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YOUNG ASTRONOMERS NEWSLETTER

TESS THE EXOPLANET HUNTER IS GOING TO WORK

TESS stands for Transiting Exoplanet Survey Satellite. It is a space telescope designed to look for exoplanets (planets orbiting stars) by using the transiting method. This entails looking for a dimming of light emanating from a star as a planet moves in front of the star from our point of view. TESS was launched by NASA in April of 2018 for a two-year mission and its performance is monitored by scientists at MIT.

TESS began surveying the sky in August, and the first object of interest noted was a comet (C/2018 N1). But it soon spotted several exoplanets, bringing the most recent number to eight confirmed and 300 unconfirmed.

However, we have high hopes for TESS because it is to survey 85 percent of the sky, which is 400 times larger than what TESS's predecessor, Kepler studied. Kepler worked for nine years and discovered 2,600 confirmed exoplanets as it focused its attention on just one patch of sky. As TESS makes its orbits of the Earth it will spend the first year of its mission surveying the southern hemisphere and then switch to the northern hemisphere for its second year of duty. TESS's orbit is fixed so that it makes two orbits of Earth as the Moon makes just one; this is called a 2:1 resonance.

The Kepler space telescope was eminently successful, but its fuel ran out last October, so it could no longer control its orientation.

It has been estimated that TESS might find as many as 20,000 exoplanets. Its four, wide-field cameras should be able to detect small, rocky planets that orbit in a star's habitable zone. Exceptionally interesting planets will be further examined by the James Webb space telescope which is expected to be launched in 2021. Scientists are confident that after the 2-year mission, TESS will be directed to new scientific objectives. [Science News, Feb. 2, 2019; https://www.Forbes.com]

AN END OF AN ERA: OPPORTUNITY DECLARED DEAD BY NASA

It was bound to happen eventually: the Mars rover Opportunity has been silent for eight months. In the summer of 2018, a global dust storm covered the rover's solar panels and so it lost the ability to recharge the batteries that power its systems. NASA had its last communication with Opportunity last June. Continued attempts to resume communication failed and so, reluctantly, on Feb. 13, the decision was made to declare an end to the mission.

But what a mission it was! Opportunity and its twin rover, Spirit landed on Mars in 2004 with projected mission duration of 90 days. Well, Spirit lasted five years and Opportunity fifteen. Spirit covered 4.8 miles (7.7 km) while Opportunity covered the marathon distance of 28.06 miles (45.16 km). The two rovers carried various instruments that made historic discoveries related to mineral content and evidence that ancient bodies of water existed on the red planet.

Spirit got stuck in soft sand in 2009 and its orientation did not allow for its solar panels to pick up sufficient energy to power its systems. It was declared dead in 2011.

But what a legacy these scientific gems have left for us. Their findings will fill planetary science journals for years to come. Their accomplishments are a testimony to outstanding NASA science and engineering. [Space.com; Feb. 13, 2019]

PEACEFUL USES FOR PLUTONIUM-238 INCLUDE APPLICATION TO SPACECRAFT

Even though trace quantities are found in natural uranium ore, plutonium (Pu) is regarded as a man-made element. Fifteen isotopes of plutonium are known. Some have been used in atomic weapons, but the isotope with atomic mass of 238 is useful as a source of thermoelectric generation. ^{238}Pu has been used in the health fields as in artificial pacemakers, but for space exploration, the isotope is ideal as a means of generating electricity and maintaining a certain level of thermal stability to spacecrafts.

Plutonium-238 based electric generation has been utilized in a number of spacecrafts, such as the Viking, Voyager, Cassini and New Horizons missions.

On November 1, 2018, the American Chemical Society designated the production of ^{238}PU as a fuel for thermoelectric generators as a National Historic Chemical Landmark. This special designation took place at the Savannah River Site Museum in Aiken, S.C. The production and purification of plutonium isotopes took place at Savannah River since the 1950's. In 1988, with the end of the Cold War, the production of ^{238}Pu was terminated and as supplies ran out, production was resumed at the Oak Ridge National Laboratories. So, space exploration can still rely on this valuable element. For curious readers: the half-life of ^{238}Pu is 88 years. [Chem. Eng. News, Jan. 28, 2019].

ALL ABOUT GALAXIES

The March issue of Astronomy magazine has a thoroughly written article about galaxies. For those just beginning their studies of astronomy, we use the magazine article as a jump-off to give a brief chronicle about our current knowledge of galaxies.

- Before 1925, astronomers assumed that the total envelope of stars that we could see were contained in the Milky Way. Unresolved blobs of light were called nebulae. They were assumed to be clouds of gas and dust that were gravitationally associated with the Milky Way
- Using the newly installed Hooker telescope on Mount Wilson, Cal., the largest telescope in the world at that time, Edwin Hubble began to examine the Andromeda "nebula". There, in the fall of 1924, he spotted a variable star, identified as a Cepheid variable star and he was able to use it to calculate the distance to Andromeda. (He was able to do this because of the ground-breaking discovery by American astronomer, Henrietta Leavitt which directly related the cycle time of variation of a Cepheid to its absolute magnitude.) This enabled Hubble to claim that Andromeda was not a cloud, but a huge population of stars and located too far away to be considered to be within the Milky Way.

So, all stars that we see are not located just in our Milky Way galaxy. Furthermore, there are many more galaxies, like Andromeda, that are located at huge distances, not imagined until 1925.

- It is estimated that there are between 200 and 400 billion stars in the Milky Way. Perhaps a somewhat larger number are in Andromeda.
- The number of galaxies in the universe is estimated to be over 200 billion.
- Hubble devised a classification for galaxy shapes: spiral galaxies, barred spirals (e.g. the Milky Way), elliptical and irregular.
- It is believed that the current Milky Way galaxy is the result of mergers between dozens of protogalxies.

[We will continue our discussion of galaxies in next month's issue.]

BIRTHDAYS IN MARCH

Albert Einstein, (Ger. – Amer.) b. Mar. 14, 1879, d. April 18, 1955. General relativity, Special relativity. Space – time concepts.

George Gamow, (Ukr. – Amer.) b. Mar. 4, 1904, d. Aug. 19, 1968. Explanations of nuclear synthesis at the Big Bang and in Stars.

Walter Baade, (Ger. – Amer.) b. Mar. 24, 1893, d. June 25, 1960. Explained nuclear synthesis in stars. Recalibrated the Cepheid variable distance, resulting in a doubling of the estimated size of the universe.

Percival Lowell, (Amer.) b. Mar. 13, 1855, d. Nov. 12, 1916. Established the Lowell observatory in Arizona. Erroneously believed that the lines on Mars were canals made by intelligent beings.

Henry Draper (Amer.) b. Mar. 7, 1837; d. Nov. 20, 1882. An accomplished doctor who took up studies in astronomy. A pioneer of astro-photography.

Giovanni Schiaparelli (Ital.) b. Mar. 14, 1835; d. July 4, 1910. Observed Mars and described seas and continents, as well as lines which he described as canali. This was misinterpreted (see Lowell, above) as representing canals made by intelligent beings. He demonstrated that meteor showers were associated with comets.

MOON PHASES IN MARCH: New: Wed. the sixth; First Qtr.: Thurs. the 14th; Full: Wed. the 20th; Last Qtr. Thurs. the 28th.

OTHER MARCH EVENTS: Daylight savings begins on Sunday, the tenth. Vernal equinox on Wednesday the twentieth. On this day, the noon Sun is shining directly (vertically 90°) on Earth's equator. We call this the first day of spring.

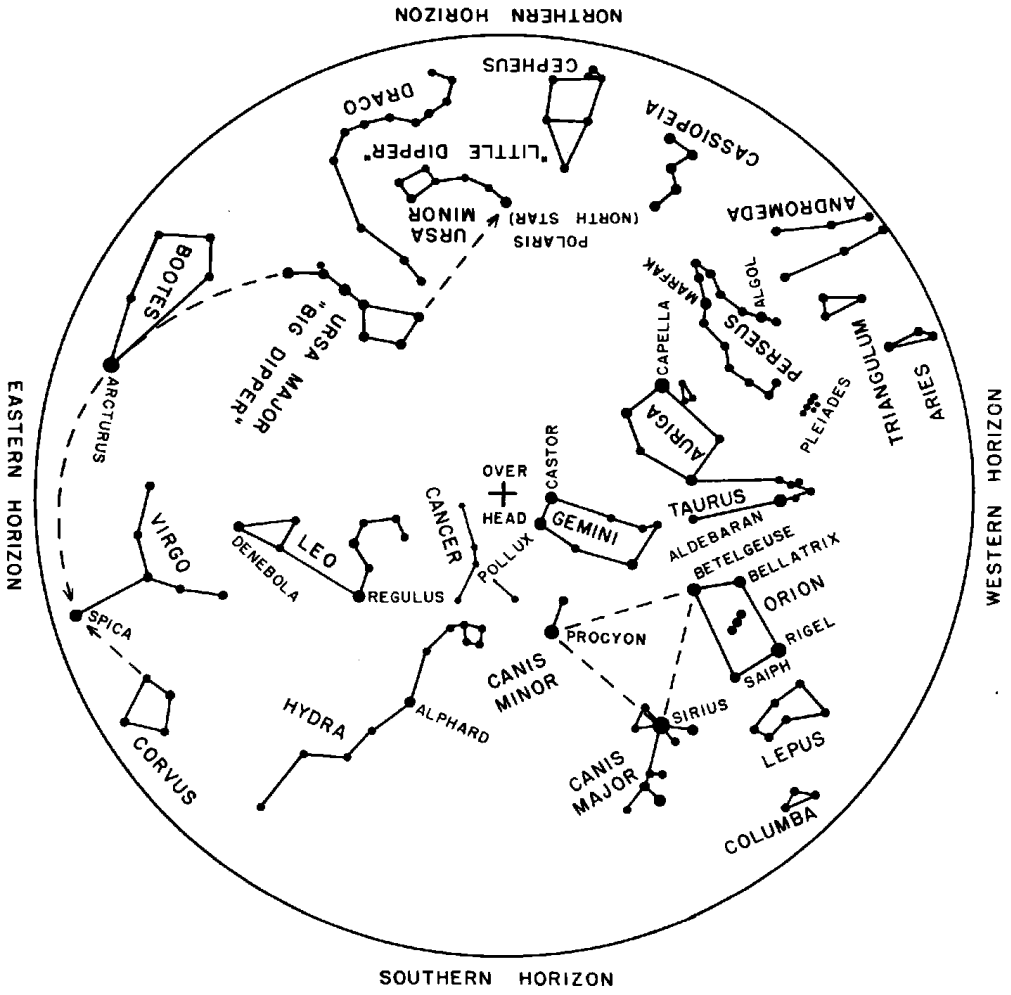
THE PLANETS IN MARCH: Early morning, before sunrise, on the first of the month, you will see **Saturn,** which rises around 4 a.m. (EST) at magnitude 0.6 in the background stars of Sagittarius. Shortly after, at 4:40, **Venus** pops up and at mag. -4.0, to outshine the ringed planet. The two bright planets are visible in the east during all March mornings. Well in advance, is **Jupiter,** which rises above the eastern horizon around 2:30 a.m. It is quite bright at magnitude -2.0. In the evening sky and looking low in the west after sunset, you can see **Mercury** which gives us only about an hour to see it before its setting at 7:40 p.m. Higher up, we can see red **Mars**, which drifts eastward during the month toward Taurus and the Pleiades. It still shines brightly, at mag. 1.3, though not as dominant as last summer's opposition.

FORSYTH ASTRONOMICAL SOCIETY: Meetings are held the second Wednesday of the month at Kaleideum North (formerly SciWorks) at 7:30 p.m. The March meeting will be on the 13th. Other FAS activities for March include public astronomical viewing on Pilot Mountain on Saturday the 9th and at Stone Mountain State Park on Sat. the 30th (see the FAS website for directions). All outside events are subject to weather conditions. Check with the FAS website (www.fas37.org) . Also, the Kaleideum front desk may be called (336-767-6730 ext. 1000). FAS encourages experienced and novice astronomers to attend the TriStar Conference on Sat. March2 at Guilford Technical Community College. Excellent presentations, free to the public. See: https://www.gtcc.edu/community-engagement/cline-observatory/special-lectures-and-events/tristar.php

See the spring sky chart on page 4. Have a great spring. Bob Patsiga, editor

THE SPRING SKY

In the spring and fall we are looking out away from the cross-section of the Milky Way, so we do not see so many stars. In early spring, you may still see Gemini, Orion and The Pleiades drifting off to the West. The only prominent constellation in the spring is Leo. Leo has as its main star, Regulus (mag 1, 78 LY). Leo shows up as a backward question mark and a triangle (the rump of the lion). Less obvious constellations are Boötes (look for the bright star Arcturus: mag 0, 37 LY) and Virgo (bright star Spica: mag 1, 260 LY). Regulus, Arcturus and Spica make up what is known as the spring triangle. The Beehive cluster can be seen with binoculars just west of the constellation Cancer. Viewers with good telescopes can spot a number of distant galaxies around the bottom and rear of Leo. If you trace a line up from the top of the lion's head, you will come to the bowl of the Big Dipper (Ursa Major) in the northern sky.



THE NIGHT SKY IN MARCH