THE STAR

THE NEWSLETTER OF THE
MOUNT CUBA ASTRONOMICAL GROUP
VOL. 4 NUM. 3

CONTACT US AT
DAVE GROSKI
David.M.Groski@Dupont.com

OR
HANK BOUCHELLE
hbouchelle@live.com
302-983-7830

OUR PROGRAMS ARE HELD THE SECOND TUESDAY OF EACH MONTH AT 7:30 P.M. UNLESS INDICATED OTHERWISE
MOUNT CUBA ASTRONOMICAL OBSERVATORY
1610 HILLSIDE MILL ROAD
GREENVILLE, DE
FOR DIRECTIONS PLEASE VISIT
www.mountcuba.org

PLEASE SEND ALL PHOTOS AND ARTICLES TO
pestrattonmcag@gmail.com

MCAG NEXT MEETING
TUESDAY NOVEMBER 10TH 7:30 p.m.
ALL MEETINGS HELD AT THE MCAO

Approaching Darkness: Examining a Sunset
Hank Bouchelle, Ed.D.

Sunsets can be as gorgeous as they are dramatic. However, interesting phenomena related to the Sun and Earth's rotation do not end there!

IN THIS ISSUE:

When you see titles or words in any color other than black or red, it most likely is a link to a Web Site. Right click and select open hyperlink.

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.

Diffuse nebulae, sometimes inaccurately referred to as gaseous nebulae, are clouds of interstellar matter, namely thin but widespread agglomerations of gas and dust. If they are large and massive enough they are frequently places of star formation, thus generating big associations or clusters of stars.Aug 27, 2007

Protoplanetary disk is a rotating circumstellar disk of dense gas surrounding a young newly formed star, a T Tauri star, or Herbig Ae/Be star.

Asteroseismology (from Greek ἀστήρ, astēr, "star"; σεισμός, seismos, "earthquake"; and -λογία, -logia) also known as stellar seismology is the science that studies the internal structure of pulsating stars by the interpretation of their frequency spectra.

Helioseismology is the study of the propagation of wave oscillations, particularly acoustic pressure waves, in the Sun. Unlike seismic waves on Earth, solar waves have practically no shear component (s-waves).

FROM THE WORLD OF ASTRONOMY:

The **Orion Nebula**

(also known as Messier 42, M42, or NGC 1976) is a diffuse nebula situated in the Milky Way, being south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae, and is visible to the naked eye in the night sky. M42 is located at a distance of 1,344 ± 20 light years and is the closest region of massive star formation to Earth. The M42 nebula is estimated to be 24 light years across. It has a mass of about 2000 times the mass of the Sun. Older texts frequently refer to the Orion Nebula as the Great Nebula in Orion or the Great Orion Nebula.

The Orion Nebula is one of the most scrutinized and photographed objects in the night sky, and is among the most intensely studied celestial features The nebula has revealed much about the process of how stars and planetary systems are formed from collapsing clouds of gas and dust. Astronomers have directly observed protoplanetary disks, brown dwarfs, intense and turbulent motions of the gas, and the photo-ionizing effects of massive nearby stars in the nebula.

Something Strange Is Happening Inside Saturn

Unusual ripples in Saturn's rings are revealing the mysterious inner workings of the great gas giant. Planetary scientists and modelers are slowly picking apart that mystery.

Billions of particles race around Saturn's 170,000-mile-wide (273,600 kilometers) set of rings, which are mostly water ice with a smattering of rock. The rings are full of activity, including waves that ricochet outward in spiral patterns, most caused by the gravitational pull of Saturn's 62 moons. Waves caused by the moons, which orbit outside the rings' sphere, always travel outward.

Most scientists' models of Saturn and other gas giants assume the planet is pretty uniform — just a large gas envelope surrounding a small, dense core that's perhaps the size of Earth. But by studying the rings' waves, researchers are finding the picture much more complicated.

"The one thing that might produce this [series of waves] is that some sort of disturbance inside Saturn itself is spinning around with a period that's less than 7 hours," Phillip Nicholson, a planetary scientist at Cornell University in New York, told Space.com. Researchers first noticed hints of that disturbance in the 1990s, and Nicholson's team used more precise measurements to fully document the ring waves' structures, which reflect the oscillations of the planet within — sort of like recurring Saturn quakes.

Right now, measuring those oscillations offers scientists the best possible chance to grasp what's going on far inside the planet, like Saturn's internal rotation or structure, which appears to be more complicated than previously thought, scientists say.

"Even dropping a probe into the atmosphere would not necessarily help a lot, because the probe will only get down to a pressure of five or 10 atmospheres before it gets cooked or squashed," Nicholson said. "We need to go much deeper to understand this."

Everything is ringing

Saturn isn't the only astronomical body with a groove; for many years, researchers have been watching the vibrations of the sun and other stars. Even Earth has a hum, and scientists use whole-Earth oscillations, triggered by large earthquakes, to discern what's going on inside.

"The basic idea is that we know of many stars, including our own sun, that oscillate at certain frequencies that are determined by the actual internal structure of the planet or the star," Jim Fuller, a researcher at the California Institute of Technology, told Space.com. Fuller studies and models those oscillations, including those in Saturn, building off of initial work by Nicholson and his collaborator Matthew Hedman, now at the University of Idaho.

Tools like NASA's orbiting Kepler Space Telescope, which precisely measures the brightness of distant stars while searching for planets orbiting around them, can send back information about changes in brightness detailed enough to see the stars' shifting— a field called Astroseismology. Helioseismology, which measures sound waves below the sun's surface, has given researchers a detailed understanding of the flow of materials deep within the sun. Seismographs can measure whole-Earth vibrations directly, using the same process as ordinary seismology, which has told researchers about conditions deep inside Earth. But it is much more challenging to detect movements within planets humans aren't sitting on.

Enter Kronoseismology, the study of oscillations within Saturn. Nicholson and Hedman chose the name because Kronos (or Cronus) is the Greek equivalent of the Roman god Saturn, a mighty Titan, whose namesake planet has correspondingly mighty rings. Those rings act as a rare window into the movements at the heart of the planet.

NASA's Cassini spacecraft, which is currently exploring Saturn and its moons, has carefully measured how much light from individual stars shines through the rings with its Visual and Infrared Mapping Spectrometer, which allows scientists to calculate the changes in the rings' density at different locations. Researchers can pull out the patterns of ring density, in the form of waves, caused by the oscillations of mass within Saturn itself, and use those patterns to learn about the planet, like using the sounds made by a violin or a drum to determine its shape.

Something strange

When Nicholson put together the series of waves caused by Saturn's movement for a 2013 paper, they didn't quite add up. Instead of a regular pattern of vibrations all building on one another, he was seeing multiples of some waves and missing others.

"If Saturn were a nice big ball of liquid hydrogen and helium, liquid and gas, it really should only have one frequency associated with each of these overtones," he said. Instead, the measurements were like a violin that plays multiple discordant tones when one string is strummed. There's "something a bit wrong with your violin, if that's the case," he said.

Fuller has conducted follow-up research to try to find the possible causes of the discord. "Saturn must have a layer deep down inside of it that's stably stratified," he said. "For some reason, the fluid is very stable and doesn't move around very much ... And that part is new, because the conventional models of giant planets are just convective envelopes [where the materials move freely to exchange heat] all the way down to their core. But what I found is that those very simple models can't explain what we're seeing in the rings."

Fuller suggested that the stable layers could have a number of causes. By modeling each potential scenario and measuring the waves it would create, he and others are hoping to narrow down the possibilities. One explanation, he said, is that the helium is separating from its mix with hydrogen lower down in the planet, because of higher pressure, and condensing into helium raindrops that fall even deeper. Then, the boundary between the high-helium area below and the mostly hydrogen area above would be a stable border, Fuller said.

Another explanation might be that the ice and rock of the core are dissolving upward into the hydrogen and helium that make up most of the planet. That, too, would create smooth layers of fluid beneath the turbulent gas above.

"In the past, people have thought of these ideas, but it's been very hard to test them because we have no way of seeing what's inside of Saturn," Fuller said. "But with the seismology, for the first time, we're starting to get a glimpse of that interior structure. It's still pretty primitive, because we can only detect some of Saturn's operations, but it's enough to give us some interesting prospects, at the very least.

Astronomers discovered a new component of the Milky Way galaxy that they never expected to find

.

(Wikimedia Commons)

The universe is a mysterious place — comprised of mostly dark matter and dark energy, neither of which scientists fully understand.

And now, a recent study shows that even our own cosmic neighborhood can surprise us at times.

Reporting in this month's Astrophysical Journal Letters, a team of astronomers identified a band of special, young stars residing in one of the last spots they expected: near the heart of the Milky Way.

The remarkable discovery suggests that some unknown force is breathing new life into our galaxy's center.

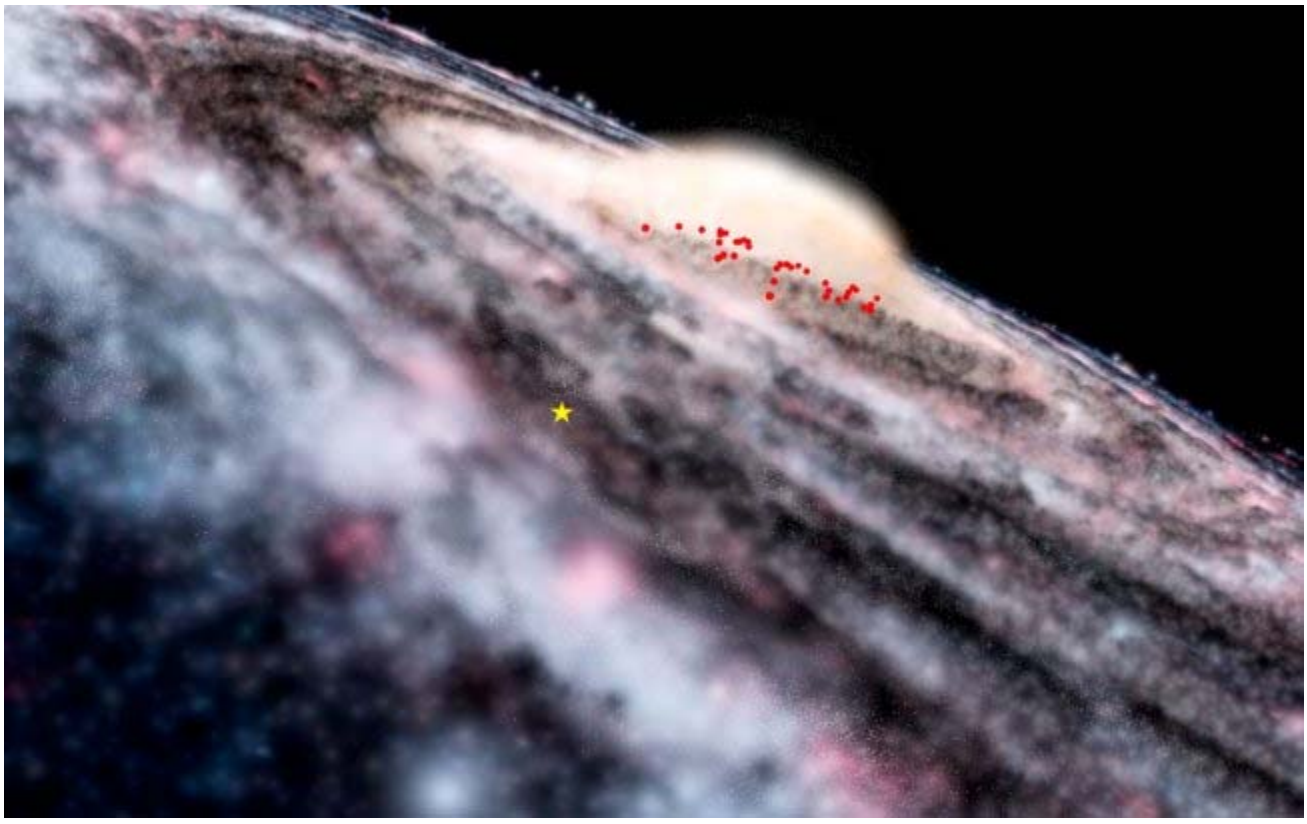
Before the team's report, astronomers thought the Milky Way's center, also called the galactic bulge, contained mostly old stars, which have been around for billions and tens of

billions of years. The team's discovery has uncovered a completely new component of our galaxy.

By analyzing nearly four years of observations — conducted between 2010 and 2014 — with the VISTA Telescope at the Paranal Observatory in Chile, the team discovered a band of 35 extremely young stars within the central bulge.

In the image below, the red dots represent the band of young stars, while the yellow star identifies our sun:

.



(ESO / Microsoft WorldWide Telescope)

These stars are of a particular class called Cepheids, which are famous for their pulsations that astronomers use to calculate extremely accurate distance between Earth and the star.

Each Cepheid has a unique pattern where it brightens, dims, and then repeats the cycle. Some Cepheids take days to complete a single cycle while others can take months.

"All of the 35 classical Cepheids discovered are less than 100 million years old," Dante Minniti, who is a co-author of the paper and researcher at the University Andres Bello, Santiago, Chile, said in a European Space Agency press release. "The youngest Cepheid may even be only around 25 million years old."

.

(ESO)

For comparison, the sun, which is in the prime stages of its life, is roughly 4.5 billion years old — 180 times older than the youngest Cepheid of this newly discovered group.

The team's find "implies a continuous supply of newly formed stars in the central region of the Galaxy over the last 100 million years," they stated in their paper.

The VISTA telescope is a powerful instrument for mapping the heart of our Milky Way galaxy, which is hidden from the human eye.

.

If you look toward the galactic bulge (shown above), you'll notice that it is shrouded by dark, molecular clouds, which obstruct our view of what lies beyond.

But with VISTA, astronomers can see through the clouds as if they weren't even there because it observes not in visible wavelengths (what humans see) but in the infrared.

Infrared radiation is not absorbed by the molecular clouds in the galactic bulge and instead passes straight through. Some of it eventually reaches Earth.

For this reason, the team has been using VISTA to map the Milky Way's center by seeking out Cepheid stars that lie beyond the molecular clouds. They call their project the VVV Survey.

Right now, our distance to the galactic bulge is uncertain. By using the pulsating nature of Cepheids, astronomers can get a better handle on this distance and eventually produce a three-dimensional map of the Milky Way's center.

In their latest analysis of the data VISTA has collected so far, the team identified 655 Cepheids. And when they looked at how quickly each star was pulsating, which is related to the star's age, they were surprised to discover that 35 of their Cepheids were unusually young.

"This part of the galaxy was completely unknown until our VVV survey found it!" Minniti said in the press release.

The next step is to determine if these young stars formed where astronomers see them today, or if they migrated toward the center from a more distant region of space.

Finding the answer will undoubtedly improve our understanding about the past and future of our galaxy as well as other galaxies like it throughout the universe.

WEB SITES OF INTEREST:

Naval observatory Foggy Bottom
http://ghostsofdc.org/2014/07/09/old-u-s-naval-observatory-foggy-bottom/

PUBLIC NIGHTS AT MCAO:

November 9 8:00 p.m.	**Lynn King**	**An evening with Caroline Herschel**
November 23 8:00 p.m.	**Greg Weaver**	**How to select a Telescope**
December 11 7:30 p.m.	**Scott Jackson**	**The Christmas Star**
December 14 7:30	**Scott Jackson**	**The Christmas Star**

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)_____

Mail to: Carolyn Stankiewicz
Mount Cuba Astronomical Observatory
1610 Hillside Mill Road
Greenville, DE 19807