- Decide what you want to do, Visual Observing or Astrophotography.
- Research online resources.
- Get Star Maps or Smartphone/Tablet Apps and learn your way around the night sky (learn major constellations). Stellarium for PC or Mac is free and very good.
- Nightwatch: A Practical Guide to Viewing the Universe and Turn Left at Orion are excellent books.
- When you get your scope learn how to use it the day light (Don't Point it at the Sun).
- Bring it a Star Party or Astronomy Night for help in learning how to use it.





ASTRONOMY LINKS

- Sky & Telescope Magazine: www.skyandtelescope.com
- Astronomy Magazine: www.astronomy.com
- Stellarium Planetarium Software (Free): www.stellarium.org
- Astronomy Picture of the Day: www.apod.nasa.gov
- Universe Today (Astronomy Blog): www.universetoday.com
- Space.com (Astronomy Blog): www.space.com
- Cloudy Nights Astronomy Forum: www.cloudynights.com
- Buffalo Astronomical Association: www.buffaloastronomy.com



ASTRONOMY LINKS CONT'D



- Orion Telescopes & Binoculars: www.telescope.com
- Meade Instruments: www.meade.com
- Celestron Telescopes: www.celestron.com
- Eyes on the Sky: www.eyesonthesky.com
- Williamsville North Planetarium: <http://www.williamsvillek12.org/academics.cfm?subpage=125>
- Whitworth Ferguson Planetarium (Buffalo State): <http://www.fergusonplanetarium.net/Index.html>
- Crash Course Astronomy: <https://youtu.be/0rHUDWjR5gg?list=PL8dPuuaLjXtPAJr1ysd5yGlyiSFuh0mIL>

