

2. The Nobel Prize in Physics 2019

Prelims: Science & Technology

Mains: GS-III Awareness and Field of Space

- ▶▶ The royal Swedish Academy of Sciences announced that the Nobel Prize in Physics would go to three people: One half of it would be shared by Michel Mayor and Didier Queloz of the University of Geneva, for discovering for the first time a planet outside our solar system orbiting a Sun-like star; the other half would go to James Peebles, Princeton University, for his contribution to physical cosmology.
- ▶▶ This brought the topics of exoplanets, dark matter, dark energy, cosmic microwave background (CMB) into limelight.

Exoplanets:

- ▶▶ An exoplanet is a planet outside our solar system. It is an extrasolar planet.
- ▶▶ '51 Pegasi b' was the first exoplanet to be discovered in 1995. It is unlikely that we can survive in that.
- ▶▶ According to NASA, there are 4,073 confirmed exoplanets.

Cosmic Microwave Background (CMB):

- ▶▶ About 400,000 years after the Big Bang, the universe expanded and cooled to a few thousand degrees Celsius.
- ▶▶ This caused it to become transparent, allowing light to pass through it.
- ▶▶ This ancient afterglow of the Big Bang, the remnants of which still can be observed, is known as the cosmic microwave background (CMB).
- ▶▶ CMB is a faint cosmic background radiation filling all space.
- ▶▶ Microwave radiation is invisible light.
- ▶▶ The CMB is useful to scientists because it helps us learn how the early universe was formed. It is at a uniform temperature with only small fluctuations visible. By studying these fluctuations, cosmologists can learn about the origin of galaxies.
- ▶▶ CMB-Bharat is a proposal for comprehensive next generation Cosmic Microwave Background (CMB) mission, which could help listen to the faintest murmurs of the early universe.
- ▶▶ It is proposed as an international collaboration mission with major Indian contribution

Dark Matter:

- ▶▶ By measuring the speeds of rotating galaxies, scientists were able to see that a lot of mass needed to be there that would hold the galaxies together with the strength of their gravitational attraction.
- ▶▶ Before Peebles intervened, the missing mass was attributed to neutrinos.
- ▶▶ Peebles instead said this is due to a hitherto unknown type of “dark” matter particles. However, while they could “see” a portion of this mass, a large part of it could not be seen. Hence the mass missing from view was named “dark” matter.
- ▶▶ Even though this matter is all around us, close as well as far away, we only feel it through its gravity, but we cannot see it through other interactions. This is because it does not interact with light.
- ▶▶ About 25% of the mass of the universe is made up of dark matter.

Dark Energy:

- ▶▶ In 1998, it was discovered that the universe is expanding, and that this expansion was gaining speed or accelerating.
- ▶▶ There had to be an “invisible” energy that was driving this.
- ▶▶ Calculations showed that this dark energy did not interact with the observed mass and makes up about 70% of the universe.

