Celestial Observer

Volume 40 Issue 3 March 2020

CCAS Member: Dave Majors M31. Take a look at the detail on the upper dust lanes.

Next Meeting:

Thursday, March 26th with guest speaker Dr. Bob Field on *We are Stardust: Cosmogenesis,* 7pm. Free and open to the public!

Next Star Gazing:

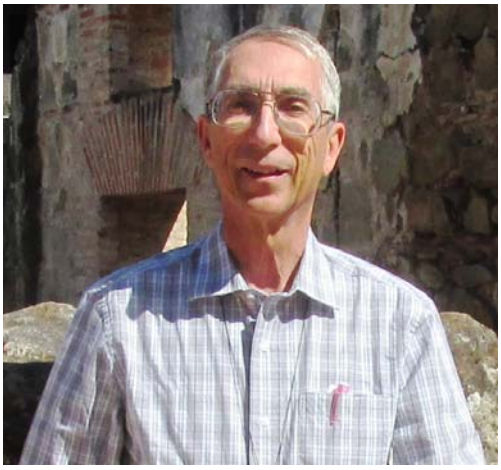
Saturday, March 21st at sunset at the new location at Santa Margarita Lake.

www.CentralCoastAstronomy.org/starparty

March 26th Meeting:
"We are Stardust: the cosmogenesis of the building blocks of planets and life"

Wesley Room, 1515 Fredericks Street, San Luis Obispo

6:30pm Doors Open | 6:45 Refreshments | 7:00 Meeting Starts



We are here because our solar system inherited the Periodic Table elements synthesized by earlier generations of stars that lived and died before the Sun formed. These elements formed the building blocks of planets and life itself. In January, OSU Prof. Richard Pogge skyped about his research exploring some of these elements. Bob will take a deeper dive and talk about the stellar and nuclear processes that formed all of the Periodic Table elements. He will show his own NetLogo and PowerPoint animations of Big Bang nucleosynthesis, cosmic web, star, and planet formation, massive post main sequence stars that go supernova, and remnant neutron stars dissipating gravitational wave energy as they merge and explode.

Dr. Bob Field was an aerospace physicist and laser optical system designer and analyst at Rocketdyne and Schafer Corporation. He retired in 1998 and was a docent in our local state parks where he developed many original talks and walks about the natural science behind natural history. As a research scholar in residence at Cal Poly, he has supervised dozens of student geophysics and astrophysics projects and created many animated PowerPoint slide shows and poster displays.

As the founder of the cosmic evolution project, Bob trains and organizes students to give slide and poster talks on campus for the public. He now works closely with CESAME and seeks more California based collaborations.

Dr. Field earned his BS in physics in 1970 from Case Western Reserve University and his MS and PhD in physics from the University of Illinois in 1972 and 1978, respectively. His experimental solid state physics PhD thesis required him to design and build several state-of-the-art spectroscopic instruments.

Me & My Telescopes: Larry Cossette

My fascination with astronomy started on my many campouts with my Dad and a simple pair of binoculars.

Then in 1985 I bought my first telescope, an 8 inch Celestron for viewing Halley's Comet. I now have a 14 inch Celestron and love it. For the past 5 years I have been attending the Grand Canyon Annual Star Party (this is their 30th year hosting).

The 14 inch Celestron is a hit with the park guests. My latest acquisition is an 11 inch Celestron which I plan to use to return to astrophotography which I have not done since film cameras went out of style.

Volunteers Needed

Atascadero Middle School is planning a 900-student science education night and is reaching out to our club for volunteers to help with their event.

The theme is "Light, Space & Time". Please connect with Scott at scmcmillan@charter.net if you'd like to help out!

Next Star Gazing

Saturday, March 21st at sunset (7:16 PM) at the Santa Margarita Lake
Our Sky Star Parties occur once a month, and are free and open to the public, and also weather-permitting.

Check our website for all the details:

www.CentralCoastAstronomy.org/starparty

CCAS Member's Work

We love the images our astronomers share with us! For all images , visit our "Gallery" on our website.

Pinwheel Galaxy imaged by CCAS Member Peter Bresler

CCAS Member Peter Bresler images Orion M42: Pixinsight taken with the Celestron Edge HD 1100, focal reducer, ZWO 294MC Pro color camera, Sequence generator pro.

CCAS Member Report: Betelgeuse

Betelgeuse is classified as a Semi-Regular variable with a period of about 423 days and brightness range from visual mag 0 to mag 1.6. Like all Semi-Regulars the period and both maximum and minimum brightness levels are subject to fluctuations cycle to cycle. This cycle the star dimmed more than a magnitude greater than usual.

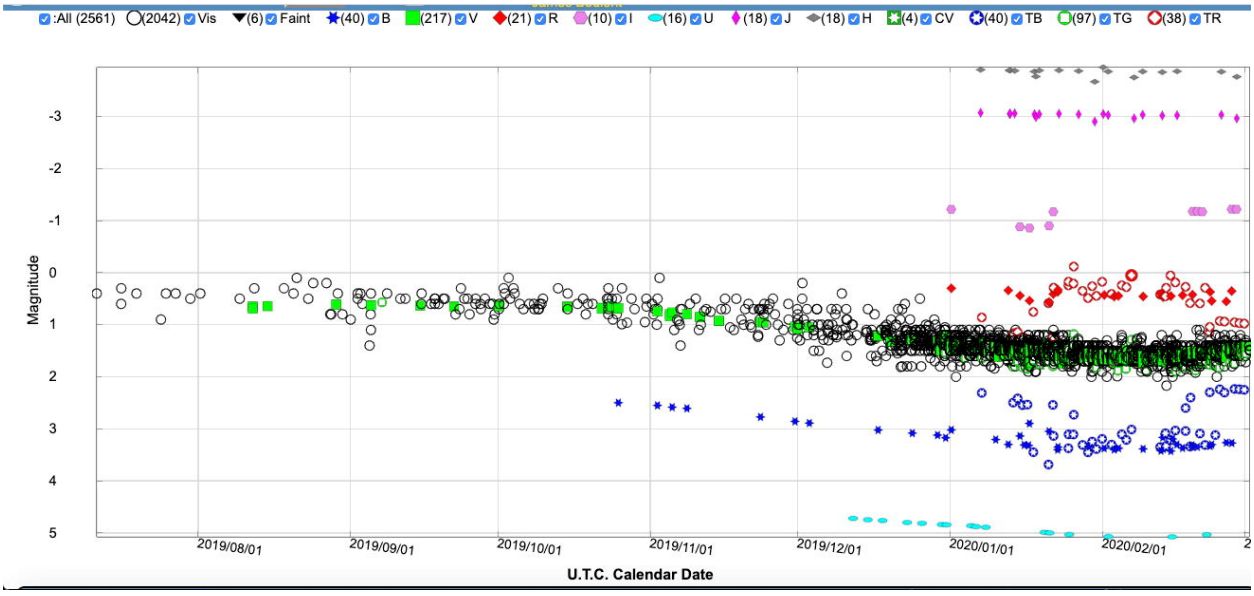
This led to speculation that Betelgeuse might be about to explode as a Supernovae. As the surface brightness of highly evolved stars do not reflect the conditions in the core of the star but rather in the energy producing shells in between I was skeptical of this interpretation.

In looking at the past history of the star I noticed that for about three cycles around 1985 Betelgeuse appears to have had a similar dimming episode. In those cases the dimming was much less than what we have seen the last several months but the behavior was similar. Looking back even further toward 1940 there was

another similar episode. In that one however the star's maximum brightness stayed below normal for several cycles. The data gets sparse before 1920 so I stopped there.

My hypothesis based on this data was that if Betelgeuse repeated its past history the brightness should bottom out by mid-February and by the end of the month we should have evidence of it brightening. In early February I attended a presentation put on by Los Cumbres Observatory at their "Astronomy on Tap" event. My thinking on the predicted behavior of this star was validated by the UCSB Astronomers making the presentations.

As of Mar 1 the evidence is clear - Betelgeuse stopped dimming and began brightening as predicted. Here is an image of Orion with Betelgeuse top left and another of the latest Light curve of Betelgeuse over this cycle. For our purposes disregard the colored dots- these are measurements taken in the standard Astronomical UBVRI color indexing system. Look at the black dots which are measurements using the Mark I eyeball. They clearly show the dimming, bottoming out and the rise in brightness.



So what will happen when the star does explode? Look to LIGA gravity waves. The collapse of the core should produce a gravity burst which will be seen a full day before the break-out shock reaches the surface of the star.

CCAS Member Dave Majors

Findings From NASA's Juno Update Jupiter Water Mystery Credit: NASA JPL

NASA's Juno mission has provided its first science results on the amount of water in Jupiter's atmosphere. Published recently in the journal Nature Astronomy, the Juno results estimate that at the equator, water makes up about 0.25% of the molecules in Jupiter's atmosphere - almost three times that of the Sun. These are also the first findings on the gas giant's abundance of water since the agency's 1995 Galileo mission suggested Jupiter might be extremely dry compared to the Sun (the comparison is based not on liquid water but on the presence of its components, oxygen and hydrogen, present in the Sun).

An accurate estimate of the total amount of water in Jupiter's atmosphere has been on the wish lists of planetary scientists for decades: The figure in the gas giant represents a critical missing piece to the puzzle of our solar system's formation. Jupiter was likely the first planet to form, and it contains most of the gas and dust that wasn't incorporated into the Sun.

The leading theories about its formation rest on the amount of water the planet soaked up. Water abundance also has important implications for the gas giant's meteorology (how wind currents flow on Jupiter) and internal

structure. While lightning - a phenomenon typically fueled by moisture - detected on Jupiter by Voyager and other spacecraft implied the presence of water, an accurate estimate of the amount of water deep within Jupiter's atmosphere remained elusive.

Before the Galileo probe stopped transmitting 57 minutes into its Jovian descent in December 1995, it radioed out spectrometer measurements of the amount of water in the gas giant's atmosphere down to a depth of about 75 miles (120 kilometers), where the atmospheric pressure reached about 320 pounds per square inch (22 bar). The scientists working on the data were dismayed to find ten times less water than expected.

Even more surprising: The amount of water the Galileo probe measured appeared to be still increasing at the greatest depth measured, far below where theories suggest the atmosphere should be well mixed. In a well-mixed atmosphere, the water content is constant across the region and more likely to represent a global average; in other words, it's more likely to be representative of water planet-wide. When combined with an infrared map obtained at the same time by a ground-based telescope, the results suggested the probe mission may have just been unlucky, sampling an unusually dry and warm meteorological spot on Jupiter.

"Just when we think we have things figured out, Jupiter reminds us how much we still have to learn," said Scott Bolton, Juno principal investigator at the Southwest Research Institute in San Antonio. "Juno's surprise discovery that the atmosphere was not well mixed even well below the cloud tops is a puzzle that we are still trying to figure out. No one would have guessed that water might be so variable across the planet."

Measuring Water From Above

A rotating, solar-powered spacecraft, Juno launched in 2011. Because of the Galileo probe experience, the mission seeks to obtain water abundance readings across large regions of the immense planet. A new kind of instrument for deep space planetary exploration, Juno's Microwave Radiometer (MWR) observes Jupiter from above using six antennas that measure atmospheric temperature at multiple depths simultaneously. The Microwave Radiometer takes advantage of the fact that water absorbs certain wavelengths of microwave radiation, the same trick used by microwave ovens to quickly heat food. The measured temperatures are

used to constrain the amount of water and ammonia in the deep atmosphere, as both molecules absorb microwave radiation.

The Juno science team used data collected during Juno's first eight science flybys of Jupiter to generate the findings. They initially concentrated on the equatorial region because the atmosphere there appears more well-mixed, even at depth, than in other regions. From its orbital perch, the radiometer was able to collect data from a far greater depth into Jupiter's atmosphere than the Galileo probe - 93 miles (150 kilometers), where the pressure reaches about 480 psi (33 bar).

"We found the water in the equator to be greater than what the Galileo probe measured," said Cheng Li, a Juno scientist at the University of California, Berkeley. "Because the equatorial region is very unique at Jupiter, we need to compare these results with how much water is in other regions."

Northward Bound

Juno's 53-day orbit is slowly moving northward, as intended, bringing more of Jupiter's northern hemisphere into sharper focus with each flyby. The science team is eager to see how atmospheric water content varies by latitude and region, as well as what the cyclone-rich poles can tell them about the gas giant's global water abundance.

Juno's 24th science flyby of Jupiter occurred on Feb 17. The next science flyby takes place on April 10, 2020.

"Every science flyby is an event of discovery," said Bolton. "With Jupiter there is always something new. Juno has taught us an important lesson: We need to get up close and personal to a planet to test our theories."

NASA's Jet Propulsion Laboratory in Pasadena, California, manages the Juno mission for the principal investigator, Scott Bolton, of the Southwest Research Institute in San Antonio. Juno is part of NASA's New Frontiers Program, which is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama, for NASA's Science Mission Directorate. The Italian Space Agency contributed the Jovian Infrared Auroral Mapper and the Ka-Band translator system. Lockheed Martin Space in Denver built and operates the spacecraft.

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CCAS Information

Founded in 1979, the Central Coast Astronomical Society (CCAS) is an association of people who share a common interest in astronomy and related sciences.

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