

THE YOUNG ASTRONOMERS NEWSLETTER

EARLIEST STARS

The first stars in the universe began forming over 13 billion years ago from collapsing clouds of hydrogen and helium. These first-generation stars are called Population-III, and eventually lead to heavier elements, like lithium, beryllium and carbon. Population-III stars have, until now, only been supposed but not detected. But astronomers at the University of Lisbon, Portugal have discovered a galaxy, CR7, whose formation is so early that it exhibits emission lines from only hydrogen and helium. However, second-generation stars were also discovered in the same galaxy, which suggests that star evolution and creation can give rise to mixed generations. (Sky & Tel. Dec. 2015).

THE BIG PICTURE IS GETTING BIGGER

Until recently, it was believed that the Milky Way resided in the Virgo Supercluster of galaxies. This is a collection of thousands of galaxies that are gravitationally bound together. Now, special techniques used by R. Brent Tully at the Univ. of Hawaii and Helene Courtois of the Univ. of Lyon reveal that the Virgo Supercluster is merely a component of an even larger supercluster called Laniakea. Laniakea spans more than 500 million light years and consists of approximately 300 to 500 known clusters. The Virgo Supercluster is designated as an appendage to the much larger object. Laniakea means "immense heaven" in the Hawaiian language. (Astron. Dec. 2015).

EXOTIC TELESCOPES

A number of space-based and land-based telescopes are planned or are near to completion that will be able to make

measurements which can test Einstein's General Relativity.

One such telescope, called the Event Horizon Telescope makes use of a global network array of radio telescopes tuned to far infrared and short microwaves. EHT uses dishes located in Chile, Europe, North America, Hawaii and Antarctica. Additional component telescopes are being added so that the final resolution should allow us to image the Black Hole located in the center of the Milky Way (Sagittarius A*). This is like trying to visualize a poppy seed in Los Angeles from New York City. The black hole in the center of the Milky Way is calculated to have a diameter about 10 percent the Sun-Earth radius. The EHT is expected to begin making measurements in the spring of 2016. (Sky & Tel. Dec. 2015)

Other exotic telescopes are the Euclid Satellite, supported by the European Space Agency, expected to be launched at the end of the decade.

Another land-based system, the Large Synoptic Survey Telescope (LSST), is under construction in Chile. It will have an 8.4-meter primary mirror, and when it is operational in 2023, it should be able to monitor 37 billion stars.

The largest radio telescope of all, is planned for construction in 2018 and located in Australia and South Africa. This is called the Square Kilometer Array (SKA) telescope and is projected to be 50 times more sensitive than any other radio instrument (Sky & Tel)

GRAVITY WAVE DETECTORS

The December, 2015 Sky and Telescope describes several gravity wave detection instruments. Some older ones are being upgraded and some new ones are planned. The most elaborate systems constructed to date are located in Hanford, Washington and Livingston, Louisiana. They are called LIGO (Laser Interferometer Gravitational-wave Observatory). Next year, the LIGO detectors will be coupled with detectors in Europe. In addition, the European Space Agency is preparing to launch eLISA, the first space-based gravitational wave observatory. Gravity waves have been presumed in the orbital energy loss of two orbiting neutron stars (binary pulsar PSR B1913+16)

THE LATEST ABOUT MARS

*Some unfortunate news from NASA: the Insight instrument launch scheduled for March, 2016, has apparently been cancelled. This is due to a leak in one of the seismometers provided by the French Space Agency. The leak has been determined to be non-repairable. Since the most favorable Mars craft launch periods occur every two years, the next chance for Insight will not occur until 2018. (MSN.Com, Dec. 22, 2015). The Insight lander was to examine the interior geology of Mars.

*The rover, Opportunity is still chugging along after eleven years and 26.5 miles of exploration. Currently, it is located on a steep slope of the west rim of Endeavor Crater, trying to maneuver into position to use its rock abrasion tool.

*The rover, Spirit has been immobilized in Martian soil, and efforts to make a recovery were concluded in May of 2011.

*The rover, Curiosity is making its way to Mount Sharp and is currently at a large field of sand dunes (Bagnold Dunes). The area is rich in silica, which on Earth, is associated with water activity. Curiosity has covered about 7 miles.

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*The MAVEN orbiter has completed one year of investigation of Mars atmosphere. It has related the loss of Mars atmosphere to solar winds. Since Mars does not have a global magnetic field, the particles and plasma from the Sun blast away the Martian atmospheric molecules at the rate of about 100 grams every second (Science News, Dec. 12, 2015).

*The Mars Reconnaissance Orbiter (MRO) has just had a makeover of its flash memory. The MRO is used to relay communication between the Mars rovers and Earth and it has done marvelous high resolution photography of the Martian surface. Its surface analyses have helped to support the existence of ancient bodies of water as well as current aqueous activity.

*The planned workhorse for carrying man and supplies to Mars and other bodies, such as the Moon and the Asteroids, will be NASA's Space Launch System (SLS). The SLS will be the largest and most powerful rocket so far built by man. The SLS will be at least 350 feet tall. The RS-25 engines were test-fired in August. The Orion crew vehicle will be fitted to SLS for manned missions. An unmanned exploratory mission is planned for 2017.

PLENTEOUS PLUTO

The vast accumulation of information about Pluto and its moons is still being downloaded to Earth since the July flyby of the spacecraft New Horizons. It is estimated that about 20 percent of the information has been transmitted. Pluto displays a wide variety of geological features and activity. These include water-ice mountains, solid nitrogen plains, an atmosphere of mostly nitrogen plus carbon monoxide and methane. Old and new geological areas can be discerned based on the presence or absence of craters. Cryovolcanos spew up ammonia and other gases.

ASTRONOMICAL EVENTS FOR JANUARY 2016

Moon phases: Full: Sat. 23; New: Sat. 9; 1st Qtr.: 16; Last Qtr.: Sat. 2 and Sun. 31

Meteor shower: Quadrantids, Mon. 4.

Planets: Mercury is visible during the first couple of days in Jan. in the west, right after sunset. Later in the month, it reappears in the early morning. Jupiter rises in the late evening. Look for it in Leo. Mars rises after Jupiter. Look for it in Virgo (with Spica, the bright star) after midnight. Mars will gradually increase in visual size throughout the spring. Venus and Saturn are prominent early morning in the southeast.

Constellations: (viewing around 9pm midmonth) Pegasus in the southwest; Taurus and the Pleiades are straight overhead; Orion, slightly east of Taurus; Gemini, east of Orion. Brightest star in the sky is Sirius in Canis Major. Follow the line of Orion's belt to the southeast until you come to the bright star.

Word search: moons of the planets

M I T I T A N R O M
 C H E Y I B M P A I
 T T U R H T I E Y R
 E R R S O P M S N A
 T I O D C H A R O N
 H T P H R O S T A D
 Y O A U R B I O N A
 S N T P H O E B E T
 C A L L I S T O L H
 E N C E L A D U S Y

CHARON TETHYS
 CALLISTO TITAN
 ENCELADUS
 EUROPA
 IO
 MIMAS
 MIRANDA
 PHOBOS
 PHOEBE

Fill in the blank with one of the names listed below.

The Polish astronomer that proposed the heliocentric model for the Solar System was _____ and the German astronomer who developed the laws of planetary motion was _____. _____ developed the laws of gravity, but _____ showed that gravity could bend light.

The first person to study the heavens with a telescope was _____ but _____ proposed that the universe was expanding.

EINSTEIN GALILEO COPERNICUS HUBBLE NEWTON KEPLER

Teachers: Topic for class discussion: What is time?

Useful web sites: Forsyth Astronomical Society: <http://www.fas37.org> www.space.com
<https://stardate.org/nightsky> earthsky.org www.skytonight.org

SciWorks telephone number: 767-6730

Little known facts:

Pluto has blue skies due to light scattered by suspended particles.

Voyager 1 is now 132 Astronomical Units (AU) out from the Sun. It is said to now be out of the heliosphere, and essentially out of range of solar charged particles. Particles that Voyager 1 now encounters are likely coming from interstellar space.

(Astron. Mag. Dec.) If the Sun were a grain of sand, the stars of the Milky Way average 4 miles apart.