



East Rand Astronomy Club

The Universe Is In Us



Interstellar News

September 2019





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Description of our Cover Picture

The bright clusters and nebulae of planet Earth's night sky are often named for flowers or insects. Though its wingspan covers over 3 light-years, NGC 6302 is no exception. With an estimated surface temperature of about 250,000 degrees C, the dying central star of this particular planetary nebula has become exceptionally hot, shining brightly in ultraviolet light but hidden from direct view by a dense torus of dust.

This sharp and colourful close-up of the dying star's nebula was recorded in 2009 by the Hubble Space Telescope's Wide Field Camera 3, installed during the final shuttle servicing mission. Cutting across a bright cavity of ionized gas, the dust torus surrounding the central star is near the centre of this view, almost edge-on to the line-of-sight. Molecular hydrogen has been detected in the hot star's dusty cosmic shroud. NGC 6302 lies about 4,000 light-years away in the arachnologically correct constellation of the Scorpion (Scorpius).

Image Credit: NASA/ESA/Hubble

nasa.gov/multimedia/imagegallery/image_feature_2526.html

THE EDITORS PIECE:

September, The month of spring in the Southern Hemisphere. One looks forward to warmer, sunny days. September, a time when Planet Earth is filled with the joys of spring in the Southern Hemisphere.

Life is rested and renewed. At peace with spring fresh flowers and colours. Perfume scented evenings and the Milky Way beauty which one beholds, like a halo in our night sky, and the perfume scented evenings that dance to the song in one's soul.

All this is the soft side of life which must needs, give over to the renewal and learning of science and technology.

Time is far faster than what one can perceive. Not only should man know the past, but, given the opportunity, one should embrace the future by a study of all sciences, wherever one can.

Answer all tests that face one, bitter or better, becoming victors of life on Earth first, bearing in mind that someday, with knowledge and expertise man will venture into space.

Looking upward!



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OUR NEXT MEETING:

WHERE: Marachelle Country Estate.

WHEN: Wednesday 2 October 2019

SPEAKER: Jerome Jooste

SUBJECT: Astronomy: Title to be advised.

A Biography of Our Speaker:



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SUNRISE AND SUNSET TIMES IN SEPTEMBER 2019:

<u>DATE</u>	<u>SUNRISE</u>	<u>SUNSET</u>
1/9/2019	6:19	17:54
14/9/2019	6:13	17:56
21/9/2019	5:57	18:02
28/9/2019	5:50	18:05

SOLAR ECLIPSES:

Solar Eclipses have caused fear, inspired curiosity, and have been associated with myths, legends, and superstitions throughout history.

The ancient Greeks believed that a solar eclipse was a sign of angry gods and that it was the beginning of disasters and destruction.

Other legends surrounding solar eclipses are all about the sun being eaten or some animals stealing the sun.

Many other legends instilled fear and mysticism by interpretation of the event as being an angry god, or, a god made angry by disobedient people.

Today we have no reason to question our science. A solar eclipse occurs when the moon gets between Earth and the sun, and the moon casts a shadow over Earth. A solar eclipse can only take place at the phase of new moon, when the moon passes directly between the sun and Earth and its shadows fall upon Earth's surface.

THE MOON IN AUGUST 2019:

	<u>MOON RISE</u>	<u>MOONSET</u>	<u>MOON PHASE</u>
06/9/2019	11:27	00:24	Third Quarter
14/9/2019	18:18	06:24	Full Moon
22/9/2019	00:35	11:26	First Quarter
28/9/2019	05:45	17:52	New Moon

After the moon has completed the first quarter of its orbit around Earth, the relative positions of the Earth, sun, and moon cause us to see it half-illuminated - on its eastern side. At first quarter, the moon always rises around noon and sets around midnight local time, so it is also visible in the afternoon daytime sky. The evenings around first quarter are the best times to see the lunar terrain dramatically lit by low-angled sunlight.



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A LUNAR ECLIPSE:

An eclipse happens when one astronomical body blocks light from or to another. In a lunar eclipse, the Moon moves into the shadow of Earth cast by the Sun.

A total lunar eclipse takes place when the Earth comes between the Sun and the Moon and covers the Moon with its shadow. A total lunar eclipse is sometimes called Blood Moon because the Moon may look red when it's only illuminated by the light in Earth's shadow. However, the Moon does not have its own light. It shines because its surface reflects the Sun's rays. A lunar eclipse occurs when Earth comes between the Sun and the Moon and blocks the Sun's rays from directly reaching the Moon, thus, Lunar eclipses can only happen at full moon.

After the moon has completed the first quarter of its orbit around Earth, the relative positions of the Earth, sun, and moon cause us to see it half-illuminated - on its eastern side. At first quarter, the moon always rises around noon and sets around midnight local time, so it is also visible in the afternoon daytime sky. The evenings around first quarter are the best times to see the lunar terrain dramatically lit by low-angled sunlight.

THE PLANETS:

To define a Planet, it must do three things:

1. It must orbit a star.
2. It must be big enough to have enough gravity to force it into a spherical shape.
3. It must be big enough that its gravity clears away any other objects of a similar size near its orbit around the sun.

In August 2006, Pluto was downgraded to a dwarf planet because it did not clear item three. on the above list as designated by the International Astronomical Union (IAU). The story goes that Pluto was discovered in 1930 and a grandchild suggested the name to her grandfather Clyde Tombaugh. Tombaugh an American was an astronomer who discovered Pluto.

When discovered, Pluto was considered as the ninth planet and the most distant from the sun as it was found in the Kuiper Belt which is a zone beyond the orbit of Neptune. At the time, it was also the largest known Planet in the Kuiper Belt which is populated by thousands of rocky, icy bodies. Some call the Kuiper Belt a shadowy zone and say it is the home of a trillion or more comets.

In 2015, NASA's New Horizons space probe made a close flyby of Pluto and did observations of Pluto's surface. It has a diameter of 2370km. It has mountains as high as 3500kms, very much like Earth's surface but Pluto's surface is covered with methane and nitrogen ice.



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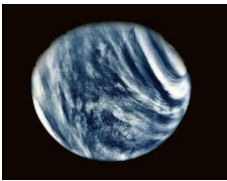
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Although the Kuiper Belt is one of the largest structures in our Solar System, little is known about this area. We do know it is a huge disc which begins at the orbit of Neptune about 30 light years from the sun and ends about 50 light years from the sun. Given that one light year is the distance from Earth to the sun. The Kuiper Belt is a long way away indeed! This area is vast and mysterious, as much as it is unknown, cold and dark. Scientists have only just begun to explore this area and believe that it holds important clues to the origins of our solar system



Mercury: is very close to the sun in September, making it very hard and difficult to see.



Venus: is also close to the sun and only visible for a short while in the west after the sun has set. Mars will transition from the evening to the morning sky at solar conjunction on Sept. 2; from our vantage point it will then be at a distance of nearly 249 million miles (400 million km) from Earth. It will reappear low in the eastern sky in mid-October in eastern Virgo and by New Year's Eve it will be a magnitude +1.6 interloper near the Libra-Scorpius border, rising about three hours before the sun. Mars and Uranus will Appear close together on Feb. 12, and Mars and Mercury will shine very close together on June 18.



Earth: The sun is moving southward and our spring Equinox takes place on the 22/23rd of September. Our days are growing longer, and temperatures are rising. Everything is fresh and green after the drab browns of winter.

Most of the earth's internal fires are fuelled by the radioactive decay of uranium and thorium. The heat produced by these disintegrations eventually makes its way to the surface where we can measure it. but the helium (4He) created by the radioactive decay of the uranium and thorium is mostly missing. The discrepancy is large, and scientists are confronted with the possibility that we are wrong about either the source of



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the earth's heat or the facts of nuclear physics. You can bet it will not be the latter. We are confident that helium atoms cannot change their type like those solar neutrinos! Neither can we blame chemical sequestration because helium is a noble gas. Perhaps the missing helium is physically trapped and stored somewhere in the earth's mantle. No one knows the answer; nor does anyone pay much attention to this clearcut anomaly.

(Chin, Gilbert, ed; "A Scarcity of Gas," *Science*, 292:2219, 2001.) From *Science Frontiers* #137, SEP-OCT 2001. © 2001 William R. Corliss



Mars: is very close to the sun in September and not visible at all. It will reappear low in the eastern sky in mid-October in eastern Virgo and by New Year's Eve it will be a magnitude +1.6 interloper near the Libra-Scorpius border.



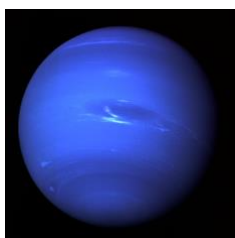
Jupiter: Is one of our "sky lovelies" this month. High up in the NNW and beautiful to see through a telescope.



Saturn: The "Queen of the Night", as surprising as ever, is to be seen NNE going toward midsky.



Uranus: is of average visibility. When Uranus and Neptune are visible, they normally appear as tiny discs. In our Solar system, Uranus is different in that its axis of spin is tilted by 98 degrees. This means it spins on its side.



Neptune: Neptune is difficult to see and appears in the sky as a tiny blueish disc.

NASA Solar System Exploration pictures



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THE ASHEN LIGHTS OF VENUS:

Some years back, when I first heard of the Ashen Lights of Venus, I immediately went into the realms of an airy dreamworld, after all, it was about planet Venus, Venus a Greek goddess attached to love and beauty. I searched for information about the Ashen Lights and became greatly disappointed. The ashen lights of Venus are not really of anything worth mentioning. No wonder they are relatively unknown! I searched the Internet and found the following.

“On occasion, the night side of Venus (which goes through phases like the moon) seems to glow softly and subtly. For some 350 years, keen-eyed observers have seen this phenomenon through their telescopes. Nevertheless, the effect is so elusive that many astronomers doubt its physical reality. Additionally, it is easy to doubt the existence of the ashen light because good explanations are as elusive as the light itself.

1. Spectrographic studies of the upper atmosphere of Venus do detect some night-time air glow, but it is much too weak to account for the abundant telescopic observations from earth.
2. The Cassini spacecraft did not detect any high-frequency radio noise typical of lightning when it passed close to Venus in 1998 and 1999. This put an end to the surmise that the ashen light was due to rapid, widespread lightning occurring deep inside the planet's thick atmosphere and then blended into a steady glow by atmospheric scattering. “

Sadly though, I learnt that Venus, under its poisonous gas cloud is dry, brown, barren and extremely volcanic – no beauty, and not pure and goddess-like and maybe, just another planet.

(Anonymous; "Case for 'Ashen Light' Weakens," *Sky & Telescope*, 101:27, May 2001.) <https://www.science-frontiers.com/sf137/sf137p10.htm>

THE CONSTELLATIONS:

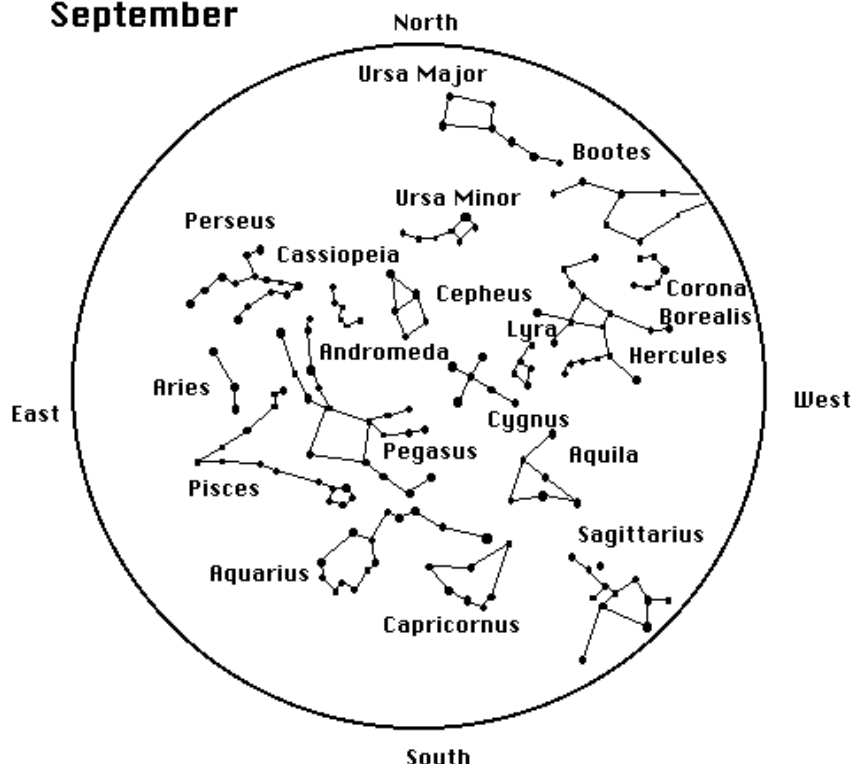


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September



In the long past, people liked to make up stories about constellations in the sky. They started off by joining the stars in imaginary lines of stars in the sky and in so doing, made patterns of group of stars, forming certain shapes and then gave those patterns names according to their appearance. This is how the constellations of Orion and others were formed or drawn. In the southern hemisphere Orion is our most important summer constellation.

Currently, Orion is a constellation in our early morning sky. There are so many points of interest in Orion and as it commands the southern sky it helps one greatly to identify other constellations like Taurus and Pleiades, lying very close to the west side of Orion.

Scorpius is making its way to the west. It is visible high up in the sky, always close to Jupiter.

Saying that, our summer constellation is already up and visible in the early morning sky before sunrise.

Other constellations are the same as mentioned before. If one has not yet looked at our winter/ spring skies. It would be interesting to join the dots and see what one comes up with. While doing that, do look at the bright stars within them.

There are interesting ones such as Capricornus, Pegasus and if one can find it on the horizon, Andromeda. Ophiuchus, as is Lyra and Hercules



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TELESCOPES:

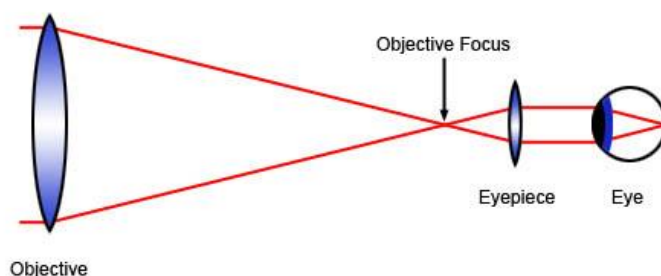
For the month of September, do take time off to check out your eyepieces and see if they are all in order. One cannot observe the night sky without a good eyepiece. Generally, the focal length of one's telescope in mm. divided by the focal length of one's eyepiece in mm. gives one the magnification of one's eyepiece. Also, the greater the number in size(mm), the wider the field of view. The smaller the number the more magnification one has.

Placing a camera at the focus of a telescope will also capture an image, since the telescope becomes the camera lens. But, placing one's eye at the focus point of a telescope does not produce an image. This is because one's eye is also an optical system. Your eye focuses light just like a telescope does, and it cannot focus on a real image such as that created by a telescope. It requires a virtual image, which is what an eyepiece creates.



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It is important to use the correct eye piece and possibly also a moon filter when looking at the moon since the moon is very bright and will make one's eye water considerably.

THE SPEED OF LIGHT:

Einstein's theory, which he proposed in 1905, describes the relativity of motion, particularly the motion of anything moving at, or close to, the speed of light. At the time, people believed that light waves, just as sound waves, ocean waves or shock waves, had to travel through a medium. But rather than air, water or ground, they believed light waves travelled through a substance called the ether, less tangible than air, that pervaded the universe.

Scientists assumed that the laws of physics would be different for an object at rest with respect to the ether, and with the proper experiments it would be possible to figure out what was truly at rest, according to Peter Galison, a professor of physics and the history of science at Harvard University.

"Einstein got rid of that," Galison said. "There are no physical properties that go with the statement 'I am truly at rest.' That's really what special relativity is about."

Special relativity is also based on a second assumption that gives the speed of light — 186,000 miles per second (300 million metres per second) — in a vacuum a special status. Einstein postulated that light always travels at the same speed for every observer, in other words, the properties of physics are the same for me whether I am riding my bicycle or sitting on a park bench. Special relativity, however, does not apply to acceleration. Einstein would tackle this later in his general theory of relativity, regardless of that observer's speed, Galison explained.

So, if you have a car that is fast enough, in theory, you could catch up to a bullet. But you could never catch up to, or even reduce the apparent speed of a pulse of light, regardless of whether you were driving toward it or away from it.



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Under Einstein's theory, the speed of light becomes a sort of ultimate speed limit. In fact, objects with mass, be they cars or neutrinos, can't reach the speed of light because they would need infinite energy to do so, according to the theory.

Some experiments have appeared to play with the speed of light, but these effects are illusory, according to Galison. Light traveling through different mediums, such as chilled sodium gas, does slow substantially, but this is because the light is being bounced between the atoms within the medium. But between interactions with atoms, it is still traveling at 186,000 miles per second (300 million metres per second), he said.

Claims that it's possible to push light beyond 186,000 miles per second (300 million metres per second), are equally illusory, Galison said.

Since Einstein introduced special relativity, the theory and the special status it gives to the speed of light have appeared ironclad.

Until now, that is. Scientists working on the OPERA experiment at the CERN laboratory in Switzerland beamed neutrinos 454 miles (730 kilometres) underground to Italy. They calculated how fast they made the trip. Shockingly, the neutrinos appeared to beat light speed by 60 billionths of a second. The finding appears to fly in the face of the last 106 years of physics.

"Our understanding hasn't evolved at all, we've been doing extremely precise tests of special relativity since the very first days," said Ben Monreal, an assistant professor of physics at University of California, Santa Barbara. "Special relativity has been passing tests with flying colours for over 100 years now. That is why this result is so surprising and unexpected."

If the finding of the OPERA experiment does pan out, the implications are much more mind-bending. Under special relativity, if something travels faster than the speed of light, it goes backwards in time. Such a proposition could interfere with the basic rule that cause precedes effect, called causality.

"The reason a lot of physicists are very unmoved by these claims is that it could make causality itself very problematic," Galison said. In other words, it raises the prospect of time travel.

There is another issue too. Einstein introduced the speed of light as a mathematical constant, c . If neutrinos can indeed exceed the speed of light, then, c , loses its special status, giving rise to a host of other problems elsewhere in physics, where, c , has been used in calculations, such as the famous formula $E=mc^2$.

"For all of these reasons, people are going to need extra evidence to conclude that it is going to hold up," Galison said.

<https://www.livescience.com/16248-speed-light-special-relativity-neutrinos.html>



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THE NIGHT SKIES IN SEPTEMBER:

Later in the month is a good time to look high in the Northeast towards the constellations of Cassiopea and Perseus. Perseus contains two interesting objects; the Double Cluster between the two constellations and Algol the 'Demon Star' which is an eclipsing Binary system.

September is a good month for 'moonists' to observe two of the greatest craters on the Moon, Tycho and Copernicus, as the terminator is nearby. By explanation the "Terminator" is the edge where the shadow on the moon moves or changes.

Tycho is towards the bottom of Moon in a densely cratered area called the Southern Lunar Highlands. It is a relatively young crater which is about 108 million years old. It is interesting in that it is thought to have been formed by the impact of one of the remnants of an asteroid that gave rise to the asteroid Baptistina.

Another asteroid originating from the same breakup may well have caused the Chicxulub crater 65 million years ago. It has a diameter of 85 km and is nearly 5 km deep. At full Moon the rays of material that were ejected when it was formed can be seen arcing across the surface. Copernicus is about 800 million years old and lies in the eastern Oceanus, Procellarum, beyond the end of the Apennine Mountains. It is 93 km wide and nearly 4 km deep and is a classic "terraced" crater.

COMETS AND METEORS FOR 2019:

Is there anything better than lying on the ground on a warm night to look for shooting stars? The best time to "catch a falling star" is in the cool of the early predawn morning hours. However, do be aware, sometimes the moon might just be a nuisance declaring bright light and then bed would be better than a blanket on the ground.

Orionids

Oct 02 – Nov 07 Oct 21 23



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Southern Taurids	Oct 01 – Nov 25	Nov 05 5
Northern Taurids	Oct 01 – Nov 25	Nov 12 5
Leonids	Nov 10 – Nov 23	Nov 18 15+
Puppis/Velids	Dec 01 – Dec 15	Dec 07 10
Geminids	Dec 07 – Dec 17	Dec 14 120
Ursids	Dec 17 – Dec 26	Dec 23 10

COSMOLOGY NEWS:

Supernova explosions of massive stars or dense white dwarfs send material hurtling into space at thousands of kilometres per second. The initial blast wave rapidly decelerates as it ploughs through the interstellar medium; the deceleration triggers yet another shock wave that moves inward and reheats the ejected debris. Researchers have long analysed x-ray spectra of the reheated material to learn about supernova remnants (SNRs) and the explosions that produced them, but because of their low resolution those measurements provide only a fuzzy picture.

At the University of New South Wales in Australia, Ivo Seitenzahl and his colleagues have used optical spectroscopy to expose multiple elemental layers of SNRs. Applying the technique to probe type Ia's. Along with x-ray studies, supernova remnant tomography, as the researchers call their new technique, may help astrophysicists determine whether the explosions are triggered by individual white dwarfs, collisions between pairs of white dwarfs, or some supernovae triggered by white dwarfs could help reveal the mechanism by which those stars explode or a combination of both.

A SOLAR WEB:

By Paul Sutter May 30, 2019
Science & Astronomy

Zooming out from solar systems, stellar clusters and even galaxies another pattern emerges in nature. When you zoom out far enough, entire galaxies, each one home to hundreds of billions of stars, are just single dots of light, you'll find a web. Long, thin ropes of galaxies millions of light-years long. Compact knots of thousands of galaxies and clusters.

The cosmic web is the largest pattern found in nature. It completely fills the universe. It's immense and vast, very delicate to see. Among this is gigantic cosmic voids, anywhere



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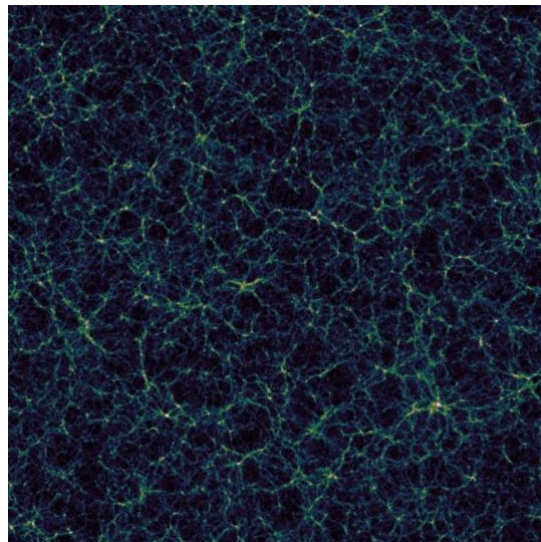


from 20 million to hundreds of millions of light-years across. It is the cosmos, devoid of matter, "nothing", a very powerful "nothing".

A long time ago, around 13.8 billion years ago, there was no cosmic web, just the fundamental components of the universe being: dark matter, hydrogen, helium and a little lithium, evenly spread throughout the universe.

But there were tiny differences here and there. Some spots had more density. Some spots had less. And the denser spots had slightly more gravitational attraction than the less dense spots. So those heavier spots would pull on their neighbours, grow larger and develop even stronger gravity — and the process would continue.

This all happened very slowly, over the course of hundreds of millions of years, Matter flowed into the dense pockets, where it eventually coalesced into the first stars, galaxies and clusters. That matter had to come from somewhere, so as the cosmic web grew and evolved, the voids emptied out.



This simulated view of the large-scale structure of the universe shows the vast cosmic web of galaxies, as well as the dark, empty expanses of the cosmic voids in between.

(Image: © Nico Hamaus, Universitäts-Sternwarte München, courtesy of The Ohio State University)

<https://www.space.com/why-avoid-the-cosmic-voids.html>

[/physicstoday.scitation.org/doi/10.1063/PT.6.1.20190823a/full/](https://physicstoday.scitation.org/doi/10.1063/PT.6.1.20190823a/full/)

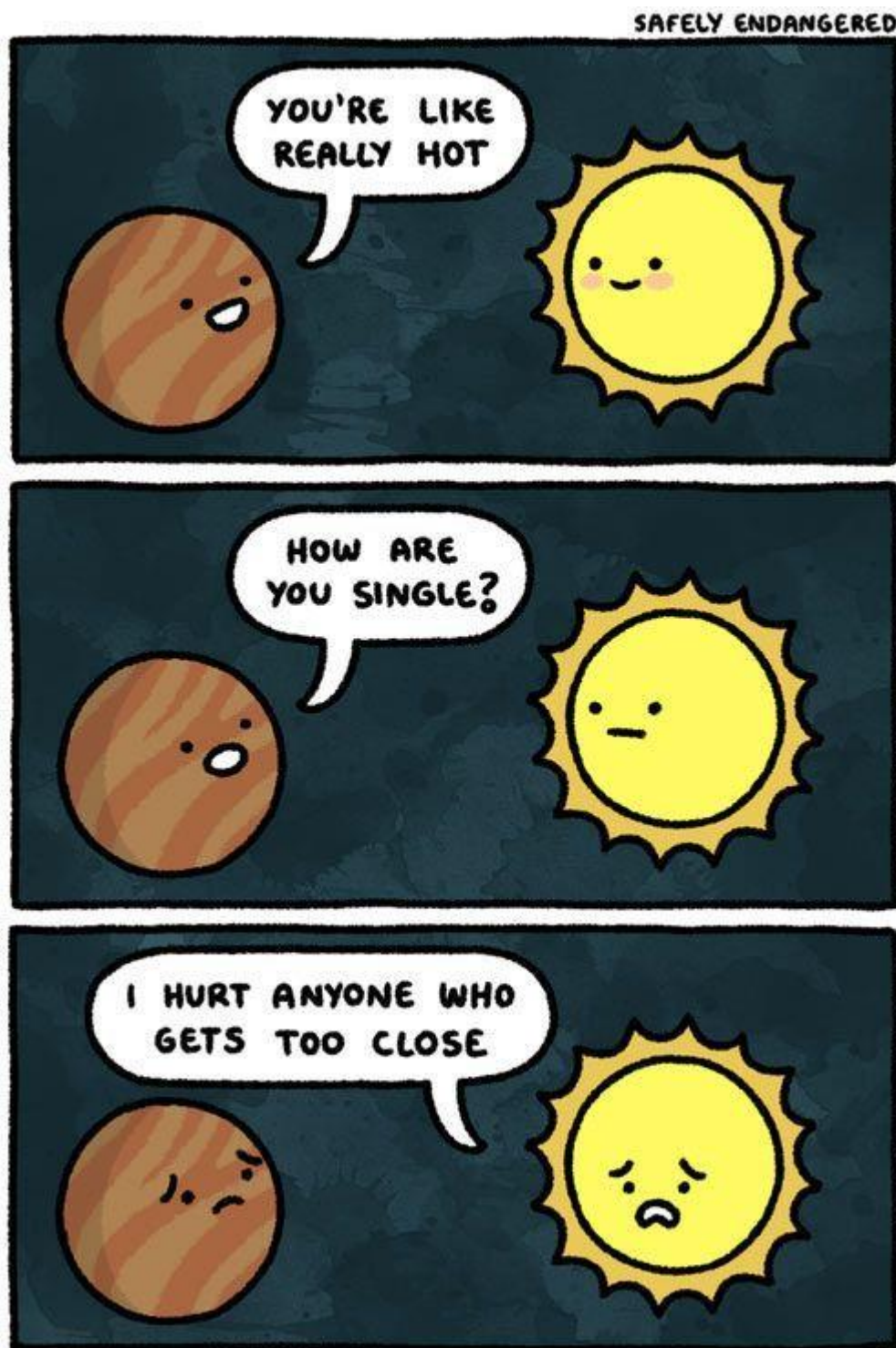
<https://www.space.com/16042-cosmology.html>

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