

# YOUNG ASTRONOMERS NEWSLETTER

## NASA RELEASES SOME UNIQUE SCENES OF THE CENTER OF THE MILKY WAY

In celebration of the 20th anniversary of the launching of the Chandra X-ray Observatory, NASA released several new images of the heart of the Milky Way taken by Chandra.

The photos are colorized renditions of the intense x-rays emanating from the central region of gas that is heated to millions of degrees. The hot nebular clouds contain mostly hydrogen atoms which, when excited, give off a characteristic red color. In the mix is a menagerie of various bodies, such as red and blue stars, white dwarfs, neutron stars and black holes. That's beside giant Sagittarius A\*, a supermassive black hole with a mass more than 4 million times that of the Sun.

Star colors are related to their surface temperatures. Blue stars are very hot, in the range of 40,000 Kelvin. Red stars are cool, around 3,000 K. Our Sun has a surface temperature around 6,000K which produces the yellow color we see.

So, close into the center of the Milky Way is a lot of action. Stars and other matter orbiting Sagr A\*, and various bodies are falling in to the black hole and radiation is blowing outward. This produces many types of celestial bodies and energies and a variety of colors.

[Astronomy Nov. 2019].

## ASTRONOMY FEATURED IN THIS YEAR'S NOBEL PRIZE IN PHYSICS

One Canadian-American and two Swiss scientists were awarded the 2019 Nobel Prize in Physics. Canadian-born James Peebles was recognized for his elucidation of what happened in the universe right after the Big Bang.

Swiss scientists Michel Mayor and Didier Queloz are credited with being the first to

discover an exo-planet. This is a planet which orbits a distant star.



MILKY WAY CENTRAL BLACK HOLE REGION (SAGITTARIUS A\*) AS IMAGED BY THE CHANDRA X-RAY OBSERVATORY (NASA image)

## 2019 IS THE CENTENARY FOR THE FIRST VISUAL VERIFICATION OF EINSTEIN'S THEORY OF RELATIVITY

In November of 1919, English astronomer-physicists Sir Arthur Eddington and Sir Frank Watson Dyson announced the observation of light being bent as it passes near a massive body.

In April of 1919, the two scientists each led expeditions to observe the shifting of the image of a star as its light passed near the Sun while the Sun's light was blocked by the Moon during a solar eclipse. The eclipse took place on May 29 as the two observing posts noted any shifting of the star's location.

Eddington's team went to Principe island, off the coast of western Africa and Dyson set up his observation post at Sobral in Brazil. Einstein's general theory proposed that space can be bent by massive bodies. This means that the image of a star would be bent as it passed near the Sun. This would show up as an apparent shifting of the position of the star.

The two scientists made their announcement to the Royal Society on November 6 which showed that the star's deflection was the correct amount as predicted by Einstein's theory. [Amer. Scientist, Nov. - Dec., 2019].

### **FIFTY YEARS SINCE THE APOLLO 12 MISSION**

Another noteworthy event in November was the successful NASA lunar mission, Apollo 12. The crew consisted of: Commander Pete Conrad, Command Module Pilot Dick Gordon and Lunar Module Pilot Alan Bean.

The Saturn V rocket lifted off on November 12, 1969. But just 36.5 seconds into the flight, the craft was hit twice by lightning, which played havoc with its electrical systems. However, no permanent damage was done, and the mission was able to continue. The Lunar Module set down in Oceanus Procellarum, within 600 feet of the objective target, the Surveyor 3 lander that reached the Moon in 1967.

Conrad and Bean spent 7 hours 45 minutes on the Lunar surface. They deployed several advanced instruments, collected 75 pounds (34 kg) of rock samples as well as pieces from the Surveyor 3 lander. They were surprised to see that the lander, which left Earth with a pure white coat, had turned brown over the 2 years it was perched on the Moon. [Astronomy, Nov. 2019].

### **ADVANCES IN INTERFEROMETRY ARE ALLOWING ASTRONOMERS TO SEE DETAILS ON THE SURFACE OF STARS**

Generally, even big telescopes see distant stars as just pinpoints of light. Being able to see details on a star's surface gives astronomers some idea of what's happening in its interior and provides insight as to the future fate of our Sun. However, it can be unwise to extrapolate the behavior of one star to all stars. Rachael Roettenbacher, an astronomer at Yale U. says: "Every star is uniquely complicated."

To get around the limitations of single lens or single mirror telescopes, astronomers are turning to interferometry. This uses multiple

small mirrors, like individual telescopes, placed hundreds of meters apart and directs their light to a central hub where the light waves overlap and interfere with one another. The complex pattern is straightened out by computer programs to produce a coherent image. The result matches what would be obtained by a single large telescope with an aperture equal to the many meters separation of the individual small mirrors.

In 1921, physicist Albert Michelson and astronomer Francis Pease used interferometry to measure the diameter of the supergiant star, Betelgeuse. Current instruments are getting very sophisticated, but there are only a few established world-wide because they take up a lot of space and they are expensive. Some noteworthy interferometric facilities are located at Mount Wilson, California, Northern Arizona, and at the Atacama Desert in Chile.

The latter facility has revealed surface features on the red giant Pi1 Gruis, which is believed to resemble the status of our Sun just before it blows up to form a planetary nebula. Similar surface studies were done on the red giant Antares in Sagittarius.

If the technology continues to improve, one day we may be able to see the surfaces of exoplanets. Imagine being able to see oceans and continents on another planet. However, we must remember that if distances are measured in light years, we may be seeing a planet in its ancient history. [Sky & Telescope, Nov. 2019].

### **BIRTHDAYS IN NOVEMBER:**

**Edwin Hubble** (Amer.), b. Nov. 20, 1889, d. Sept. 28, 1953. Proved that there were galaxies outside of our Milky Way; that galaxies were moving apart more rapidly at increasing distances (Hubble Law); classified galaxies according to shape.

**Frederick William Herschel** (Eng., German born). b. Nov. 15, 1738, d. Aug. 25, 1822. Proposed that the Milky Way was a flattened

