Prelim Bits 09-10-2019

The science behind Physics Nobel Prize

- This year's Nobel Prize for Physics recognises research that helps us understand our place in the universe.
- It was awarded to,Canadian-American cosmologist **James Peebles**.
- He won one-half of the Prize for his theoretical work to understand how the universe evolved after the Big Bang.
- The other half went to Swiss astronomers **Michel Mayor** and **Didier Queloz**.
- It is for their discovery of an exoplanet that challenged preconceived ideas about planets.

James Peebles Work on Evolution of Universe

- Modern cosmology assumes that the universe formed as a result of the Big Bang.
- Peebles used theoretical physics and calculations to interpret what happened after.
- His work is focused largely on 'Cosmic Microwave Background' (**CMB**) radiation.
- **CMB** is electromagnetic radiation left over from the early universe once it had cooled sufficiently following the Big Bang.
- Peebles has correlated the temperature of this radiation with the amount of matter created in Big Bang.
- This was a key step towards understanding how this matter would later form the galaxies and galaxy clusters.
- From his work derives our knowledge of how mysterious the universe is,

    1. just 5% known matter and
    2. the rest unknown, as Dark matter (26%) and
    3. Dark energy (69%).

Michel Mayor and Didier Queloz Work on Exoplanets

- The two scientists detected the first planet orbiting an alien star.
- Exoplanets are being discovered very frequently, today over 4,000 are known.
- The planet discovered by **Mayor** and **Queloz** in 1995 is 50 light years away.
- It is orbiting the star '**51 Pegasus'** that is similar to our Sun.
- **ELODIE** a spectrograph, built by **Mayor**, predicted the planet.
- It was, by observing the "Doppler effect" when the star wobbles as an effect of a planet's gravity on its observed light.
- It is a gas giant comparable to Jupiter, yet it is very hot, unlike icy cold Jupiter;
- **51 Pegagsus b** is even closer to its star than Mercury to our Sun.
- Until then, gas giants were presumed to be cold, formed a great distance from their stars.
- Today, it is accepted that these hot gas giants represent what Jupiter would look like if it were suddenly transported closer to the Sun.
- The discovery of the planet started a revolution in astronomy and since then many exoplanets have been found in our galaxy.

Geotail and its impact on Chandrayaan-2

- Recently, **ISRO** tweeted that an instrument on Chandrayaan-2, **CLASS**, had detected charged particles during the mission.
- This happened during the orbiter's passage through the 'Geotail'.

- The Geotail is a region in space that allows the best observations.
- The region exists as a result of the interactions between the Sun and Earth.
- The Sun emits the solar wind, which is a continuous stream of charged particles.
- These particles are embedded in the extended magnetic field of the Sun.
- Since the Earth has a magnetic field, it obstructs the solar wind plasma.
- This interaction results in the formation of a magnetic envelope around Earth.
- On the Earth side facing the Sun, the envelope is compressed into a region that is approximately 3 to 4 times the Earth radius.
- On the opposite side, the envelope is stretched into a long tail, which extends beyond the orbit of the Moon.
- It is this tail that is called the **Geotail**.
- Once every 29 days, the Moon traverses the geotail for about six days.
- When Chandrayaan-2, which is orbiting the Moon, crosses the geotail, its instruments can study the properties of the geotail.
- It can helps to detect the presence of key elements like Na, Ca, Al, Si, Ti and Fe the lunar soil.

Source: PIB, The Indian Express

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