UPSC Daily Current Affairs | Prelim Bits 01-10-2024

Earth's Future after Red Giant Phase of Sun

The recent discovery of earth like planet orbiting a white dwarf is getting a sneak peek at the future of the Solar System, and the fate of Earth.

- **Rocky planet** – It comes in at *around 1.9 times the mass of Earth*, orbiting its star at around twice Earth's distance from the Sun.
- The star is a white dwarf which means any life that might have been on the exoplanet was probably obliterated before or during the star's red giant death throes.
- **White dwarf** – It began as an ordinary star *1 or 2 times the mass of the sun* and its current mass is about half the sun.
- **Distance of Orbiting** – Before its host star's death, it orbited at a distance, possibly placing it in the habitable zone.
- Following its star's demise, it is at *2.1 times that distance*.
- **Current state of the planet** - It's *currently a freezing world* because the white dwarf, which is in fact smaller than the planet, is extremely faint compared to when it was a normal star.
- **Significance of the finding** – It offers insight into Earth's potential survival after sun's death.

Red Giant Phase of Sun
• The sun, roughly four and a half billion years old, is destined to become a white dwarf. • **Red Giant phase** – It is the end of our sun's life when it will puff up to enormous size. • It is estimated to occur 7 billion years from now and will become a white dwarf a billion years after that. • It gently *blow off its outer layers in a wind*. • As our sun loses mass, the planets' orbits will expand to larger sizes. • Eventually, the s*tar will eject its outer material completely*, and the core will collapse under gravity to form a dense object whose bright light not generated by fusion, but the residual heat of its collapse process. • That h*ot core is the white dwarf,* and it will take trillions of years to cool to complete darkness.

- Research modeling shows that this planet very likely had a similar orbit to Earth before its host star became a red giant.
- It implies that *Earth's chances for survival may be higher* than currently thought.

Reference

Science Alert| Earth like Planet Orbiting a Dwarf Star

White Dwarf

A recent study using Hawaii-based telescopes, found the 1st rocky planet that is orbiting the white dwarf about 4,200 light years away from our solar system near the bulge at the center of the Milky Way galaxy.

- **White Dwarf** – It is the *stellar core left behind after a dying star* has exhausted its nuclear fuel and expelled its outer layers to form a planetary nebula.
- It is the last observable stage of evolution for low- and medium-mass stars.

Stars having a larger mass may end their lives as black holes or neutron stars. A light year is the distance light travels in a year, about 5.9 trillion miles.

- **Conditions for formation** – Stars with a ***mass less than 8 times the sun.***
- **Formation** – It is formed when a low-mass star like our sun *exhausts most of its nuclear fuel*.
- **Composition** - Compared to our sun, it has a *similar carbon and oxygen mass* though it is much smaller in size.
- **Features** - It is about as massive as the Sun, yet only slightly bigger than the Earth.
- It is *one of the densest forms* of matter, surpassed only by neutron stars and black holes.
- **Temperatures** - It can *exceed 100,000 Kelvin* according to NASA.
- They no longer support nuclear fusion reactions that generate energy, but they are still extremely hot.

*White Dwarfs cool over time, and it is predicted that they would ultimately form **'black dwarfs'**, although the Universe is likely not old enough for any black dwarfs to exist yet.*

- **Luminosity** - Despite having too high a temperature, they have a ***low luminosity*** as they're so small in size.
- It luminosity can be used by astronomers to measure how long ago star formation began in a particular region.

Hubble was the 1st telescope to directly observe white dwarfs in globular star clusters in 2003, which astronomers reported as the dimmest stars ever seen in a globular star cluster.

References

1. The Hindu| Planet Orbiting a White Dwarf
2. ESA Hubble| White Dwarfs

Khur

Khur have recently overcome a near-extinction event.

- It is an *Indian Wild Ass*, a species of ass that is native to the countries of southern Asia.
- It is one of the 4 remaining subspecies of the Asian Wild Ass.
    - **Scientific name** - Equus hemionus khur
    - **Other local terms** – Ghudkhur or Indian onager
- **Range** – Earlier it extended from Southern India towards southern Pakistan, Afghanistan and south-eastern Iran.
- Now, it can only be found in India.
- **Features** – It is almost the *size of a zebra*, and lives for *21 years*.
- Stable groups consist of *females and their young* while Stallions tend to be loners, especially in the breeding season.
- On the flat terrain of the Rann, they are capable of bursts of up to *70 km per hour*.
- Their gestation periods are long, 11 to 12 months, and concurrent lactation and pregnancy is sometimes seen.
- **Feed** – It predominantly feeds on grasses.

Survival strategies of Khur
• Like donkeys and other members of the Asinus subgenus, possesses a remarkable ability to locate sustenance in desolate environments. • During summer when grasses are scanty and dried they used to *feed on Prosopis pods and leaves*. • Their *digestive systems are adept* at processing even the most arid vegetation. • **Overcome a near-extinction event** – On account of diseases like - Viral African Horse sickness - Surra • **Low level of genetic diversity** - It is due of a *genetic bottleneck* caused by disease outbreaks, which left only a small survivors. • Khur has outlasted predators such as the cheetah and the lion, which were last spotted in this region in the 1850s.

> *Surra is an infection in Indian Wild Ass caused by the protozoan parasite Trypanosoma evansi and spread by biting insects*

- **Threat** – *Increased human presence* for salt farming, agriculture coupled with extensive *cattle grazing*, has led to their dispersal.
- *Irrigation canals* that bring water to the southern rim of the Little Rann can also add salinity to the soil.
- **Conservation status**
    - **IUCN** – Endangered
    - **Wildlife Protection Act 1972** – Schedule I
- **Conservation** – India has declared a ***Wild Ass Sanctuary*** in Little Rann of Kutch, the largest sanctuary in Gujarat.
- It was set up in 1973, only remaining habitat of the Indian wild ass.
- About 6,000 of these sandy and brown creatures live in this area.

Reference

The Hindu| Survival of Khur in India's Salt Desert

The Rann of Kutch

- It is reputed to be *one of the largest salt deserts* in the world.
- **Location** – It lies at the end of the Gulf of Kutch in Gujarat.
- **Size** – It is about 7500 km^2 in area.
- **Evolution** – It evolved when *waters of the Arabian Sea* made incursions into this region 150-200 million years ago.
- Geological upheavals led to the *rise of a landmass* that cut off the Kutch basin from the sea.
- **Types** – It is divided into the ***Little Rann and the Big Rann***.



- **Landscape** – For most of the year, it consists of vast, barren desiccated, *unbroken bare surface of dark silt*, encrusted with salts.
- It is also known for ecologically important Banni grasslands
- **Landscape changes** - A striking alteration occurs when the monsoon sets in, and the Rann turns *into a shallow wetland*.

The Rann of Kutch can be considered a large ecotone, a transitional area between marine and terrestrial ecosystems.

- **Bets** – About 75 elevated pieces of land turn into islands, called bets by the local *Agariya and Maldhari communities*.
- The largest plateau is called *Pung*.
- **Economic significance** – The salt marsh attracts human enterprise, 30% of India's salt comes from the Little Rann.

Reference

The Hindu| India's Salt Desert



SHANKAR
IAS PARLIAMENT
Information is Empowering