



AU AstroNews

The Newsletter of the Astronomical Unit

September 2020

Sponsored by the Santa Barbara Museum of Natural History



Tim Crawford explains how reflector optics works at a mirror-making workshop. Photo credit: Tom Totton.

OUTREACH SUMMARY

Because of the ongoing pandemic, there was no public telescope outreach in August. Please stay safe and healthy by wearing masks, washing your hands frequently, and practicing physical distancing.

OUTREACH EVENTS

The SBAU radio hour on KZSB 1290AM at 9 AM on the second and fourth Monday of each month will continue as a phone-in show, thanks to the dedication of Baron Ron Herron. Otherwise, there will be no SBAU meetings, public telescope outreach, or school events.

Although the Museum has opened for a limited set of outdoor activities, star parties and club meetings are as yet too contact-intensive for this stage of the pandemic.

SEPTEMBER SKY HAPPENINGS

Pegasus, the Flying Horse, is now rising up in the East, leaping from the northern edge of the great ocean in the sky. Andromeda is chained at the shoreline, which means that views of the Andromeda Galaxy are not far behind. The Great Bikini Bottom in the sky, Capricornus the Sea Goat,

half goat and half fish, marks the opposite shore to the South. Between them, the constellations are all associated with water, since in ancient Babylonia when these constellations were being dreamed up, it was their rainy season and the Sun was entering this area of sky. Precession has moved the path of the Sun, but the watery sky remains.

Around midnight on September 5, see bright orange Mars hanging just off the dark limb of the waning gibbous Moon. Mars is growing in apparent size as it heads for its big show next month.

Neptune, the most distant major planet, is well positioned in Aquarius for views all month. It will reach opposition on September 11, rising at sunset and up all night. You should be able to see it in binoculars, at magnitude 7.8 and bluish. Finder charts are at skyandtelescope.org

Fall for the Northern Hemisphere starts in the early morning with the Autumnal Equinox at 0631 PDT on September 22.

COSMOLOGY BOOK SUGGESTION

Leila Carvalho

I wish to suggest (in case you haven't read it yet) a book that I simply love and can't stop reading. The book is "Cosmology for the Curious" by Delia Perlov and Alex Vilenkin. This book was based on classes to undergraduate students taught by Alex Vilenkin at Tufts University. So, it does not only have "words" like similar others, but also has several figures, graphics, and simple equations that allow anyone with high school degree to follow.

I really enjoy the way they present difficult problems in tangible ways. Because it has graphics and some simple equations, it makes you really understand the theory very well. I think it is a perfect book for SBAU members.

FROM THE PRESIDENT

Jerry Wilson

From original clouds of dust, objects accumulate mass through mutual gravitational attraction. When they are big enough, (about the size of Ceres) gravity pulls them into a sphere. As the mass accumulates the internal pressure builds, but is continually resisted by the molecular structure of the elements and minerals that make up the solid matter. This is the size range of planets.

As more mass is accumulated the pressure builds further and the internal temperature rises.

Molecular bonds can no longer resist gravity's compression and atoms are squished together and ionized by the temperature. Molecular bonds are broken and mineral identity is lost. This is the brown dwarf stage. It shines feebly by the heat of gravitational compression. Jupiter shines in the infrared by residual heat of compression.

Add more mass and the core temperature increases. When it reaches ten million degrees, nuclear fusion of hydrogen begins, and a star is born. When nuclear fusion starts it is the outward flow of radiation that now resists gravity's inward pull. The star is essentially stable while it burns its hydrogen and produces helium.

When hydrogen burning stops, gravity wins, and the star proceeds to collapse. As it collapses, its internal temperature rises until nuclear fusion of helium begins. The outward flow of radiation is stronger this time, so the star swells a bit compared to its hydrogen burning diameter. A massive star goes through several cycles of getting hotter and burning the next element until it reaches iron. Now, no matter how hot compression makes the core, no nuclear burning can occur, and gravity wins. The star suddenly collapses, core temperature soars and the star explodes.

The explosive shock wave briefly enables endothermic fusion and produces elements above iron, and leaves behind a neutron star. Here gravity has compressed electrons into atomic nuclei, where they combine with protons to produce neutrons. The Pauli exclusion principle called neutron degeneracy pressure resists further collapse.

Less massive stars like our sun do not explode as violently, but do stop producing the intense emission that balances against gravity. They undergo a less violent collapse. The rebound throws

off the outer layers, producing a planetary nebula and leaving behind a white dwarf star. The white dwarf star is supported against collapse by electron degeneracy pressure. That means that gravity is trying to push electrons into the same quantum state, which they resist.

Enough more mass can overcome even the Pauli exclusion principle, resulting in the whole object's disappearing inside its event horizon to become a black hole. Since we can't see inside a black hole, we really don't know whether there are one or more levels of resistance to further compression yet to go. At this point the mass may collapse to a singularity, but this is probably an over simplification. Beyond neutrons there may be some sort of quark repulsion. Someday we may know.

ARTS CORNER

"I believe a leaf of grass is no less than the journey-work of the stars...."

Walt Whitman

"I saw Eternity the other night,
Like a great Ring of pure and endless light,
All calm, as it was bright;
And round beneath it, Time in hours, days, years,
Driven by the spheres
Like a vast shadow moved; in which the world
And all her rain were hurled."

Henry Vaughn, seventeenth-century poet

"When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in
columns before me,
When I was shown the charts and diagrams, to add,
divide, and measure them,
When I sitting heard the astronomer where he
lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to
time,
Look'd up in perfect silence at the stars."

Walt Whitman

"I've loved the stars too fondly to be fearful of the night."

Sarah Williams



“This is the last time I set up under a bird’s nest!” Photo credit: Tom Totton.



“Well, I’ll be darned. I just won a one-way trip to Mars!” Photo credit: Tom Totton.

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September 2020

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
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| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 TECH TALK KZSB (AM1290) 9-10 AM | 15 | 16 | 17 | 18 | 19 |
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