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THE YOUNG ASTRONOMERS NEWSLETTER

JUNO AT JUPITER (NASA illustration)

THE JUNO PROBE FACES JUPITER'S POWERFUL MAGNETIC FIELD

On July 4, 2016, NASA's probe, Juno, reached the gas giant planet Jupiter. At that point the spacecraft carefully reduced its speed so that it could initiate its polar orbiting sequence.

The orbit will be given a final adjustment in October to produce an elongated path; stretching from its most distant point of 1.2 million miles from the planet, to within 3,100 miles of the planet's cloud tops. All this will be done while trying to avoid (or at least minimize) Jupiter's extreme radiation and powerful magnetic field. Once established, each research orbit will last 14 days. This should continue for 37 orbits. All the while, the probe will be subjected to extremes in radiation, with the final accumulation equal to 100 million dental X-rays. Many of the vital electronic components in the spacecraft are housed in a titanium vault having walls 1 centimeter thick, so as to shield sensitive components. Even so, it is predicted that the visible light camera, JunoCam will survive only to the eighth orbit, and the microwave radiometer should make it through the 11^{th} orbit.

On board the spacecraft are nine instruments which have various goals, for example, measuring the planet's magnetic field and gravitational flux, as well as measuring the content of gases, especially water and ammonia in the gaseous atmosphere. We are looking forward to what revelations Juno will provide for us in the next 20 months, or so. The mission should come to an end when the probe dives into the planet in early 2018. [Astronomy magazine, August, 2016].

NAMES PROPOSED FOR NEW ELEMENTS

The super heavy elements with atomic numbers: 113, 115, 117 and 118 were recently created/isolated in laboratories in the U.S., Japan and Russia. The International Union of Pure and Applied Chemistry (IUPAC) has a stepwise process for arriving at the name and symbol for newly created/isolated elements. The discoverers may propose names, and after they are discussed and agreed on by an IUPAC committee, they are submitted for public review for five months. Then, the names must be approved by the IUPAC Council. This will take place on, or shortly after November 8, 2016.

The proposed names and symbols are: Atomic number 113: Nihonium (Nh), At. No. 115: Moscovium (Mc), At. No. 117: Tennessine (Ts), At. No. 118: Oganesson (Og). With the addition of these four elements, row 7 in the Periodic Table becomes filled out.

Nihonium derives from the word Nihon, one of the ways to say "Japan" in Japanese. Moscovium derives from the region around

Moscow, and is the locale for the Russian Flerov Laboratory of Nuclear Reactions. Tennesine is in recognition of the contributions from the laboratories in the Tennessee region, for example, the Oak Ridge National Laboratory. Oganesson recognizes the Russian nuclear physicist, Yuri T. Oganessian, who heads the Flerov laboratory. (Chem. & Eng. News, June 13, 2016).

NEW TARGET FOR KEPLER

The Kepler space telescope, launched in March of 2009, was designed to look for habitable planets orbiting stars. However, in July of 2012, one of the spacecraft's four reaction wheels, needed for guidance, stopped turning. Then in May of 2013 a second wheel ceased to function. This was a serious blow to the Kepler mission, since the spacecraft would be of little use without stabilizing and guidance apparatus. Clever minds at Ball Aerospace in Boulder, Colorado, configured the craft to utilize the pressure of sunlight to provide enough impulse in concert with the two remaining reaction wheels so that it would still be possible to aim the telescope at selected targets.

Thus, in 2014, a new mission, called K2, was designed for Kepler. K2 focused on a hunt for planets around red dwarf stars.

Now, yet another new mission has been created for Kepler. This is to study the spin rate of stars in the Pleiades star cluster. The knowledge gained in this study will help astronomers understand star formation.

The number of confirmed exoplanets discovered by Kepler is over two thousand. The number of confirmed exoplanets discovered by K2 is over 100. These numbers are constantly being adjusted upward as follow-up studies verify the Kepler planetary candidates. Kepler has about two more years of fuel remaining. (nasa.gov/mission_pages/kepler/main/index.html) (earthsky.org/space/).

DISCREPANCY IN THE VALUE FOR THE HUBBLE CONSTANT

In 1929, Edwin Hubble proposed a radical idea about the cosmos. Working from the Mount Wilson Observatory, in California, he used the Doppler shift of light from distant galaxies to support the idea that the universe was expanding. Furthermore, he claimed that the farther out one looks, the faster is the expansion rate. The relationship between distance and expansion rate remained remarkably consistent and this led to the Hubble distance – velocity equation:

$$\mathbf{V = H_o \times D}$$

Where **V** is the velocity (in km per second) of the object (e.g. galaxy), **D** is the distance in megaparsecs (1 parsec equals 3.26 light years. A megaparsec is equal to a million parsecs, or 3.26 million light years). And $\mathbf{H_o}$ is called the Hubble constant. (having usual units of km/s/Mpc)

The numerical value of the Hubble constant is important to astronomers, since it is used in estimating the size and age of the universe.

Unfortunately, different methods for calculating $\mathbf{H_o}$ are producing slightly different values. The Hubble constant based on supernovae luminosities gives a value of 73 km/s/Mpc, while the value based on analysis of the cosmic microwave background gives a value of 67 km/s/Mpc. Scientists using the two methods claim that their results are within just a few percent error. The difference in the two values is not blamed on experimental scatter. We must wait for this discrepancy to be resolved. (Science News, Aug. 6, 2016)

September birthdays: James Alfred Van Allen; b. September 7, 1914. Credited for establishing the field of magnetospheric research. Earth's Van Allen belts are named after him. The Van Allen belts are regions of charged particles that surround the Earth and are held in place by the Earth's magnetic field.

CELESTIAL INFORMATION FOR SEPTEMBER 2016

Moon phases: New Moon: Sept. 1 and Sept. 30; First Qtr.: Sept. 9; Full Moon: Sept. 16; Last Qtr.: Sept. 23.

Autumnal Equinox: Sept. 22 (Use your alidade that you built from directions in the June Newsletter to measure the height angle of the noon Sun, if it is a sunny day. The measurement should be made at 1 pm, since we will still be in daylight saving time. If you are in school, ask your teacher to let you go outside to make the measurement.).

The planets in September: In the evening western sky, you will see that Jupiter is nearly lost in the glare of the setting Sun and will disappear by midmonth; while Venus rises higher and higher above the Sun. In the first couple of days of the month, Jupiter and Venus are joined by the crescent Moon. Meanwhile, Mars and Saturn are still travelling in the Scorpius – Sagittarius region. Saturn stays with the scorpion's claws, while Mars gradually shifts eastward into Sagittarius.

Later in the month, and in the morning, you can spot Mercury, which on the 28th it reaches greatest elongation above the eastern horizon 30 minutes before sunup.

ATOMIC MATTERS

O	P	H	O	T	O	N	T	E	B	L	T
R	N	U	R	S	L	L	E	P	T	O	N
H	E	P	B	A	R	Y	O	N	Q	U	L
A	U	O	I	D	Q	V	H	M	I	E	B
D	T	S	T	E	L	E	C	T	R	O	N
R	R	I	O	F	U	D	N	I	L	W	E
O	I	T	E	G	H	Q	U	A	R	K	U
N	N	R	W	E	T	P	C	L	S	H	T
B	O	O	M	G	A	I	L	E	C	O	R
T	I	N	Q	U	C	R	E	H	E	M	O
P	R	O	T	O	N	L	U	J	T	O	N
G	B	O	S	O	N	K	S	H	E	L	L

BARYON	**NUCLEUS**
BOSON	**ORBIT**
ELECTRON	**PHOTON**
HADRON	**POSITRON**
LEPTON	**PROTON**
NEUTRINO	**QUARK**
NEUTRON	**SHELL**

CALCULATOR CORNER: Assuming that the Earth's orbit around the Sun is a perfect circle with radius of 93 million miles (9.3×10^7 mi) and that it takes exactly 365 days to complete one circuit around our star, calculate the speed of the Earth in its orbit in miles per hour. (answer below)

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Hours in one year = 365 x 24 = 8760 hrs. Circumference = $2\pi \times$ Radius = $2 \times \pi \times 9.3 \times 10^7$ = 5.84×10^8 miles

Speed = Miles/Hours = 5.84×10^8 divided by 8.760×10^3 = 66.6×10^3 mph