March 2016 Volume 24 Number 3 **Forsyth Astronomical Society**

THE YOUNG ASTRONOMERS NEWSLETTER

JUPITER'S GREAT RED SPOT IS SHRINKING

Astronomers have observed that Jupiter's Great Red Spot (GRS) had been shrinking since the early 1900's. This amounts to a decrease in length of 0.1^{o} to 0.2^{o} per Earth year. Overall, the GRS has an east-west length of about 25,000 miles. Over the last 20 years, observation using the Hubble Space telescope showed that the spot has gotten noticeably smaller and rounder. The GRS has been studied regularly since the 1870's, when it was very red and prominent. It was first noted in the 1660's by Gian Domenico Cassini and Robert Hooke. The spot was used to determine Jupiter's rotation rate of 9hr 56min. Astronomers are not sure if the spot will disappear completely. There are present other red-hued cyclonic clouds that could take its place. (Sky & Telescope, March, 2016).

GRAVITY WAVES DETECTED

Did you feel it? It was a pulse caused by a gravity wave that came from the merger of two black holes. This signal was detected by LIGO (Laser Interferometer Gravitational-Wave Observatory) last September, and the discovery was published in the February issue of Physical Review Letters. This news has stirred the scientific community of astronomers, cosmologists and those looking for verification of Einstein's general theory of relativity. The two black holes are 1 billion light-years distant and each was roughly 30 times more massive than our sun before the merger.

The apparatus used for this remarkable discovery is located in two sites: Hanford, Washington and Livingston, Louisiana. It is L-shaped and uses mirrors to observe laser beam deflections caused by gravity waves. The geometry is so precisely constructed that a shift in mirror position can detect changes in length down to one-ten thousandths the diameter of a proton. The double location for the detectors is to allow confirmation of the pulse by the constructive overlap of the laser waves coming from the two sites. In the case of the September 14, 2015 event, the Louisiana site received the pulse 6.9 milliseconds before the Washington site. But the two wave patterns matched perfectly.

The researchers claim that since the September event, they have detected four additional pulses, possibly caused by other black hole mergers. Monitoring has ceased for the time being, but will resume this summer, as will also the European cooperating team called Virgo.

It is interesting that measurement of the mass for the single product black hole indicates a missing mass of three suns, which when converted into energy (E = MC^2) amounts to an output of 3.6 x 10^56 ergs per second. Our sun emits energy at about 3.8 x 10^33 ergs/sec. So, the black hole merger produced energy equivalent to 10^23 suns!

The researchers worked out of several U.S. universities as well as institutions around the world. A New York Times article (Feb.11) stated that there were 1,000 authors listed in the publication.

Being able to detect the merger of massive bodies like black holes or neutron stars will greatly add to our knowledge about cosmic interactions.

MARS' MOON PHOBOS BREAKING UP

Unlike its partner martian moon, Deimos, Phobos is slowly spiraling toward Mars. As it gets closer, the planet's gravity exerts a pull that is distorting the moon and revealing grooves that might be stress cracks. In the next

50 million years, or so, Phobos could break apart, according to researchers at the Space Science Institute in Boulder, Colo. An alternate suggestion for the streaks is that meteorites or rocks blown off the moon's surface could form groves when they return in a crash. (Science News, Dec., 2015).

STAR CLUSTERS PROVIDE AN ENVIRONMENT FOR INTELLIGENT LIFE TO TRAVEL

If globular clusters harbored intelligent life, the resident beings could easily go star hopping. The stars in globular clusters are situated relatively close to each other. Our sun's neighbor is Proxima Centauri, at 4.2 light years. But in globular clusters, stars can be as close as 0.01 light years, which is comparable to our Solar System. The down side is that stars in the clusters are old and low in heavier elements, like calcium and iron. (Sci. News, Feb. 6, 2016)

PLUTO'S NITROGEN ICE GLACIERS

Solid (semisolid) nitrogen glaciers are carving away huge chunks of water ice and carrying them along until they accumulate and pile up at the edges to form deposits up to 20 km across. Water ice is less dense than solid nitrogen and the ice may be parts of the hills around the vast plain called Sputnik Planum. (jhuapl.edu site of Feb. 4, 2016).

ICE ON CHARON

The New Horizons flyby of Pluto also made some detailed analyses of the moon, Charon. Images indicate that movement or expansion of water ice deposits has produced tectonic faults that can be seen as ridges, scarps and valleys. (jhuapl.edu site of Feb. 18, 2016).

ACTION AT THE CENTER OF THE MILKY WAY

The center of our Milky Way galaxy harbors a black hole which has a mass of about 4 million suns. The center of the Milky Way is near the summer constellation, Sagittarius. The black hole is designated as SagrA* The diameter of SagrA* is about 15 million miles.

Various telescopes located around the world and in orbit have been observing SagrA* for at least 15 years (ESA XMM-Newton, Chili, Hawaii, plus the Chandra X-ray observatory and the Swift Gamma Ray Burst Explorer.). These observatories have noted regular x-ray flares emanating about once every ten days. But in 2014 this activity increased to about once a day. This coincided with the observation of an energy producing object that was headed for SagrA*. This object was gamma emitting and was labeled G2, and gave indications that it was becoming distorted in shape due to the black hole's strong gravitational pull. Calculations of the trajectory of G2 indicated its close approach to the black hole's accretion zone at about the time of the increase of x-ray flares. However, nothing out of the ordinary was observed during or after the closest approach. Nine observatories located around the world will be looking at SagrA* in 2017 (Antarctica, Spain, Mexico and Arizona, as well as the ones listed above.) (Sky & Tel., Feb. 2016).

COMET LANDER PHILAE WEAKENING

Philae was dropped onto comet 67P/-Churyumov-Gerasimenko by the Rosetta spacecraft in November 2014. But it was a bouncey landing which placed the lander in an awkward position relative to its needed solar power source. Philae managed to take valuable pictures of surface features and detect a fog of organic compounds and surface minerals. However, recent communication has been intermittent, with the last message of data being sent July 9, 2015. Meanwhile, 67P is moving away from the sun, and so receives less solar power each day. The project manager at the German Aerospace Center said that once the temperature drops below -51^{o}Celsius, the computers will no longer boot up. But Philae will eventually get some company: Rosetta will make some close-up views of the comet this summer and then make a crash landing, taking pictures all the way down. (Sci. News. Feb. 20, 2016).

March birthdays: George Gamow: Mar. 4, 1904; Albert Einstein: Mar. 14, 1879;

ASTRONOMICAL EVENTS FOR MARCH 2016

Moon phases: Full: Mon. Mar. 23; New: Wed. Mar. 9; First Qtr.: Tues. Mar. 15; Last Qtr.: Mar. 1 and 31.
Vernal equinox: Sun. Mar. 20.
Total eclipse of the Sun: Wed. Mar. 9 (Visible from Indian Ocean, across Indonesia, northern Pacific Ocean past Wake Island.)
Penumbral (partial) lunar eclipse: Wed. Mar. 23
Begin Daylight Savings Time: Sunday, March 13.

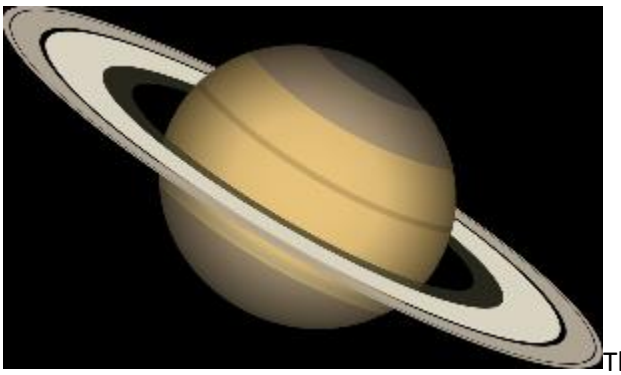
WORD SEARCH: **Sky Locations:**

O P POS I T IO N E R
C I LOR T RAN S I T
E T UL S O APOG E E
C E NSO L S T I C E Q
L I M E R I D I AN Z U
I MZ OQ IC E L T R I
P DE C L I N A T I ON
T AN OXL E P I STO
I N I T HS XO T HI X
C I TP O L E R UGN A
S CHU I TO C DUT E
A P I P E R I G E ENM

ALTITUDE **PERIGEE**
APOGEE **POLE**
DECLINATION **OPPOSITION**
ECLIPTIC **SOLSTICE**
EQUINOX **TRANSIT**
MERIDIAN **ZENITH**

Classroom discussion topic: What causes the seasons?
Who was George Gamow?
What happens during a solar or lunar eclipse?

Calculation problem: The density of substances or objects represents the mass of the object divided by its volume. In the sciences, the usual units of density are grams per cubic centimeter [g/cm^3] or sometimes kilograms per cubic meter [kg/m^3]. The density of water is 1.00 g/cm^3 [or 1000 kg/m^3]. Saturn is said to have a low density. Calculate the density of Saturn from these facts: It has a radius of 5.85×10^7 meters and it has a mass of 5.68×10^{26} kg.



The volume of a sphere is: $V = 4/3\ \pi\ r^3$ (r is the radius). The answer is given below.
The densities of the rocky planets is high [in kg/m^3] Mercury: 5427, Venus: 5243, Earth: 5515. The gas giants have much lower densities: Jupiter: 1326, Saturn: 680, Uranus: 1270. The Sun has a density of 1408.

Forsyth Astronomical Society website: http://www.fas37.org **SciWorks No.; 336-767-6730**

Mini facts: If the Sun were a grain of sand, the nearest star (Proxima Centauri) would be four miles away.

Hope that things will be looking up for you in March. Bob Patsiga, editor