THE STAR

THE NEWSLETTER OF THE
MOUNT CUBA ASTRONOMICAL GROUP
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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, ARTICLES AND COMMENTS TO
pestrattonmcag@gmail.com

OCTOBERS MEETING
TUESDAY OCTOBER 13 7:30 p.m.
Mt. Cuba Astronomical Observatory

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 topics and 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.

Multiverse.

The multiverse (or meta-universe) is the hypothetical set of infinite or finite possible universes (including the Universe we consistently experience) that together comprise everything that exists: the entirety of space, time, matter, and energy as well as the physical laws and constants that describe them. The various universes within the multiverse are also called "parallel universes" or "alternate universes".

hydrogen reionization

In Big Bang cosmology, reionization is the process that reionized the matter in the universe after the "dark ages", and is the second of two major phase transitions of gas in the universe. As the majority of baryonic matter is in the form of hydrogen, reionization usually refers to the reionization of hydrogen gas. The primordial helium in the universe experienced the same phase changes, but at different points in the history of the universe, and is usually referred to as helium reionization.

quantum field theory

Quantum field theory is a theory that asserts particles are quantized wave excitations in fields that permeate the universe. The theory is the only logically consistent known way to put together quantum physics and special relativity.

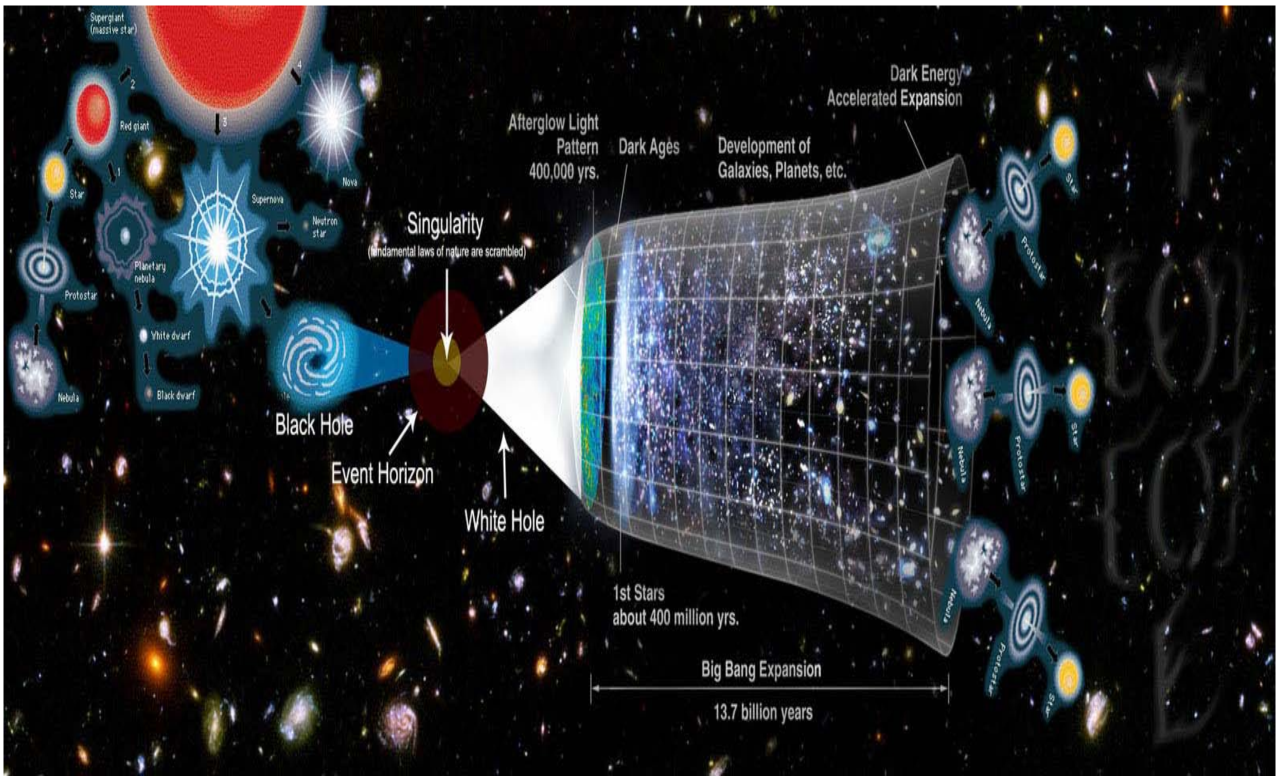
ARTICLES IN THIS ISSUE:

Discovery of Farthest Known Galaxy Brings New: Questions About Early Universe

Messier 63

A trip back in time.

What Came Before the Big Bang?



Astronomers are pretty sure what happened after the Big Bang, but what came before? What are the leading theories for the causes of the Big Bang?

About 13.8 billion years ago the Universe started with a bang, kicked the doors in, brought fancy cheeses and a bag of ice, spiked the punch bowl and invited the new neighbors over for all-nighter to encompass all all-nighters from that point forward. But what happened before that?

What was going on before the Big Bang? Usually, we tell the story of the Universe by starting at the Big Bang and then talking about what happened after. Similarly and completely opposite to how astronomers view the Universe… by standing in the present

and looking backwards. From here, the furthest we can look back is to the cosmic microwave background, which is about 380,000 years after the big bang.

Before that we couldn't hope to see a thing, the Universe was just too hot and dense to be transparent. Like pea soup. Soup made of delicious face burning high energy everything. In traditional stupid earth-bound no-Tardis life unsatisfactory fashion, we can't actually observe the origin of the Universe from our place in time and space.

Damn you… place in time and space.

Fortunately, the thinking types have come up with some ideas, and they're all one part crazy, one part mind bendy, and 100% bananas. The first idea is that it all began as a kind of quantum fluctuation that inflated to our present universe.

Something very, very subtle expanding over time resulting in, as an accidental byproduct, our existence. The alternate idea is that our universe began within a black hole of an older universe.
I'm going to let you think about that one. Just let your brain simmer there.

There was universe "here", that isn't our universe, then that universe became a black hole… and from that black hole formed us and EVERYTHING around us. In every direction we look, and even the stuff we just assume to be out there.

Here's another one. We see particles popping into existence here in our Universe. What if, after an immense amount of time, a whole Universe's worth of particles all popped into existence at the same time. Seriously… an immense amount of time, with lots and lots of "almost" universes that didn't make the cut.

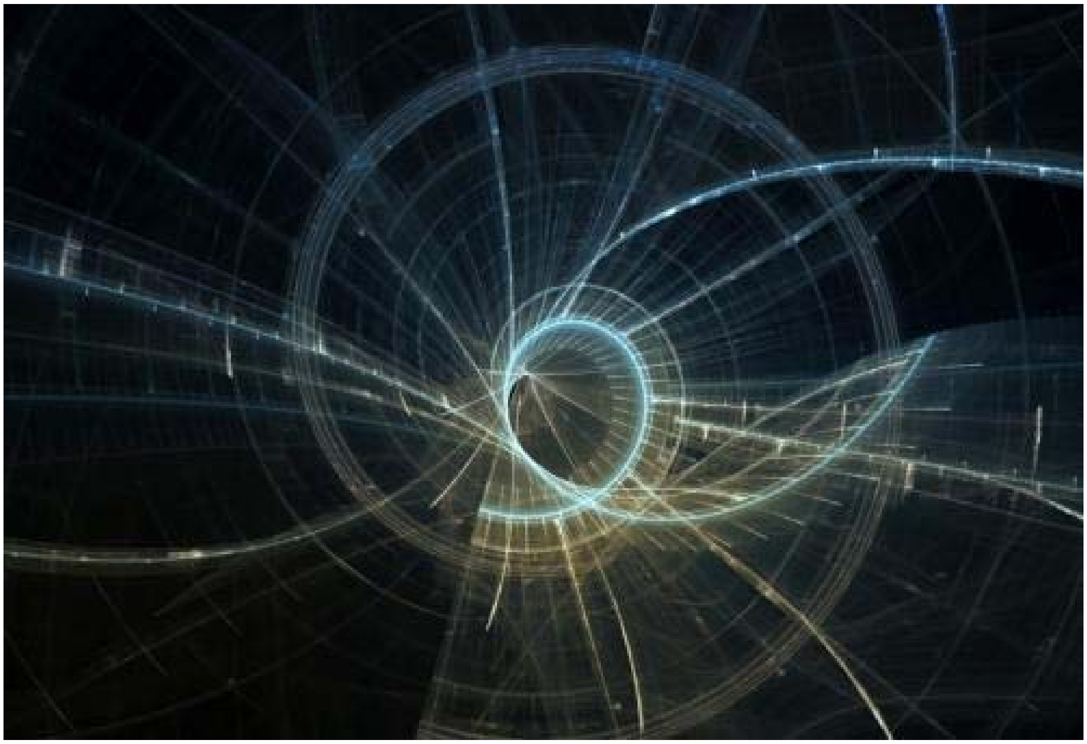
More recently, the BICEP2 team observed what may be evidence of inflation in the early Universe.
Like any claim of this gravity, the result is hotly debated. If the idea of inflation is correct, it is possible that our universe is part of a much larger multiverse. And the most popular form would produce a kind of eternal inflation, where universes are springing up all the time. Ours would just happen to be one of them.

It is also possible that asking what came before the big bang is much like asking what is north of the North Pole. What looks like a beginning in need of a cause may just be due to our own perspective. We like to think of effects always having a cause, but the Universe might be an exception. The Universe might simply be. Because.

I hope to get at least a few responses to this article.

Source unknown.

String field theory could be the foundation of quantum mechanics



Two USC researchers have proposed a link between string field theory and quantum mechanics that could open the door to using string field theory—or a broader version of it, called M-theory—as the basis of all physics.

"This could solve the mystery of where quantum mechanics comes from," said Itzhak Bars, USC Dornsife College of Letters, Arts and Sciences professor and lead author of the paper.

Bars collaborated with Dmitry Rychkov, his Ph.D. student at USC. The paper was published online on Oct. 27 by the journal Physics Letters.

Rather than use quantum mechanics to validate string field theory, the researchers worked backwards and used string field theory to try to validate quantum mechanics.

In their paper, which reformulated string field theory in a clearer language, Bars and Rychov showed that a set of fundamental quantum mechanical principles known as "commutation rules'' may be derived from the geometry of strings joining and splitting.

"Our argument can be presented in bare bones in a hugely simplified mathematical structure," Bars said. "The essential ingredient is the assumption that all matter is made up of strings and that the only possible interaction is joining/splitting as specified in their version of string field theory."

The history of string theory.

Physicists have long sought to unite quantum mechanics and general relativity, and to explain why both work in their respective domains. First proposed in the 1970s, string theory resolved inconsistencies of quantum gravity and suggested that the fundamental unit of matter was a tiny string, not a point, and that the only possible interactions of matter are strings either joining or splitting.

Four decades later, physicists are still trying to hash out the rules of string theory, which seem to demand some interesting starting conditions to work (like extra dimensions, which may explain why quarks and leptons have electric charge, color and "flavor" that distinguish them from one another).

At present, no single set of rules can be used to explain all of the physical interactions that occur in the observable universe.

On large scales, scientists use classical, Newtonian mechanics to describe how gravity holds the moon in its orbit or why the force of a jet engine propels a jet forward. Newtonian mechanics is intuitive and can often be observed with the naked eye.

On incredibly tiny scales, such as 100 million times smaller than an atom, scientists use relativistic quantum field theory to describe the interactions of subatomic particles and the forces that hold quarks and leptons together inside protons, neutrons, nuclei and atoms.

An invaluable framework

Quantum mechanics is often counterintuitive, allowing for particles to be in two places at once, but has been repeatedly validated from the atom to the quarks. It has become an invaluable and accurate framework for understanding the interactions of matter and energy at small distances.

Quantum mechanics is extremely successful as a model for how things work on small scales, but it contains a big mystery: the unexplained foundational quantum commutation rules that predict uncertainty in the position and momentum of every point in the universe.

"The commutation rules don't have an explanation from a more fundamental perspective, but have been experimentally verified down to the smallest distances probed by the most powerful accelerators. Clearly the rules are correct, but they beg for an explanation of their origins in some physical phenomena that are even deeper," Bars said.

The difficulty lies in the fact that there's no experimental data on the topic—testing things on such a small scale is currently beyond a scientist's technological ability.

NEW GALAXY:

Discovery of Farthest Known Galaxy Brings New Questions About Early Universe

By ALYSSA NEWCOMB

After the Big Bang created the universe 13.8 billion years ago, scientists believe the first galaxies began to form half a billion to 1 billion years later. Finding such galaxies has been a challenge because their light is so faint, which makes the discovery of a 13.2 billion-year-old galaxy -- the farthest known -- especially intriguing to scientists.

The galaxy, called EGS8p7, was pinpointed as an area for further investigation after scientists evaluated data from the Hubble and Spitzer space telescopes. A team of Caltech researchers then performed a spectrographic analysis of the galaxy, a process used to measure its red shift, which is used to determine the distance a galaxy is from Earth.

In theory, scientists shouldn't have been able to see a galaxy this old because neutral hydrogen atoms were believed to have absorbed radiation from newly formed galaxies, making the older galaxies incredibly faint and virtually undetectable, according to the study published in the Astrophysical Journal Letters.

While scientists aren't certain why they are able to see this galaxy, one theory is that hydrogen reionization during the early beginnings of the universe may have been patchy, explaining why some galaxies are more visible than others.

It's also possible EGS8p7 may be housing hot stars that, in turn, create a giant hydrogen bubble, allowing the galaxy to be seen.

"The galaxy we have observed, EGS8p7, which is unusually luminous, may be powered by a population of unusually hot stars, and it may have special properties that enabled it to create a large bubble of ionized hydrogen much earlier than is possible for more typical galaxies at these times," Sirio Belli, one of the Caltech researchers who worked on the project, said in a statement.

The researchers said they are now taking a closer look at the exact chances of finding this galaxy in order to gain an understanding of whether the timeline of reionization in the early universe needs to be revised.

EGSY8p7 EGSY-2008532660	
EGSY8p7 (Hubble and Spitzer, space telescopes)	
Observation data (J2000 epoch)	
Right ascension	14^h 20^m 08.50^s
Declination	+52° 53′ 26.60″
Redshift	8.68
Type	Galaxy
Other designations	
EGSY8p7,[1] EGSY-2008532660,[2] EGS8p7	

Messier 63

This newly released Hubble image shows spiral galaxy Messier 63, which is also known as the Sunflower Galaxy.

The arrangement of the spiral arms in the galaxy Messier 63, seen here in a new image from the NASA/ESA Hubble Space Telescope, recall the pattern at the center of a sunflower. So the nickname for this cosmic object — the Sunflower Galaxy — is no coincidence.

Discovered by Pierre Mechain in 1779, the galaxy later made it as the 63rd entry into fellow French astronomer Charles Messier's famous catalog, published in 1781. The two astronomers spotted the Sunflower Galaxy's glow in the small, northern constellation Canes Venatici (the Hunting Dogs). We now know this galaxy is about 27 million light-years away and belongs to the M51 Group — a group of galaxies, named after its

brightest member, Messier 51, another spiral-shaped galaxy dubbed the Whirlpool Galaxy.

Galactic arms, sunflowers and whirlpools are only a few examples of nature's apparent preference for spirals. For galaxies like Messier 63 the winding arms shine bright because of the presence of recently formed, blue–white giant stars, readily seen in this Hubble image.

A trip back in time.

I thought is might be fun to take a trip back in my time machine and take at look at just what was space news in 1915 and 1965. March 1965
Magnet Earth **"Since 1958 direct measurements of the outer reaches of the earth's field by means of artificial satellites and rocket probes have convinced many geophysicists that the simple picture of that magnetic field must be drastically revised. Far from being free of external influences, the geomagnetic field is continuously buffeted by a 'wind' of electrically charged particles emanating from the sun, distorted by electric currents circulating in the radiation belts that girdle the earth. The net result of all these influences is a geomagnetic field shaped somewhat like a teardrop with a tremendously elongated tail. Analysis of the data provided by the satellite measurements has progressed to the stage at which the broad outlines of the magnetosphere can now be mapped with reasonable accuracy."**

An Imaginative View of Saturn from Titan in 1915

SATURN, as seen from Titan, in an artist's impression, 1915.

PUBLIC NIGHTS AT MCAO:

September 14	**8:00 p.m.**	**James Dalessio**	**Our Amazing Universe**
September 25	**8:00 p.m.**		**Family Night**
October 12	**8:00 p.m.**	**Judi Provencal**	**Adventures: Modern Astronomy**
October 26	**8:00 p.m.**	**Greg Lee**	**Pluto Up Close and Personal**
November 9	**8:00 p.m.**	**Lynn King**	**Ask the Astronomer An evening w/ Caroline Herschel**
November 23	**8:00 p.m.**	**Greg Weaver**	**How to select a Telescope Christmas Present anyone.**

Mount Cuba Astronomical Group

Membership Form

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.

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)

APPLICATION FORM BELOW

Name____

Email Address_____________________________________

Home Address_____________________________________

Phone (optional)__________________________________

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