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YOUNG ASTRONOMERS NEWSLETTER

FUTURE PROBLEMS WITH THE REVERSAL OF EARTH'S MAGNETIC FIELD

Recent studies of iron trapped in ancient lava rock has given evidence that the reversal process of Earth's magnetic field may take longer than originally thought. Previous estimates of reversal time were in the range of 1,000 to 10,000 years. Recently studied indicators suggest that the reversal time is longer, more like 22,000 years. Longer reversal time means a longer period for many natural and human processes to be upset. Problems for a lot of people and animals.

The Earth's magnetic field is important from various points of view. The global magnetic field keeps our compasses aligned and keeps us on course during our travels. Migrating animals likewise are sensitive to Earth's magnetic field and use it for guidance. And, very importantly, the global magnetic field helps to shield us from excessive solar radiation.

The last magnetic field reversal occurred about 780,000 years ago. We cannot predict precisely when the next one will occur, but we do note that the magnetic north pole has been migrating from the Canadian Arctic toward Siberia. Geophysicists and other scientists are beginning to look ahead as to what measures can be used to minimize the disruption caused by an unreliable global magnetic map. [livesciences.com; Aug. 8, 2019].

OTHER THAN ON EARTH, WHAT INDICATORS DO WE HAVE THAT LIFE OCCURS IN OUR SOLAR SYSTEM?

Biology tells us that living organisms require liquid water, compatible temperature, key minerals and a minimum in destructive high energy radiation. Of course, such conditions exist on Earth, but how well can life persist if we push the environmental envelope to extremes? We know that very harsh conditions exist on distant planets or moons. And we know that there are some pretty extreme conditions even here on Earth. For example, various organisms are known to survive in hot springs such as at Yellowstone Park, hydrothermal wells in the ocean, and subzero temperatures at the Earth poles. Frigid high and dry deserts can sustain a variety of organisms.

So, what about other planets and moons in our solar system? Are there pockets of habitability?

Planetary scientists are trying to glean any clues given us by way of dozens of space missions that have explored all the major bodies in the solar system. A number of intriguing bodies make us a wee bit optimistic about the chances for life. The September issue of Astronomy magazine covers the most promising prospects.

The most encouraging body, the planet Mars, has been visited and examined enough to make us confident that water is present, if only in the form of ice, just under the surface. But Mars is very cold, with an average temperature around minus 80 ^{o}F. On the other hand, summertime temperatures near the martian equator can get to plus 70 degrees. But with an atmosphere that's 100 times less than Earth's and no magnetic field to protect living organisms from solar radiation, the possibility for life is hanging by a thread.

But from our observation of life on earth, we know that organisms have remarkable resilience to survive under the harshest conditions. This gives us a snippet of optimism.

Life, cont.

Surface features of Mars indicate that river deltas and lakes existed in the distant past. Possibly, over the past one to three billion years, as the planet cooled and lost most of its atmosphere and liquid water, living organisms adapted by hiding under the surface.

At an average distance of 142 million miles from the Sun, (93 million for Earth) It is considered to be at the outer edge of what is called the habitable zone. So, any life form that exists there must be very hardy. We wait for findings produced by current and future missions to the red planet.

Beyond Mars, we venture beyond the habitable zone. It is too cold for pure water to exist in the liquid form. Even the gases we are familiar with on Earth become liquids or even solids. However, there can be unique conditions on distant bodies that make us want to study them further.

Three moons of the outer planets have now drawn a lot of interest from planetary scientists. These are Titan and Enceladus, two moons of Saturn, and Europa a moon of Jupiter. Even though their average temperatures are exceedingly low, in the minus 200°F to minus 300°F range, they have unique geological forces that keep their cores churning up heated mixtures of chemicals that can be considered to be building blocks for biomolecules.

Europa has an icy crusty surface that is periodically burst through by geysers emanating from a subsurface ocean. Likewise, Enceladus has cryovolcanoes that populate its south polar region. The Cassini space probe flew through these geyser plumes and analyzed their chemical content which consisted of water, minerals and a complex mixture of simple and complex organic molecules.

Titan, the largest moon of Saturn, is rich in organic molecules. It undergoes regular methane rain cycles.

The kinetic and thermal energy needed to stir up the subsurface strata of these moons comes from gravitation forces acting between the moons and their parent planet or between neighboring moons. We can think of frictional heat building up due to the flexing of geological layers.

Over the next two or three decades, we expect that exploratory missions will give us definitive information and maybe a few surprises. [Astronomy, Sept. 2019].

WHAT THE EVENT HORIZON TELESCOPE STUDY HAS REVEALED ABOUT BLACK HOLES

Readers, please check the May issue of the newsletter (go to the FAS web site) to see the first ever photo of a black hole produced by an international set of radio telescopes. The combined program is called the Event Horizon Telescope collaboration. The black hole is located in the galaxy designated as M87.

From that study, we learned that the bright ring outlining the central darkness is made by synchrotron radiation created by rapidly spiraling matter such as very hot electrons releasing energy under the influence of the black hole's powerful magnetic and gravitational field lines. The plasma temperature at the closest observable location to the black hole is estimated to reach 100 billion degrees. Heat and light are released by matter as it falls inside the event horizon ring. But once inside the ring, no energy can escape, and the region appears black. Cyclic eruptions of plasma jets occur from M87 on a day-long time scale. The wavelength of the released radio energy is 1.3mm.

M87 is in the constellation Virgo, at a distance of 55 million light years. It has a mass of 6 billion Suns and an estimated diameter of 11 billion miles, which is about four times the diameter of our solar system. It is a rotating black hole. [Sky & Telescope, Sept., 2019].

BIRTHDAYS IN SEPTEMBER: James Alfred Van Allen (Amer.) b. Sept. 7, 1914, d. Aug. 9, 2006. Pioneer in the field of magnetospheric astronomy. Van Allen Belt of Earth named after him.

James Hopwood Jeans (Eng.) b. Sept. 11, 1877, d. Sept. 16, 1946. Physicist, astronomer, mathematician. Worked in quantum theory, stellar evolution and dynamics of star formation from nebular clouds.

MOON PHASES IN SEPTEMBER: First Qtr.: Fri. the 6th; Full: Sat. the 14th; (The Harvest Moon or Corn Moon); Last Qtr.: Sat. the 21st; New: Sat. the 28th

AUTUMNAL EQUINOX: Sept. 23. The angle of the Sun is half way between its northern and southern limits.

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COMET AFRICANO: This is a fast--moving comet that is just beyond naked eye visibility (Mag. 11 - 9) and presents a challenge for telescope users. Throughout the month it moves from Perseus to Andromeda.

THE PLANETS IN SEPTEMBER: Jupiter is seen in the south-southwest at magnitude -2.2 near Antares in Scorpius and fades to mag. -2.0 during the month. It sets before midnight. **Saturn** at mag. 0.4 is trailing to the east of Jupiter in the constellation Sagittarius. Its rings are favorably tilted for telescope viewers. **Mercury** and **Venus** are too closely aligned with the Sun to be favorable targets. **Mars** is currently on the far side of the Sun and will not make its appearance until the third week of October.

MOON MATCH: Place a letter in the blank that matches the planet with its largest moon. (note that there are some wrong choices) Answers given below.

1) MARS _____	**A Enceladus**	**F Triton**
2) Jupiter _____	**B Titania**	**G Miranda**
3) Saturn _____	**C Europa**	**H Despina**
4) Uranus _____	**D Phobos**	**I Titan**
5) Neptune	**E Ganymede**	**J Io**

FORSYTH ASTRONOMICAL SOCIETY: Meetings are held the second Wednesday of the month at 7:30 p.m. at Kaleideum North (formally SciWorks). Visitors are welcome. A program of general interest to amateur astronomers is given as part of the meeting. Check the FAS website to learn about special activities such as public observations. Outdoor activities are always subject to cancellation due to unfavorable weather. Check the FAS website (www.fas37.org) for any scheduling changes, or call the Kaleideum North front desk: 336-767-6730 ext 1000 A public observation is scheduled at Kaleideum North on Saturday, September 21. FAS members will start setting up their telescopes a half hour before sunset. Come and have a look at the heavenly bodies!

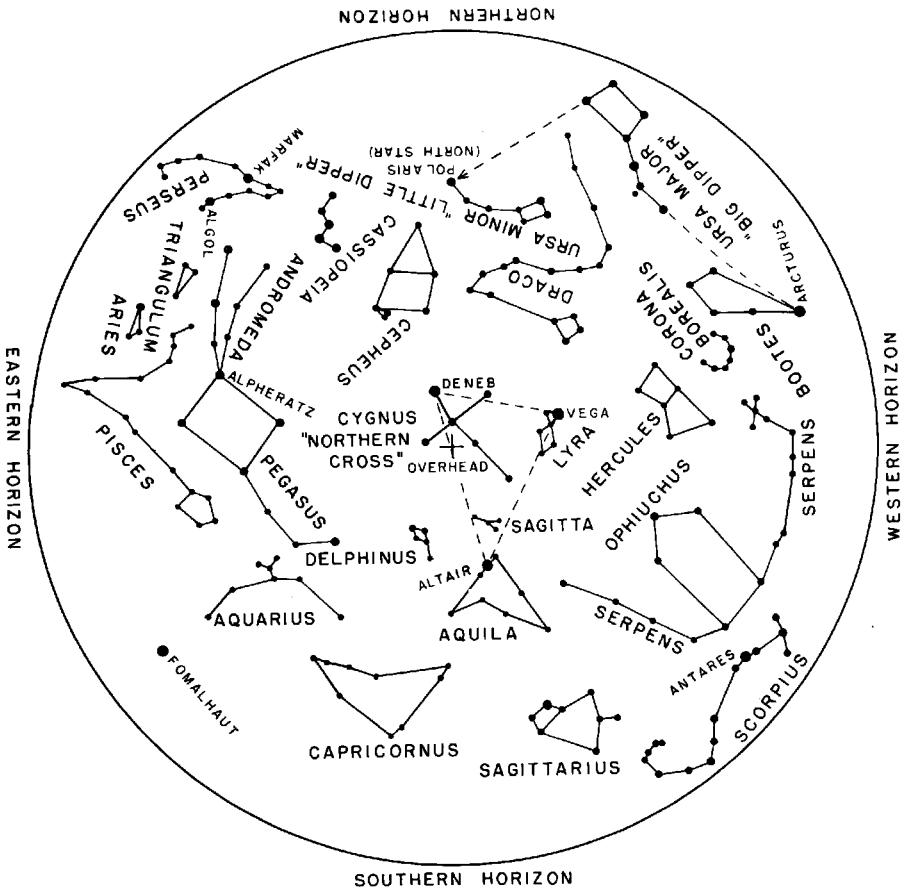
See the autumn sky chart on page 4

Answers: 1 – D 2 – E 3 – I 4 – B 5 – F

Enjoy the fall sky! Bob Patsiga, editor

THE FALL SKY

In the fall, our angle of view of the sky is away from the cross section of the Milky Way, so, we see fewer stars than in the summer or winter. The best way to get oriented is to look high overhead, even slightly toward the northern sky. There, you'll see the big W of Cassiopeia (queen of Ethiopia). From Cassiopeia, drop down a little toward the south and you'll see a rather open space, but with four stars making up the corners of a giant square. The stars are not very bright (second mag.) but there's not much else in the area to confuse you. This is the Great Square of Pegasus, the flying (winged) horse. Remember that the horse is upside down and the rump of the horse is missing. If you trace from the corner Peg. star closest to Cass. and stop roughly half way, you can see our neighbor galaxy, Andromeda. And. can be seen with the naked eye only by people with good vision and in an ideal (dark) location. It is next to the Andromeda constellation. You will probably have to use binoculars. Andromeda shows up as fuzzy spot. It is a spiral galaxy, like the Milky Way, and it is about two million light years away. The Milky Way is running diagonally from Scorpius through Cygnus and through Cassiopeia. In September, Cass. is a bit off to the northeast and you can still see Cygnus and the summer triangle. Later in the fall, Cass. and Peg. will be straight up.



THE NIGHT SKY IN SEPTEMBER