The Contributions To Our Understanding Of The Evolution Of The Universe And Earth's Place In The Cosmos

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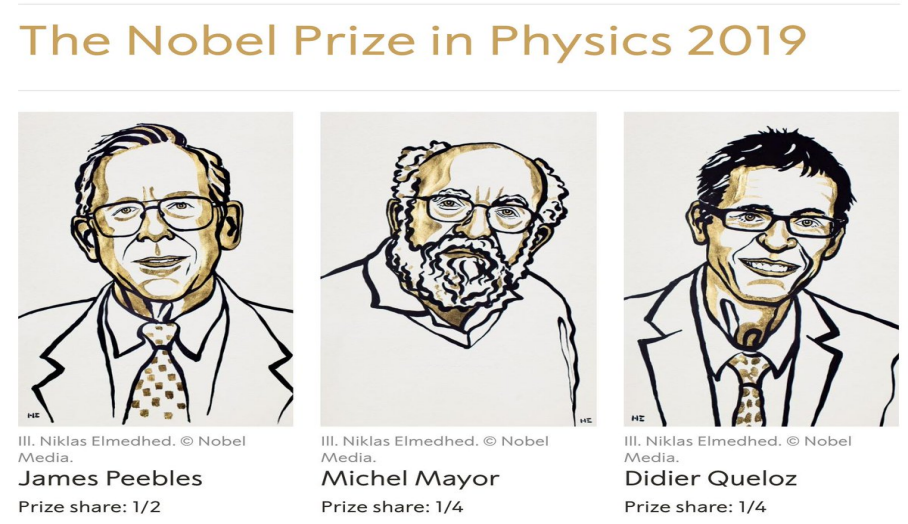
The Nobel Prize in Physics 2019 has been awarded with one half to Prof. James Peebles,"for theoretical discoveries in physical cosmology" and the other half jointly to Prof. Michel Mayor, and Prof. Didier Queloz,"for the discovery of an exoplanet orbiting a solar-type star"



I. Introduction

The last few decades have drawn remarkable progress in our understanding of the development of the universe and earth's place in it. Cosmic radiations was discovered in 1965 and turned out to be gold mine for understanding how the universe has developed from its early childhood to its present day. If there were not the theoretical discoveries of Prof. James in physical cosmology, the wonderful high precision measurements of these radiations over the last 20 years would have told us almost nothing. In October 1995, Prof. Mayor and Prof. Queloz announced the discovery of an exoplanet orbiting a solar type star. They have found more than 4000 exoplanets. And recently earth like planets with potential to host life have been discovered. Both these discoveries just

summarises our place in universe i.e. the past of our universe through the theory of physical cosmology and of course the future with the presence of exoplanets that serves as an opportunity in exploring life somewhere other than earth.

II. EVOLUTION OF UNIVERSE

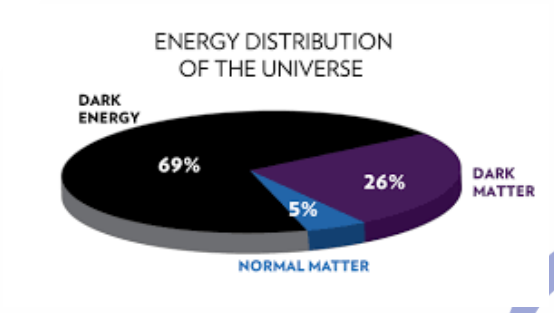


Figure 1

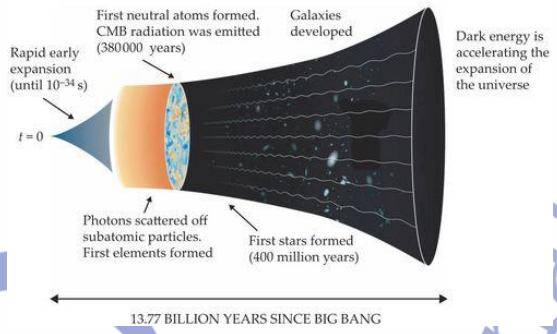


Figure 2

According to the theory given by Prof. James, the whole universe was in a hot dense state, then nearly 14 billion years ago expansion started. Then after a little less than 400,000 years of expansion, the universe had cool down to a temperature of few 1000°C and become transparent to light.Using the astronomical instruments, they looked back to the ancient times and study the cosmic microwave background radiations. At that time when light lost its grip on matter, galaxies started to form. But there is only 5% of energy in our universe which is in the form of ordinary matter like stars, planets and living beings, 26% is in the form of mysterious dark matter and 69% is the dark energy that forces the galaxies to move away even faster. According to him, we are living towards the end of the era of galaxies.**One can compare a universe to a cup of coffee, where (coffee+water) represents dark energy,now the fair amount of cream/milk in it is the dark matter and then just a tiny bit of sugar in the coffee represents the ordinary matter(which symbolically represents sweetness of life i.e.planets, stars and the living creatures) Prof. Michel Mayor and Prof. Didier Queloz focused on what is more important to us i.e. The sugar in the cup.**Using custom-made instruments, they studied a planet 51 Pegasi b, outside our solar system, "an exoplanet", orbiting a solar-type star in our galaxy. This discovery started a revolution in astronomy and over 4,000 exoplanets have since been found in the Milky Way.

III. CONCEPTS INVOLVED

Prof. Peebles' research provides insight into the field of cosmology, specifically the cosmic background radiation generated from an expansion in the universe. Various different strategies were chosen to calculate the radial velocity of the exoplanets in relation to the Earth's position in the Milky Way, when orbiting planets move around their common centre, this causes a Doppler shift due to stellar wobble. These wobbles are measured as light waves that either move closer or further away from the Earth.These indications gave rise to Prof. Mayor and his team, to develop a customised tool called the ELODIE spectrograph. The intention behind ELODIE was to expand the number of objects for which the Doppler measurements could be applied to.

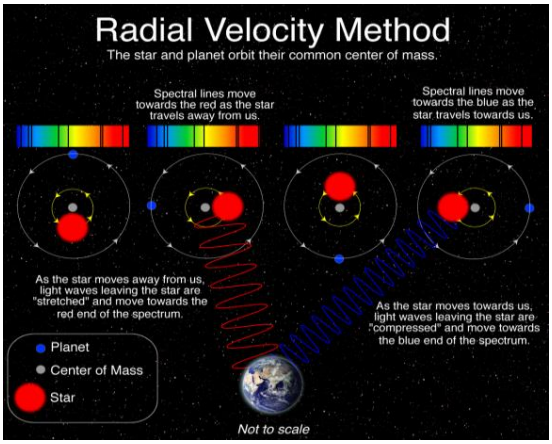


Figure 3

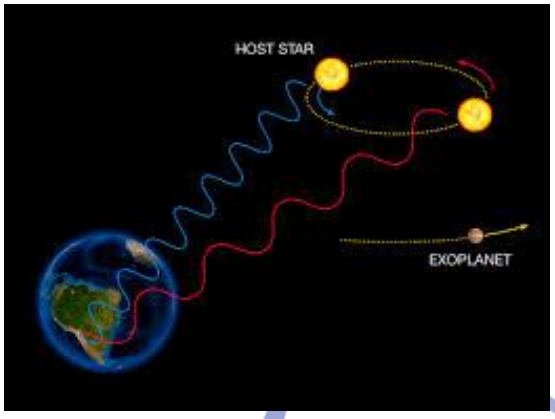
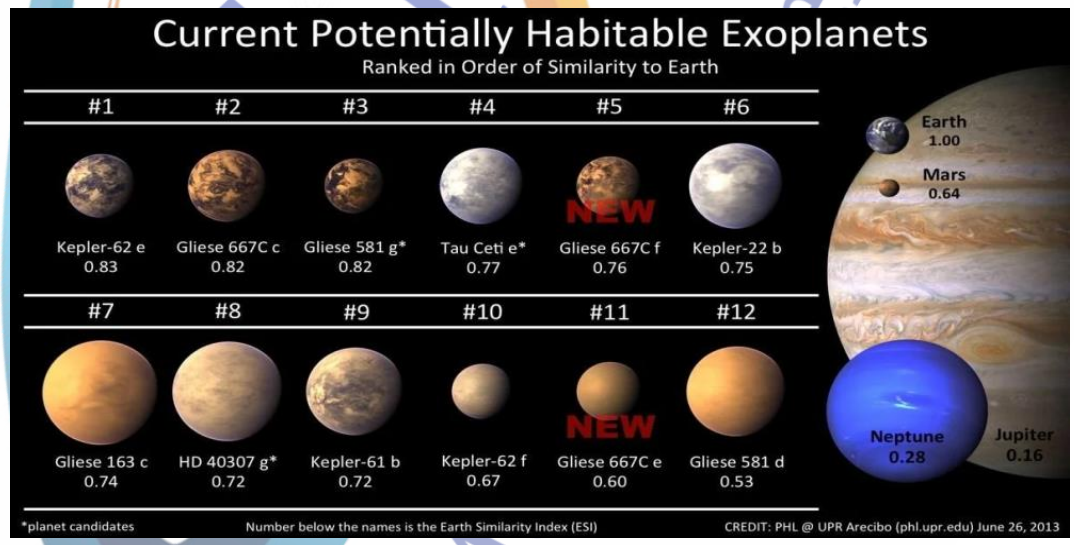


Figure 4

IV. RESULTS AND FUTURE ASPECTS

The theoretical study of cosmology gave a more tangible and physical grasp of the universe. The first exoplanet that was observed orbiting around a solar type star other than sun had some unexpected properties, it was so close to its sun that its year lasted no more that few Earth days. Its temperature was 1000°C and it was as big as Jupiter. Few had expected that such planet could exist.**These discoveries have ignited the thoughts which have been pondered since ancient times when looking up at sky: does life really exist beyond our own planet?**This has challenged our preconceived ideas about planetary systems and is forcing scientists to revise their theories of the physical processes behind the origin of planets. We now know that there are many different kinds of planetary systems with several billions of planets, some of them might be similar to our Earth. These 3 noble laureates in physics have painted a picture of universe far stranger and more wonderful than one could have ever imagined.



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