THE STAR

THE NEWSLETTER OF THE
MOUNT CUBA ASTRONOMICAL GROUP
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OUR PROGRAMS ARE HELD THE SECOND TUESDAY OF EACH MONTH AT 7:30 P.M. UNLESS INDICATED OTHERWISE
MOUNT CUBA ASTRONOMICAL OBSERVATORY
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PLEASE SEND ALL PHOTOS AND ARTICLES TO
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NEXT MEETING
TUESDAY JUNE 9th 7:30 p.m. MCAO

MCAG PUBLIC OUTREACH:

SCHOOLS:

From Lynn King a member of the MCAG.

Lynn is an avid Star Gazer and loves to portray Caroline Herschel at local events.

Caroline Lucretia Herschel (16 March 1750 – 9 January 1848) was a German British astronomer and the sister of astronomer Sir William Herschel with whom she worked throughout both of their careers. Her most significant contributions to astronomy were the discoveries of several comets and in particular the periodic comet 35P/Herschel-Rigollet, which bears her name.

She was the first woman to be paid for her contribution to science, to be awarded a Gold Medal of the Royal Astronomical Society (1828), and to be named an Honorary Member of the Royal Astronomical Society (1835, with Mary Somerville). She was also named an honorary member of the Royal Irish Academy (1838). The King of Prussia presented her with a Gold Medal for Science, on the occasion of her 96th birthday (1846).

Here is a recent photo of Lynn doing her thing.

Caroline Herschel with an Astronaut at the Bunker Hill Elementary School Space 2015 Event.

Lynn recently received an award as well as a very well done Plaque from the Appoquinimink School District for participating in Space 2015. Well done Lynn.

ASTRONOMICAL TERMS AND NAMES OF THE MONTH:

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

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 appreciated.

Globulars

A globular cluster is a spherical collection of stars that orbits a galactic core as a satellite. Globular clusters are very tightly bound by gravity, which gives them their spherical shapes and relatively high stellar densities toward their centers.

Starburst galaxies

A starburst galaxy is a galaxy undergoing an exceptionally high rate of star formation, as compared to the long-term average rate of star formation in the galaxy or the star formation rate observed in most other galaxies. In a starburst galaxy, the rate of star formation is so large that the galaxy will consume all of its gas reservoir, from which the stars are forming, on a timescale much shorter than the age of the galaxy. As such, the starburst nature of a galaxy is a phase, and one that typically occupies a brief period of a galaxy's evolution. The majority of starburst galaxies are in the midst of a merger or close encounter with another galaxy. Well-known starburst galaxies include M82, NGC 4038/NGC 4039 (the Antennae Galaxies), and IC 10.

Molecular cloud

A molecular cloud, sometimes called a stellar nursery (if star formation is occurring within), is a type of interstellar cloud, the density and size of which permit the formation of molecules, most commonly molecular hydrogen (H_2)

CONSTILLATIONS AND GALAXIES:

ANDROMEDA

A classic photo of Andromeda as viewed from Earth.

Andromeda Galaxy Facts

The Andromeda Galaxy (M31) is the closest large galaxy to the Milky Way and is one of a few galaxies that can be seen unaided from the Earth. In approximately 4.5 billion years the Andromeda Galaxy and the Milky Way are expected to collide and the result will be a giant elliptical galaxy. Andromeda is accompanied by 14 dwarf galaxies, including M32, M110, and possibly M33 (The Triangulum Galaxy).

More Facts about Andromeda

- **While Andromeda is the largest galaxy in the Local Cluster it may not be the most massive. The Milky May is thought to contain more dark matter, which could make it much more massive.**
- **Since it is the nearest spiral galaxy to us, astronomers use the Andromeda Galaxy to understand the origin and evolution of such galaxies.**
- **The Andromeda Galaxy is approaching the Milky Way at approximately 100 to 140 kilometres per second.**

- **The Andromeda Galaxy has a very crowded double nucleus. Not only does it have a massive star cluster right at its heart, but it also has at least one supermassive black hole hidden at the core.**
- **The spiral arms of the Andromeda Galaxy are being distorted by gravitational interactions with two companion galaxies, M32 and M110.**
- **The Andromeda Galaxy has at least two spiral arms, plus a ring of dust that may have come from the smaller galaxy M32. Astronomers think that it may have interacted more closely with Andromeda several hundred million years ago, when M32 plunged through the heart of its larger neighbor.**
- **There are at least 450 globular clusters orbiting in and around the Andromeda Galaxy. Some of them are among the most densely populated globulars ever seen.**
- **The Andromeda Galaxy is the most distant object you can spot with the naked eye. You need a good spot away from bright lights in order to see it.**

FROM THE WORLD OF ASTRONOMY:

The universe is short on stars, and scientists have finally figured out why.

For the past decade and a half, astrophysicists have had a problem: there aren't enough stars in the universe.

Relatively speaking, there are a lot of stars. Around 100 sextillion—1 followed by 20 zeros—to be precise. But even this (truly) astronomical number isn't large enough to satisfy these greedy scientists. That's because models of star formation predict that there should actually be two or three times as many. So where in the universe did all the stars go?

Finally, astrophysicists have an answer. In a paper published in *Nature*, researchers write that they have identified an effect that takes place in some "starburst galaxies," which form stars at a much higher rate than typical galaxies such as our own, the Milky Way.

In starburst galaxies, pressure from the radiation of the rapidly forming stars can drive gas out towards the edges of the galaxy. In other words, these galaxies scatter the necessary ingredients for making stars. The scattered gas means there's less concentrated gas to glom into a star, which would explain why there are fewer stars in the universe than the models predict.

Open Star Clusters

An open cluster is a group of up to a few thousand stars that were formed from the same giant molecular cloud, and are still loosely gravitationally bound to each other.

In contrast, globular clusters are very tightly bound by gravity.

Open clusters are found only in spiral and irregular galaxies, in which active star formation is occurring. They are usually less than a few hundred million years old: they become disrupted by close encounters with other clusters and clouds of gas as they orbit the galactic center, as well as losing cluster members through internal close encounters.

Young open clusters may still be contained within the molecular cloud from which they formed, illuminating it to create an H II region. Over time, radiation pressure from the cluster will disperse the molecular cloud. Typically, about 10% of the mass of a gas cloud will coalesce into stars before radiation

pressure drives the rest away.

Open clusters are very important objects in the study of stellar evolution.

Because the stars are all of very similar age and chemical composition, the effects of other more subtle variables on the properties of stars are much more easily studied than they are for isolated stars.

More from our members.

The following article was submitted by Robert Stack a MCAG member. Thank you Robert for your contribution to the MCAG.

Skyglow: measuring light pollution in the UK

Skyglow is the halo-like artificial illumination of the night sky above towns and cities. It's also the name of a major new study into light pollution in the UK by Hillarys. Using satellite images taken between 1992 and 2014, Skyglow shows how the UK's night-time skies have changed. The research charts a 28% decrease in light pollution*, with falls in every region – and projects this data into the future. You can see the interactive satellite imagery and full study on the Skyglow project page. Or keep reading to find out the story behind the story.

We knew what to expect with Skyglow. From the start, we expected to find that light pollution in the UK is rising.

Our expectations stood to reason. The population has grown 10% since 1992 and infrastructure must have developed to meet its needs, so light pollution should have increased too. Except – it hasn't.

Skyglow discovered something way more interesting: night skies are darker across the country.

Why we chose to investigate Skyglow

Hillarys is a gold sponsor the International Year of Light and Light-based Technologies (IYL 2015). With our sponsorship, we wanted to look at how light affects our lives in both small and big ways, from our smartphones to photosynthesis to looking at the night sky.

The idea of investigating the night sky had our attention. We started to think about how our use of artificial lighting is causing light pollution and affecting the brightness of the night.

Day by day, our research uncovered more and more about the consequences light pollution has for our lives. We spoke to Dr. Bob Mizon MBE FRAS, who told

us many people – and even well-equipped astronomers – struggle to see star-filled skies because of light pollution.

Our investigations turned to the energy issue. Despite some improvements in lighting design and efficiency, we found in the EU more than half the energy used for outdoor lighting is wasted.

Dr. John Barentine explained such careless lighting has an economic cost – and a cost to our quality of life. He said our biology and ecology are ill-equipped to handle night-time brightness in extreme measures and can suffer even in the presence of relatively small amounts of light. We found this kind of exposure to night-time light can disrupt our brainwave patterns, hormone production and cell regulation.

We decided to conduct our own research into light pollution.

What is the Skyglow project?

Skyglow came out of this initial research. We had pondered light pollution and whether it would have changed over the years. To us, at this point in the process, we were confident of finding a change and probably an increase.

Our ideas developed. Soon we were investigating ways of researching light pollution – one potential method stood out immediately.

Skyglow would take statistical data from night-time satellite images and chart historical trends in light pollution. Our method would allow us to put a value on how much artificial light escapes into the atmosphere nationwide and to break our findings down to a regional level.

In addition, we would look at the effects light pollution has on us and the wider environment. And we would use digital design to raise awareness of our findings and the issue online.

Brightness of the night sky over the UK in 2014 calculated using images from two different satellites, the Operational Linescan System (OLS) and the Visible Infrared Imaging Radiometer Suite (VIIRS). Credit: Skyglow Project.

How we created Skyglow

With the help of Jurij Stare from Dark Skies Slovenia, we settled on using images from the Defence Meteorological Satellite Programme (DMSP). For each year, we created a single composite image from hundreds of satellite photographs, which allowed us to take account of day-to-day variations.

The DMSP records analogue images, so we converted these into a greyscale digital format. On each image, different shades of grey showed the varying intensity of artificial light escaping into the atmosphere – or the amount of light pollution being created.

So to create the data needed to compare light pollution over time, we awarded each shade of grey a value from 0 to 63 (0 being the darkest and 63 being the brightest). From here, we could work pixel by pixel and show light pollution increases and decreases as percentages.

The next step was to change the map from a WGS84 coordinate system (the kind used on Google Earth 3D) to a spherical Mercator (the standard map projection, found on Google Maps).

Last but not least, we applied a colour ramp, turning the greyscale images into a coloured and easy-to-understand format.

What Skyglow found

Our work shows that light pollution in the UK is down 28% since 1992*.

The findings took us by surprise. Sure, we knew that the way energy is consumed and lighting technology has changed over the years, but the UK population has grown over the same period. And it would make sense if the rising population had caused a growth in infrastructure, which would have a knock-on effect for light pollution.

We needed a further opinion. So we turned again to Dr. John Barentine and Bob Mizon MBE FRAS, and also to Professor Martin Morgan Taylor. These established experts verified our research and helped us better understand the causes of our findings.

For example, the experts explained that while there are more streetlights, many modern designs feature guards that direct light towards the ground. This helps prevent light escaping into the atmosphere and causing Skyglow.

Region by region, the UK was experiencing a decrease in light pollution. Here are just a few of the statistics we discovered.

- **North Scotland down 40%**
- **The West Country down 41%**
- **Northern Ireland down 32%**
- **Yorkshire down 29%**
- **London down 14%**

If the trend continues at the current rate, our data projects a further 21% decrease in light pollution between 2015 and 2025.

See how UK light pollution has changed – and use Skyglow

Skyglow didn't end with the results. In many ways, this was the beginning.

The next step was to present our findings in a way that would help us raise awareness of the issue.

You can see our work at **www.hillarys.co.uk/skyglow/** and use the interactive maps we created to show how UK light pollution has changed. You'll also find out more about the project. We hope you enjoy Skyglow.

FOR THE CURIOUS OF MIND

A brief tour of the thoughts of ancient Greeks
http://en.wikipedia.org/wiki/History_of_science_in_classical_antiquity

For the importance of celestial observation to (early) astrology
http://en.wikipedia.org/wiki/Astrology

The workings of a planisphere
https://www.google.com/?gws_rd=ssl#q=planisphere show that astrology worthy of the name (if it is or ever was) died 2,500 years ago.

PUBLIC NIGHT AT MOUNT CUBA.

29 May 2015	**8:30 pm**	**Greg Weaver**	**FAMILY NIGHT**
15 June 2015	**8:30 pm**	**Harry Shipman**	**SPLENDORS OF THE NIGHT SKY.**
24 June 2015	**8:30 pm**	**Greg Weaver**	**FAMILY NIGHT**

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 FormBELOW

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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