



THE STAR

THE NEWSLETTER OF THE
MOUNT CUBA ASTRONOMICAL GROUP
VOL. 4 NUM. 1 SEPTEMBER 2015

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OUR PROGRAMS ARE HELD THE SECOND TUESDAY OF EACH
MONTH AT 7:30 P.M. UNLESS INDICATED OTHERWISE
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OUR NEXT MEETING IS
TUESDAY SEPT. 8 AT 7:30 p.m.
Mt. Cuba Astronomical Observatory

Agenda:

Greetings and welcome **Dave Groski**
Announcements **Lynn King**
Program: **Hank Bouchelle**

The Sky for September

The Autumnal Equinox, a close-up investigation

Observing, weather permitting, and refreshments

There are many fascinating events and conditions that happen every day. Some of them are astonishing but easily observed, such as the always-changing altitude of the Sun at noon, or the changing times of sunrise and sunset.

The View from a Comfortable Chair

Welcome to Year Four of the Astronomy Group!

One thing certain is that time passes, and very quickly. It does not seem like it has been four year since the Astronomy Group was formed. Along the way there have been 25 or 30 monthly meetings, dozens of programs and workshops at various libraries and other locations.

We hope that we will see many of you in the coming months.

Phenomena

One of the aspects of observational astronomy that make it such a rewarding pursuit is that the events and objects so rewarding is that such a rewarding is that the objects and events are so easily observed: Eclipses, the changing times of sunrise and sunset, the phases of the Moon, and the predictable seasonal changes in the sky and on the land. Orion is a gorgeous constellation dominating the southern sky in the autumn and particularly in winter, but it is completely invisible to us in June and July. It is, of course, in the sky every moment of the year, but it often cannot be observed. As Earth orbits the Sun there are times when the Sun appears between Orion and Earth. The Sun makes the sky blue, and it hides everything in the sky except for the Moon and, most often, Venus. This month's program will demonstrate ways that we can determine the details of various phenomena.

MISSION STATEMENT OF MCAG

The Mission of the Mt. Cuba Astronomy Group is to increase knowledge and expand awareness of the science of astronomy and related technologies.

THIS MONTHS CONTENTS:

Kuiper Belt Objects

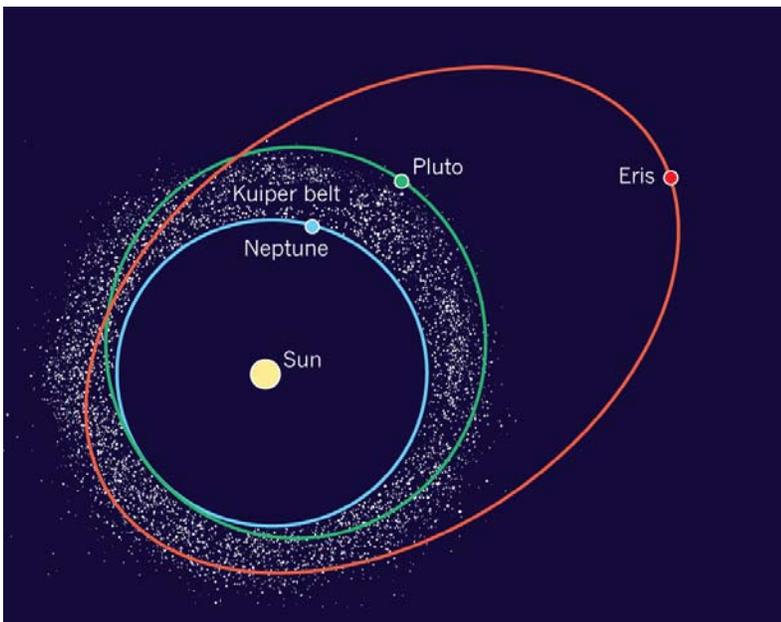
NASA camera shows moon crossing Earth – Contributed by Robert Stack MCAG member.

Galaxies collide.

When reading the articles in the STAR, you will come across various terms and names of objects you may not be familiar with. Therefore, in each edition of the STAR, we will review terms as well as objects related to Astronomy and related technologies. These topics are presented on a level that the general public can appreciate.

NEW FROM THE WORLD OF ASTRONOMY:

Kuiper Belt Objects: Facts about the Kuiper Belt & KBOs



Beyond the gas giant Neptune lies a region of space filled with icy bodies. Known as the Kuiper Belt, this chilly expanse holds trillions of objects, remnants of the early solar system. Dutch astronomer Jan Oort first proposed in 1950 that some comets might come from the the solar system's far suburbs. That reservoir later became known as the Oort cloud. Earlier, in 1943, astronomer Kenneth Edgeworth had suggests comets and larger bodies might exist beyond Neptune. In 1951, astronomer Gerard Kuiper predicted the existence of a belt of icy objects that now bears his name. Some astronomers refer to it as the Edgeworth-Kuiper Belt.

Let's take a closer look at this distant section of the solar system and the small worlds most commonly known as Kuiper Belt Objects (KBOs) and, in recent years, dwarf planets.

The Kuiper belt is an elliptical plane in space spanning from 30 to 50 times Earth's distance from the sun, or 2.5 to 4.5 billion miles (4.5 to 7.4 billion kilometers). The belt is similar to the asteroid belt found between Mars and Jupiter, although the objects in the Kuiper Belt tend more to be icy rather than rocky.

Scientists estimate that thousands of bodies more than 62 miles (100 km) in diameter travel around the sun within this belt, along with trillions of smaller objects, many of which are short-period comets. The region also contains several dwarf planets, round worlds too large to be considered asteroids and yet not qualifying as planets because they're too small, on an odd orbit, and don't clear out the space around them the way the 8 planets do.

Kuiper Belt formation

When the solar system formed, much of the gas, dust and rocks pulled together to form the sun and planets. The planets then swept most of the remaining debris into the sun or out of the solar system. But bodies farther out remained safe from gravitational tugs of planets like Jupiter, and so managed to stay safe as they slowly orbited the sun. The Kuiper Belt and its compatriot, the more distant and spherical Oort Cloud, contain the leftover remnants from the beginning of the solar system and can provide valuable insights into its birth.

The most crowded section of the Kuiper Belt lies between 42 and 48 times Earth's distance from the sun, the classical Kuiper Belt. The orbit of objects in this region remain stable for the most part, although some occasionally have their course changed slightly when they drift too close to Neptune.

Pluto was the first true Kuiper Belt Object to be seen, although scientists at the time didn't recognize it as such. The existence of the Belt wasn't realized until scientists discovered a slow moving, small world in the outer solar system in 1992 (David Jewitt and Jane Luu found the KBO, 1992QB1.). Other objects soon followed, and astronomers quickly saw that the region beyond Neptune teemed with icy rocks and tiny worlds.

Sedna (sed'nah), about three-fourths the size of Pluto, was discovered in 2004. It is so far out from the sun it takes about 10,500 years to make a single orbit. Sedna is about 1,100 miles (1,770 km) wide and circles the sun on an eccentric orbit that ranges between 8 billion miles (12.9 billion km) and 84 billion miles (135 billion km).

In July 2005, astronomers announced the discovery of an object in the Kuiper Belt thought to be larger than Pluto, though subsequent observations revealed it was slightly smaller. Known as Eris, it orbits the sun approximately once every 580 years, traveling

almost one hundred times farther from the sun than Earth does. Eris' discovery revealed to some astronomers the problem of terming Pluto a full-scale planet, and in 2006, Pluto, Eris, and the largest asteroid Ceres were reclassified as dwarf planets. Two more dwarf planets, Haumea and Makemake, were discovered in the Kuiper Belt in 2008

In order to catch a better glimpse of these remote leftovers from the birth of the solar system, NASA launched the New Horizons mission. Set to reach Pluto in 2015, the mission's robotic probe will study the most famous dwarf planet before continuing on with an aim to examine multiple KBOs.

NASA camera shows moon crossing Earth



A NASA camera aboard the Deep Space Climate Observatory (DSCOVR) satellite captured a unique view of the Moon as it moved in front of the sunlit side of Earth last month. The series of test images shows the fully illuminated “dark side” of the Moon that is never visible from Earth.

The images were captured by NASA's Earth Polychromatic Imaging Camera (EPIC), a 4-megapixel CCD camera and telescope on the DSCOVR satellite orbiting 1 million miles (1.6 million kilometers) from Earth. From its position between the Sun and Earth, DSCOVR conducts its primary mission of real-time solar wind monitoring for the

National Oceanic and Atmospheric Administration (NOAA).

EPIC maintains a constant view of the fully illuminated Earth as it rotates, providing scientific observations of ozone, vegetation, cloud height, and aerosols in the atmosphere. Once EPIC begins regular observations next month, the camera will provide a series of Earth images allowing study of daily variations over the entire globe. About twice a year, the camera will capture the Moon and Earth together as the orbit of DSCOVR crosses the orbital plane of the Moon.

These images were taken between 3:50 p.m. and 8:45 p.m. EDT on July 16, showing the Moon moving over the Pacific Ocean near North America. The North Pole is in the upper left corner of the image, reflecting the orbital tilt of Earth from the vantage point of the spacecraft.

The far side of the Moon was not seen until 1959 when the Soviet Luna 3 spacecraft returned the first images. Since then, several NASA missions have imaged the lunar far side in great detail. The same side of the Moon always faces an earthbound observer because the Moon is tidally locked to Earth. That means its orbital period is the same as its rotation around its axis.

In May 2008, NASA's Deep Impact spacecraft captured a similar view of Earth and the Moon from a distance of 31 million miles (50 million km) away. The series of images showed the Moon passing in front of our home planet when it was only partially illuminated by the Sun.

EPIC's "natural color" images of Earth are generated by combining three separate monochrome exposures taken by the camera in quick succession. EPIC takes a series of 10 images using different narrowband spectral filters — from ultraviolet to near infrared — to produce a variety of science products. The red, green, and blue channel images are used in these color images.

Combining three images taken about 30 seconds apart as the Moon moves produces a slight but noticeable camera artifact on the right side of the Moon. Because the Moon has moved in relation to Earth between the time the first (red) and last (green) exposures were made, a thin green offset appears on the right side of the Moon when the three exposures are combined. This natural lunar movement also produces a slight red and blue offset on the left side of the Moon in these unaltered images.

The lunar far side lacks the large, dark basaltic plains, or maria, that are so prominent on the Earth-facing side. The largest far side features are Mare Moscoviense in the upper left and Tsiolkovskiy Crater in the lower left. A thin sliver of shadowed area of Moon is visible on its right side.

"It is surprising how much brighter Earth is than the Moon," said Adam Szabo, DSCOVR project scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "Our planet is a truly brilliant object in dark space compared to the lunar

surface.”

Once EPIC begins regular observations next month, NASA will post daily color images of Earth to a dedicated public website. These images, showing different views of the planet as it rotates through the day, will be available 12 to 36 hours after they are acquired.

DSCOVR is a partnership between NASA, NOAA, and the U.S. Air Force with the primary objective of maintaining the nation’s real-time solar wind monitoring capabilities, which are critical to the accuracy and lead time of space weather alerts and forecasts from NOAA.

Here's what will happen to Earth when our galaxy collides with the Andromeda galaxy.

Perhaps it is more accurate to say if.



An epic war is coming: A gruesome battle between two, gigantic galaxies will be well underway in just a few billion years, and one of the contenders is our home, the Milky Way.

Right now, the Andromeda galaxy is racing toward the Milky Way at a speed of 250,000 mph — fast enough to circle the world in just six minutes. And it's scheduled to collide, head-on, with the Milky Way in approximately 3.75 billion years.

It's hard to imagine that our solar system could survive such a violent event, but experts say that it likely will.

"The reason we think that our solar system will not be much affected by this collision... is that galaxies are mostly empty space," said Roeland van der Marel in a ScienceTV video. Marel is a scientist at the Space Telescope Science Institute in Baltimore and led the team that used the Hubble Space Telescope to estimate what will happen when Andromeda collides with the Milky Way. "Even though our galaxy, as well as the Andromeda galaxy, has 100 billion stars in it, they're very far apart."

Not only will the solar system survive, but Earth will see a spectacular show as the galaxies merge:

Andromeda is currently 2.5 million light years from Earth. As it inches closer, the Milky Way's suck of gravity will grow stronger, pulling Andromeda closer and faster — the same way a ball in the air moves faster as it falls toward Earth.

In just four billion years, the Milky Way and Andromeda will have tugged and ripped at one another's throats. The remains will be a ghostly skeleton of what was once two independent galaxies:

As time marches on, the bloodshed will continue until, finally, the central supermassive black holes in each galaxy will get close enough to each other to meet and merge.

By that point, the Milky Way and Andromeda galaxies — two, separate spiral galaxies — will be no more. Our solar system will have a new home in an entirely different class of galaxy, called an elliptical galaxy.

After six billion years of cosmic carnage, Earth's night sky would be ablaze with the elliptical galaxy's bright, new core, if it weren't for the fact that the Sun will likely swallow Earth in about five billion years. The picture below is what the sky would look like on Earth if the planet was around to see the end of the galaxy war:

The solar system won't be entirely unaffected during this collision. Gravity will likely tug the Sun into a new orbit, dragging Earth and the other planets with it. But even though the Milky Way and Andromeda each have 100 billion stars, it's unlikely that many will meet.

"If two galaxies actually collide with each other the stars basically pass right between each other, and the chance of two stars directly hitting each other is really, really small," said van der Marel in the video.

This imminent collision is not the first time galaxies have been driven together by their mutual gravitational attraction. In fact, the famous Hubble Space Telescope has photographed many cases of galaxy collisions, which is why astronomers like van der Marel can predict what it will look like when the Milky Way's time comes.

Because it takes billions of years for galaxies to fully merge, astronomers search the skies for different stages of the epic battle. Below is an example of two spiral galaxies in an early stage of merging, photographed by Hubble in 2009:

Check out the video "Crash of the Titans: Milky Way and Andromeda Galaxy," from Science TV on YouTube:

OTHER MCAG ACTIVITIES:

From Lynn King.

Lunar Eclipse September 27th.

If you aren't in Philadelphia smoozing with the Pope, come to Fox Point State Park to watch the Lunar Eclipse over the Delaware River.

The Park will be open around 7:30 p.m. so you can set up any equipment. Below is what I got from the Park.

We will be able to open Fox Point to you after hours on September 27th. Club members are welcome to come to set up their equipment. Any club members coming in to volunteer and help visitors will just need to show a membership card or badge or pre-approved pass to the fee booth attendant to be waved through free of charge. All other vehicles will be charged the standard entrance fee of \$4 for Delaware vehicles and \$8 for out-of-state vehicles. Club members attending the event but not volunteering will be responsible for paying the entrance fee. (If you have a State Park pass it's free. ED.) Let me know if you will be able to come. Of course this event is weather related.

Lynn

Directions to the Park.

I495 North to exit 4 on right. Turn left on Lighthouse Rd. The Park is approx. one half mile on your right.

I495 South to exit 4B. Right on to Rt. 3 Edgemore Rd. Left onto Lighthouse Rd. The Park is approx. one half mile on your right.

PUBLIC NIGHTS AT MCAO:

The next Family Night will be held September 25th at 8 p.m.

Family Night programs are opportunities for families with young children to see and learn about astronomy by looking at and enjoying the sky and its wonders. It is meant to teach young children from ages 6 to 12 about astronomy in simple terms they can readily understand.

If you know of anyone who is interested in Astronomy or someone who would like to learn more, please do not hesitate to extend an invitation to them to attend our meetings. If they have an interest in joining, our application is below.

Mount Cuba Astronomical Group

Membership Form

The Mission of the Mt. Cuba Astronomy Group is to increase knowledge and expand awareness of the science of astronomy and related technologies. Benefits include:

Monthly newsletter that includes details about the groups activities and articles on astronomy as well as other related subjects.

Monthly programs on subjects and topics of astronomical interest.

Free or discounted subscriptions to astronomy related publications.

Free registration to MCAG workshops and classes.

Mention Mount Cuba Astronomical Group and receive a 5% discount at Manor Books in New Castle (<http://www.yelp.com/biz/manor-used-books-New Castle>)



Name _____

Email Address _____

Home Address _____

Phone (optional) _____

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