

Class Notes For Online Learning Of B. A. Part 1 Geography(hons.)

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Unit 01, Section (A), Topic 02- Supernova Hypothesis Of Hoyle

Supernova Hypothesis of Hoyle:

Fred Hoyle, a mathematician of Cambridge University (U.K.) presented his theory known as 'supernova hypothesis' in the year 1946. His hypothesis was based on the principles of 'nuclear physics' and was described in his essay entitled 'Nature of the Universe'.

According to Hoyle initially there were two stars in the universe viz.:

(i) The primitive sun

(ii) The companion star.

The companion star was of giant size and later on became supernova due to nuclear reaction.

It may be pointed out that energy, which is emitted by any star in the form of light, heat, etc., is generated by the process known as 'nuclear fusion' wherein atoms of lighter elements combine under intense heat and pressure to form atoms of heavier elements, releasing vast amount of energy. The stars generally contain hydrogen.

The hydrogen nuclei slowly and slowly combine with each other to form helium. In the process comparatively heavier element helium is formed and vast amount of energy is also released.

The same type of nuclear fusion was also going on in Hoyle's primitive sun and the companion star but the rate of nuclear fusion was many times greater in the core of the companion star than the primitive sun. With the passage of time all of the hydrogen nuclei of the companion star were consumed in the process of nuclear reaction and it collapsed and exploded.

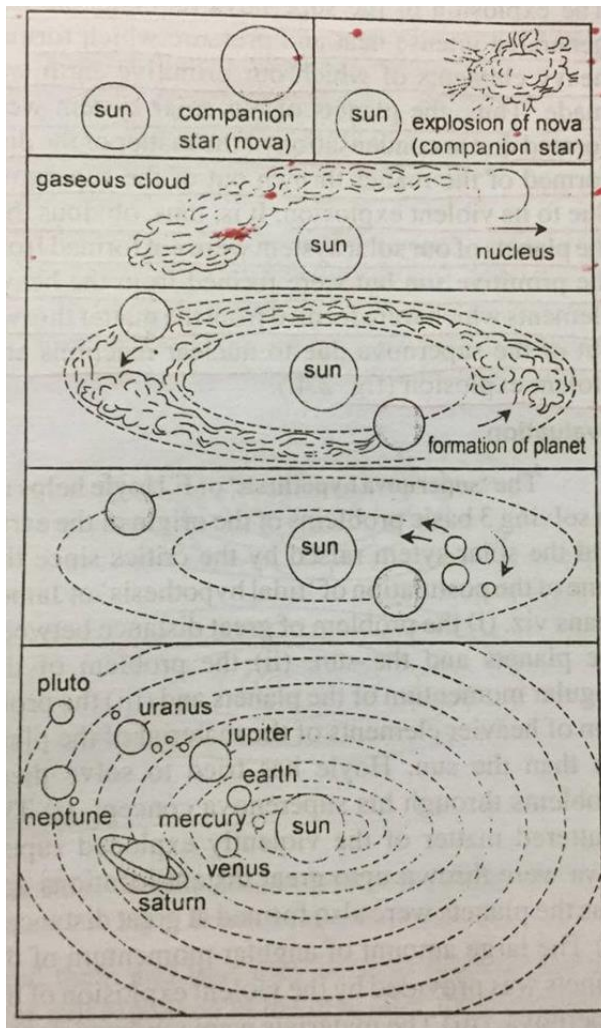


Figure 01-Source:- Savinder Singh Physical Geography

The violent explosion of the companion star (now supernova) resulted into the spread of enormous mass of dust which started revolving around the primitive sun. Hoyle maintained that when the companion star was violently exploded, the recoil of the gigantic stellar explosion threw the nucleus of the companion star out of the gravitational field of the primitive sun.

The gaseous matter coming out due to violent explosion of the companion supernova star changed into a circular moving disc which started revolving around the primitive sun. Thus, the matter of this disc became building material for the formation of future planets.

The main constituent elements of the aforesaid building material were formed during the explosion of the companion star of supernova. It may be pointed out that the explosion of the companion star or supernova generated intense heat equivalent to 5×10^9 degree C which was sufficient enough to start the process of nuclear fusion.

The intense heat and nuclear fusion became responsible for the formation of heavy elements (e.g., helium, carbon, oxygen, silicon, nitrogen, etc.). In fact, the degree of heat and pressure decides the level of heaviness of the elements in the process.

The explosion of the supernova (companion star) generated intense heat and pressure which formed heavy elements of which our primitive earth was made. Thus, the planets of our solar system were formed due to condensation of the matter of the disc formed of the matter thrown out of the supernova due to its violent explosion.

It is, thus, obvious that the planets of our solar system were not formed from the primitive sun but were formed from the heavy elements which were formed from the matter thrown out of the supernova due to nuclear reactions and violent explosion.

Evaluation:

The 'supernova hypothesis' of F.Hoyle helps us in solving 3 basic problems of the origin of the earth and the solar system raised by the critics since the time of the postulation of 'tidal hypothesis' of James Jeans viz.:

- (i) The problem of great distance between the planets and the sun,
- (ii) The problem of the angular momentum of the planets, and
- (iii) The problem of heavier elements of the material of the planets than the sun.

However, it fails to account for the cigar shaped arrangements of the planets.

References:

- **K.Siddhartha – “The Earth’s Dynamic Surface”**
- **S.Singh – Geomorphology**
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- **Strahler & Strahler – Physical Geography**
- **M.J.Shelby – Earth’s Changing Surface**