ASTROFAX

BULLETIN OF THE ATA ASTRONOMY STUDY UNIT

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New Astrofax editor appointed

Hello, everyone. My name is Leonard Zehr and I have been appointed editor of your newsletter. I currently reside in Windsor, Ontario, Canada, just across the river from Detroit. My goal is to continue the outstanding work of our previous editor, Michael Howell, who unfortunately gave up his duties because of health issues.

As you see at the top of this page, we have modernized the nameplate of Astrofax and added a new graphic to the title. Our goal is to publish quarterly, in March, June, September and December. Beginning with the March 2016 issue, Astrofax will be delivered digitally. So it's important that John Budd has your email coordinates. Members wishing to receive a printed copy should advise either John Budd or myself. Our co-ordinates can be found on the next and final pages of Astrofax.

By way of introduction, I spent my entire 36-year career in business journalism, first with the *Wall Street Journal* and *Dow Jones News Service*, and then with the Report on Business section of the *Globe and Mail*, Canada's equivalent of the *New York Times*. After retiring in 2007, I joined the Kilmer Lucas Inc. investor relations firm and in 2009, we launched a biotechnology and medical devices news website called, BioTuesdays.com. I am the editor and do most of the writing.

I have had a lifetime interest in space and astronomy and like to tell friends that had I mastered the slide rule in high school, I may have pursued a career in astronomy. Alas, high school physics probably would have sunk those hopes as well.

We are in desperate need of a volunteer to design and maintain the ASU website, which is critically important to the continued growth of the ASU as a vehicle to attract new members and interact with existing members.

In closing, let me say that the success of the ASU will depend on feedback from our members. Tell us what you like, what you dislike, and how we can improve Astrofax. After all, this is your Study Unit.

Astronomy Study Unit rejuvenation
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Please join me in welcoming Leonard Zehr as a new member of our Study Unit and thank him most sincerely for offering to be our new editor of Astrofax. I would like to think that he will have our full support in the future and maybe some input from the membership. If you would like to correspond with Leonard with an article or idea for publication, or just to welcome him, he can be reached at lenzehr@gmail.com.

We are starting off this new era with Astrofax Whole No. 92, which will be free of charge. It will not be charged against your current dues. The next issue will be Whole No. 93 available in March 2016.

Leonard and I have been discussing ideas for the future, which I would like to share with you. We intend to distribute the newsletter electronically, beginning in the New Year. I understand from the American Topical Association, of which we are a part, that a number of Study Unites are already doing this. It would, of course, require all our members to provide an email address, where possible. We will still provide a printed copy to those members wishing one. Going electronic would offer advantages in the production of Astrofax. For instance, we could offer full color and more pages to accommodate checklists of new issues, etc. We are also looking into ways to resurrect the website, which would be a valuable vehicle to be in touch with out members and attract new members.

Finally, I would like to thank Michael Howell on behalf of all of us for his tireless and valuable service as our editor since 2001. Thank you, Michael, for a wonderful job over those years.

In this issue

Happy birthday, Hubble
Twenty-five years and counting

In April, our eyes on the furthest reaches of the universe celebrated its 25th anniversary. The Hubble Space Telescope has forever changed the face of astronomy and brought the universe into our living rooms. The images and observations beamed back to Earth from the 11-ton Hubble represent the most significant advance in astronomy since Galileo's telescope and have helped determine the age and size of the Universe. By orbiting outside the distortion of the Earth's atmosphere, Hubble's 2.4-meter mirror is able to capture images with almost no background light, making them the most visible images of space ever. One only has to view the breathtaking images of the Pillars of Creation and the never-before-seen details of three giant columns of cold gas bathed in the ultraviolet light from a cluster of stars.

Hubble was originally scheduled for launch on the Space Shuttle in December 1983 but the launch date was delayed for seven years for a variety of setbacks, including technical and budgetary issues, and the Shuttle Challenger accident that killed its crew of seven astronauts in 1986. Hubble finally got off the ground on April 24, 1990 aboard the Space Shuttle Discovery. The next day, it was released into low Earth orbit, opening a new chapter in man's understanding of space.

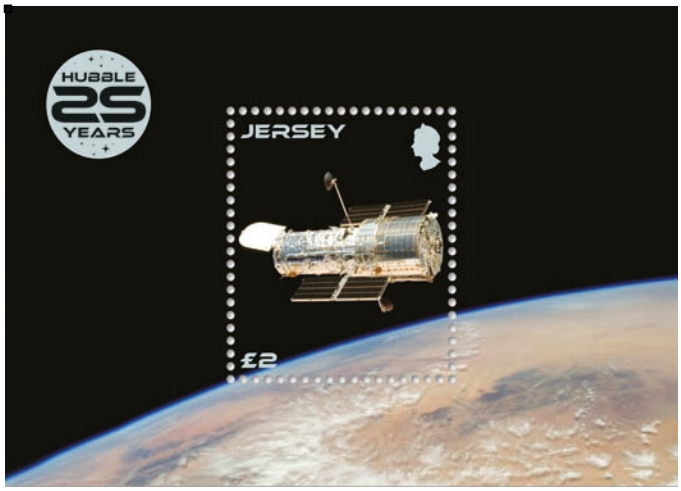
But the flawed image quality of the first pictures returned from Hubble caused severe consternation across the science community and general public. Analysis found that one of the three lenses was out of position. Finally, the crew of the Space Shuttle Endeavor performed a tricky repair mission during the first week of December 1993 and the Hubble was restored to its designed functionality.

One of NASA's most successfully missions ever, Hubble's findings have contributed to more than 11,000 scientific papers published to date, making it one of the most productive scientific instruments ever built.

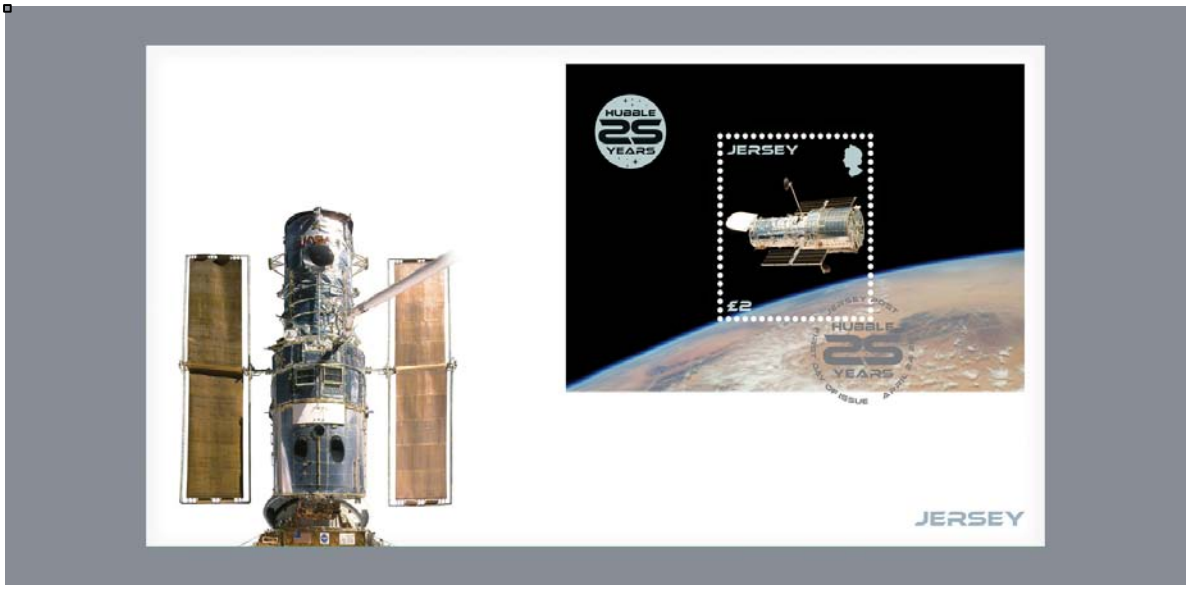
To celebrate the space telescope's 25th anniversary, Jersey Post released an attractive set of eight stamps in April that capture images credited to NASA. They are:

- V838 Monocerotis (Light Echo), a red variable star in the constellation Monoceros, lying about 20,000 light-years from the Sun;
- Messier 74 (also known as NGC 628), a spiral galaxy in the constellation Pisces, located at a distance of about 32 million light-years from Earth;
- HH 901, HH 902 (Mystic Mountain), two pillars of gas and dust, three light-years tall, in the Carina nebula, some 7,500 light-years away in the southern constellation of Carina;
- Jupiter's new red spot;
- NGC 6543 (The Cat's Eye Nebula) in the northern constellation of Draco, some 3,000 light-years from Earth;
- Mars on Dec. 3, 2007;
- Arp 273, UGC 1810 (A Rose of Galaxies) located in the constellation, Andromeda, about 300 million light-years from Earth;
- The Pistol Star, located approximately 25,000 light-years from Earth in the direction of Sagittarius, is a blue hypergiant and is one of the most luminous known stars in the Milky Way.

Jersey Post also released a miniature sheet, which features the Hubble Space Telescope in its final release over Earth on April 25, 1990, as well as two FDCs shown below.



The Jersey Post issue was created by Two Degrees North from photographs courtesy of www.hubble.org, NASA and STSci. Stamps and miniature sheet were printed in four color-offset lithography, with metallic silver by Lowe-Martin, Canada. Stamp die size 36mm by 36mm; miniature sheet overall size 75mm by 100mm, with the stamp within 36mm by 42mm.



Hubble is scheduled to remain in orbit until at least 2020, when it will be joined by its infrared successor, the James Webb Space Telescope, which is now under construction and due for launch in late 2018. Whether Hubble is refurbished with a bigger camera and new electronics package has not yet been decided. Also under study is the so-called High Definition Space Telescope, with a possible 12-meter mirror and spectrographs that will cover the wavelength range from near infrared to UV. The HDST may finally answer the age-old question: are we alone?

First landing on a comet

Comets have inspired awe and wonder since the dawn of history. Many scientists today believe that comets crashed into Earth in its formative period spewing organic molecules that were crucial to the growth of life. Comets may have formed about the same time as the giant planets of our solar system (Jupiter, Saturn, Uranus, and Neptune) - about 4.6 billion years ago. Some scientists think that comets and planets were both made from the same clumps of dust and ice that spewed from our Sun's birth; others think that these roving time capsules are even older than that, and that they may contain grains of interstellar stuff that is even older than our solar system!

Rosetta is a robotic space probe launched by the European Space Agency (ESA). Along with its lander module, Philae, Rosetta's ten-year mission was to catch the comet67P/Churyumov-Gerasimenko (67P) and to answer some of our questions about comets.

After more than 10 years travelling through space, Rosetta rendezvoused with the comet 67P in August 2014, after a journey of some 6.4 billion kilometers through the solar system, and entered actual orbit about it in September. The surface layout of 67P was unknown before Rosetta's arrival.

On November 12, 2014, 510 million kilometers from earth, Philae detached from Rosetta and approached 67P at a relative speed of around 1 m/s (2.2 mph). It bounced twice, but Philae's soft landing on the comet was the first time in history that such an extraordinary feat has been achieved. The ESA scientific team is now making the best ever analysis of one of the oldest remnants of our Solar System.

To commemorate the landing, Ascension Island issued a four-stamp set of the launch of Rosetta aboard an Ariane 5 space rocket. The accompanying souvenir sheet gives us the first glimpse of 67P. The stamps and souvenir sheet were designed by Bee Design, with the sheet 100 by 70mm.

A celestial quiz to celebrate Meteor Day

On June 30, 2015, astronomers and keen observers of the nighttime skies celebrated National Meteor Day, also known to some as National Meteor Watch Day. Although the precise origins of the holiday are unknown, it offers an ideal occasion to look skyward for the brilliant flashes of light that crisscross the sky as bits of interplanetary debris pass through the Earth's atmosphere. As our part of this annual celebration, here are some trivia questions to see how much you know about meteors and other astronomical phenomena.

What is a meteor?

Many people mistakenly think that a meteor is a physical object, such as a rock of varying size, which hurtles through the nighttime skies creating a bit of a show for those of us watching from below. Actually, a meteor, sometimes known as a shooting star, isn't an object at all but rather the stream of light created when a meteoroid burns up as it passes through the Earth's atmosphere. A meteoroid is a chunk of material that has broken off from a much larger asteroid or comet.

What's the difference between a meteoroid and a meteorite?

As we've noted, meteoroids are chunks of debris that have broken off from an asteroid or comet. Meteoroids range in size from mere pebbles, only millimeters in diameter, to larger chunks of debris up to a kilometer across. However, large meteoroids are extremely rare. Most meteoroids burn up as they pass through the Earth's atmosphere, giving us Earthlings nothing more than a light show. However, in rare cases, part of a meteoroid survives its passage through the atmosphere and eventually smashes into the Earth. Meteoroids, or the remnants of meteoroids, that make it to the Earth's surface are called meteorites.

What’s the largest meteorite to strike the Earth in recent years?

Long before historians recorded such events, meteorites of varying sizes have collided with the Earth's surface, often creating craters at their point of impact. By far the biggest meteorite to strike Earth in recent years was the Chelyabinsk meteorite, which slammed into the Earth near the Russian city of Chelyabinsk on Feb. 15, 2013. Video cameras in cars captured the passage of the fireball as the meteoroid hurtled toward its impact point in broad daylight. The force of shock waves set off by the meteoroid's entry into the atmosphere shattered windows, damaged more than 7,000 buildings, and injured some 1,500 people. Fragments of the meteorite were scattered over a wide area. The largest recovered fragments, found on the bottom of nearby Lake Chebarkul, had a total weight of 1,442 pounds.

Why do some meteors have a different hue than others?

Close observers of meteors' paths across the sky may note that these streaks of light sometimes have somewhat different colors. This is likely to be most apparent to those tracking a meteor shower with a high-powered telescope. These different hues offer a clue about the chemical composition of the meteoroid being observed. A red hue indicates the strong presence of silicates

in the meteoroid, while an orange/yellow color means sodium is the dominant chemical. Yellow represents iron, blue/green suggests a strong presence of copper, and purple means that potassium is likely the meteoroid's dominant chemical.

Taken during a Perseid meteor shower. This photograph superimposes onto a single image the flight paths of multiple meteors.

Old eyes in the sky

As part of an ongoing series of tourist attractions, South Korea in the spring commemorated Cheomseongdae, the oldest existing astronomical observatory in Asia. Located in Gyeongju, it was used for observing the stars in order to forecast the weather. This stone structure is a beautiful combination of straight lines and curves and has been featured on stamps in the past.

Cheomseongdae, which roughly translates to "star-gazing platform" in Korean, is a cylindrical structure composed of 362 granite blocks, which some claim represents the 362 days of the lunar

year. In total, there are 27 circular layers of stones, a number believed to reference the 27th ruler of the Silla Kingdom of modern-day Korea, Queen Seon-deok, during whose reign the observatory was built.

This numbers game continues further, as a window is placed strategically with 12 layers of stones above and 12 layers below, symbolizing the months of the year or the signs of the Zodiac. And if that weren't enough symbolism for one small building, the four-sided base is also thought to represent the four seasons.

But regardless of the hidden numerical messages, the observatory is interesting in its own right. As one of the oldest scientific sites in the world, Cheomseongdae provides a window into how astronomy was conducted many hundreds of years ago. In those times, the line between astronomy and astrology was considerably blurred, and astronomers often reported their findings to the king's court so that various decisions of governance could be made based on celestial activities.

Despite its use for astrological predictions, Cheomseongdae was also the site of more traditional astronomical research. From the top of the tower, state-appointed astronomers made continuous observations 24 hours a day, 365 days a year, developing the ability to predict eclipses and chart the trajectories of comets. In fact, Cheomseongdae's importance, in both the histories of Korea and astronomy, earned it the distinction of national treasure in 1962 and its image can even be found on Korean currency.

Honoring Ulugh Beg, again

Uzbekistan paid tribute in 1994 on the 600th anniversary of the birth of astronomer, mathematician and ruler, Mirza Muhammad Taraghay bin Shahrukh, better known as Ulugh Beg, one of Islam's greatest astronomers during the Middle Ages. The stamps, with labels, and a miniature sheet were reissued in 2014, with surcharges to indicate a new face value.

Ulugh Beg ruled Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan, southern Kazakhstan and most of Afghanistan for almost half a century from 1411 to 1449. He was also a mathematics genius of the 15th century, compiling accurate trigonometric tables of sine and tangent values correct to at least eight decimal places.

Ulugh Beg was best known for his work in astronomy-related mathematics, such as trigonometry and spherical geometry. He built the great Ulugh Beg Observatory in Samarkand between 1424 and 1429. It was considered by scholars to have been one of the finest observatories in the Islamic

world at the time and the largest in Central Asia. The observatory was destroyed in 1449 and rediscovered in 1908 by an Uzbek-Russian archaeology team.

While working at the excavation site, archaeologists found one of the most important astronomical instruments used at the observatory: a large arch that had been used to determine midday. A trench of about two meters wide was dug in a hill along the line of the Meridian and in it was placed the arc of the instrument. The trench, also with a globe and astrolabe, are depicted in the stamp below.

The remaining underground section of the Fakhri sextant that is now roofed over. The sextant was 11 meters long and once rose to the top of the surrounding three-story structure although it was kept underground to protect it from earthquakes. Calibrated along its length, it was the world's largest 90-degree quadrant at the time, with a radius of 40.4 meters.

Ulugh Beg also built the Ulugh Beg Madrasah (1417–1420) in Samarkand and Bukhara, inviting numerous Islamic astronomers and mathematicians to study there and transforming the cities into cultural centers of learning in Central Asia. The madrasa building survives to this day.

A note from your editor

We continue to encourage our members to take the effort and become contributors to ASTROFAX. This can take many forms, just a few of which are listed here:

- Write articles on any subject that interests you. Don't worry about your writing skills – that's what editors are for.
- Submit images from your collection and include a few words about the item (s). Again, it doesn't have to be a polished article. We have editors for that.
- Ask questions. It's likely that other share your concerns about a particular issue.
- Announce achievements, events, meeting, shows and other opportunities.

Membership dues, including an annual subscription to ASTROFAX, are $8 a year in the U.S. and Canada and $12 elsewhere. Payment should be made in U.S. dollars.

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