

(centre)
London
12:00
(-)

(land) Surround

Bigger

(large)

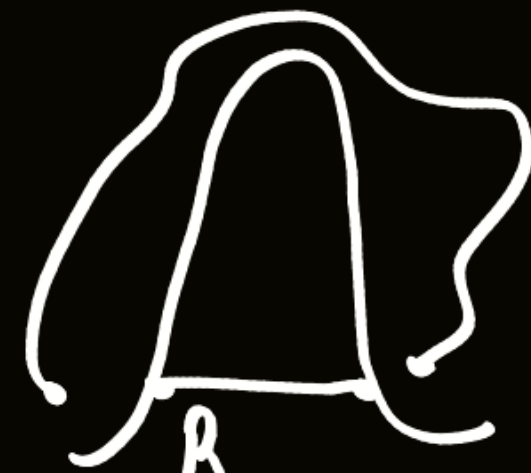
Water bodies

Ocean, Sea

(body)

Strait (Narrow)

Landmasses



MAP (Parser)

(Man-Made)



GEOGRAPHY
IS LOVE

CHAPTER OVERVIEW

→ [Origin of Earth, Sun, Moon, Planets, Stars.]

- Introduction

- Hypothesis

- Early Theories

- Modern Theories

→ Theories

①

- Star Formation

- Formation of Planets

- Our Solar System

- The Moon

→ Star

→ Planet (Early)

→ Planets, Sun
2

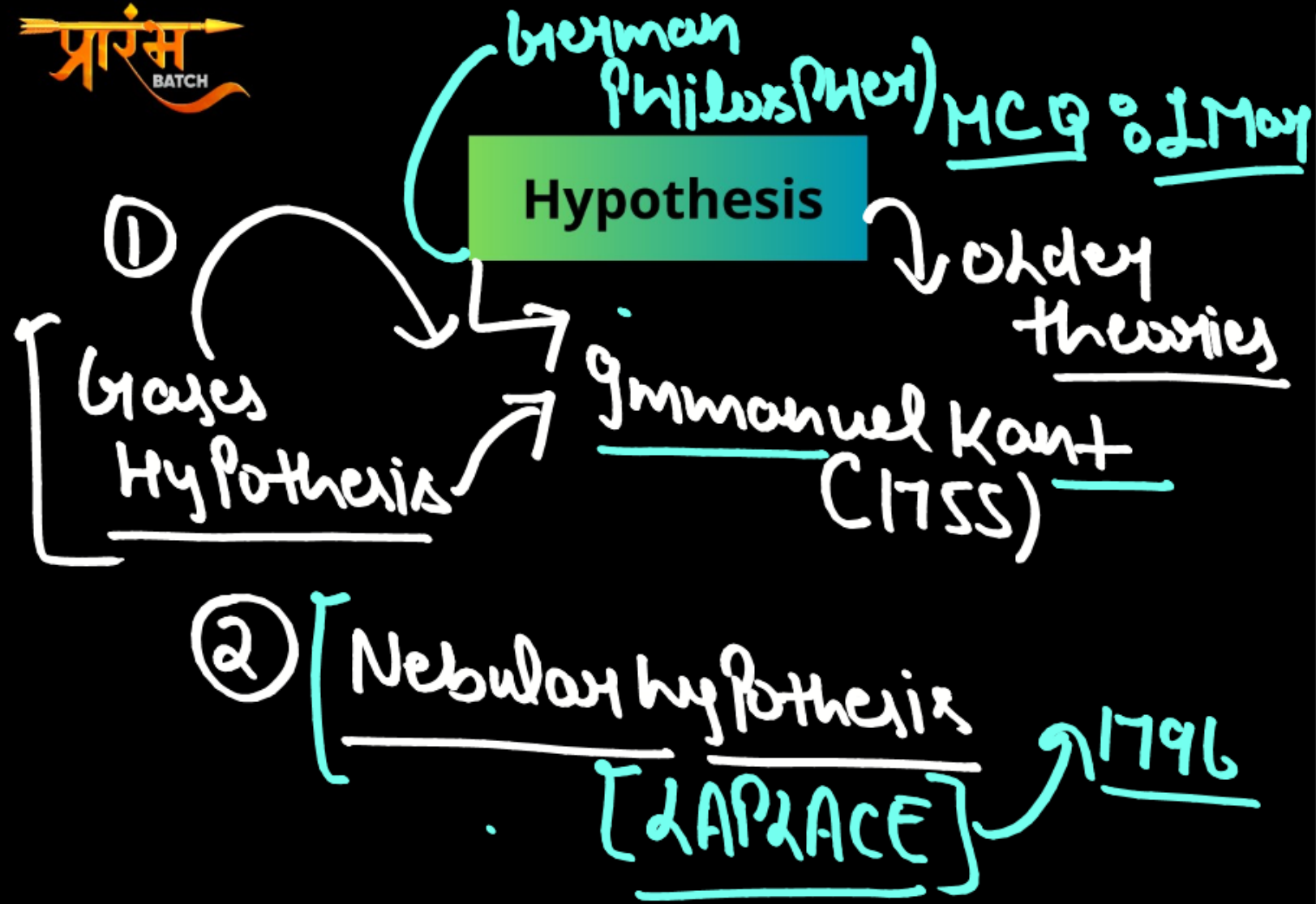


Geography
wale
agaye
hoe!!!!



Geography is love

*Made by
Projjal*



Difference

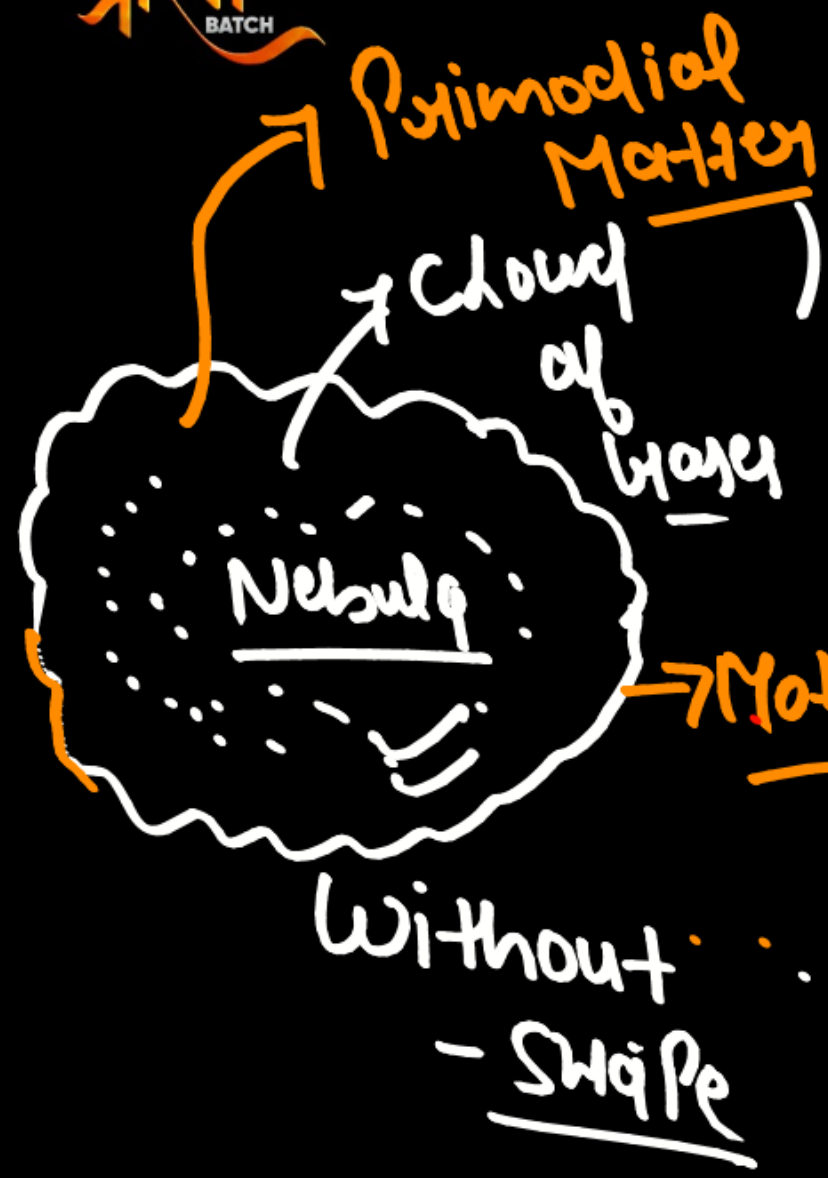


Origin of the Earth

Early Theories



Modern Theories



{ Gaseous }

①

Cold
Imm

Hot

LAPLACE

{ Solid }

Matter

Immanuel Kant Hypothesis (1755)

[Based on gravitational law of Newton.]

{ Assumption } → ✓

①

{ Super Natural }

{

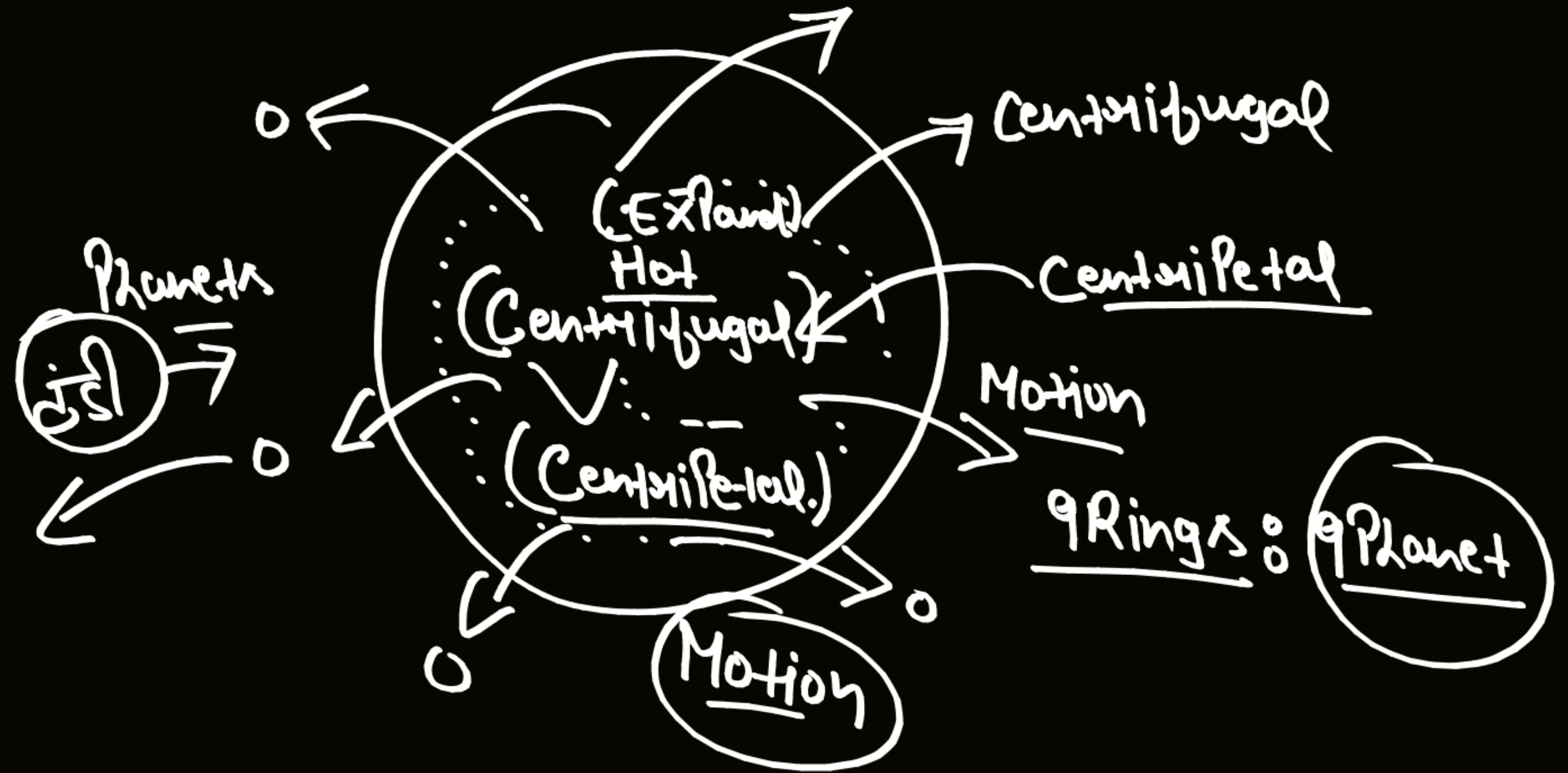
Primordial Matter scattered in the universe. (Cold, Solid, Motionless)

Particles

②

The Particles began to Collide (Gravitational)

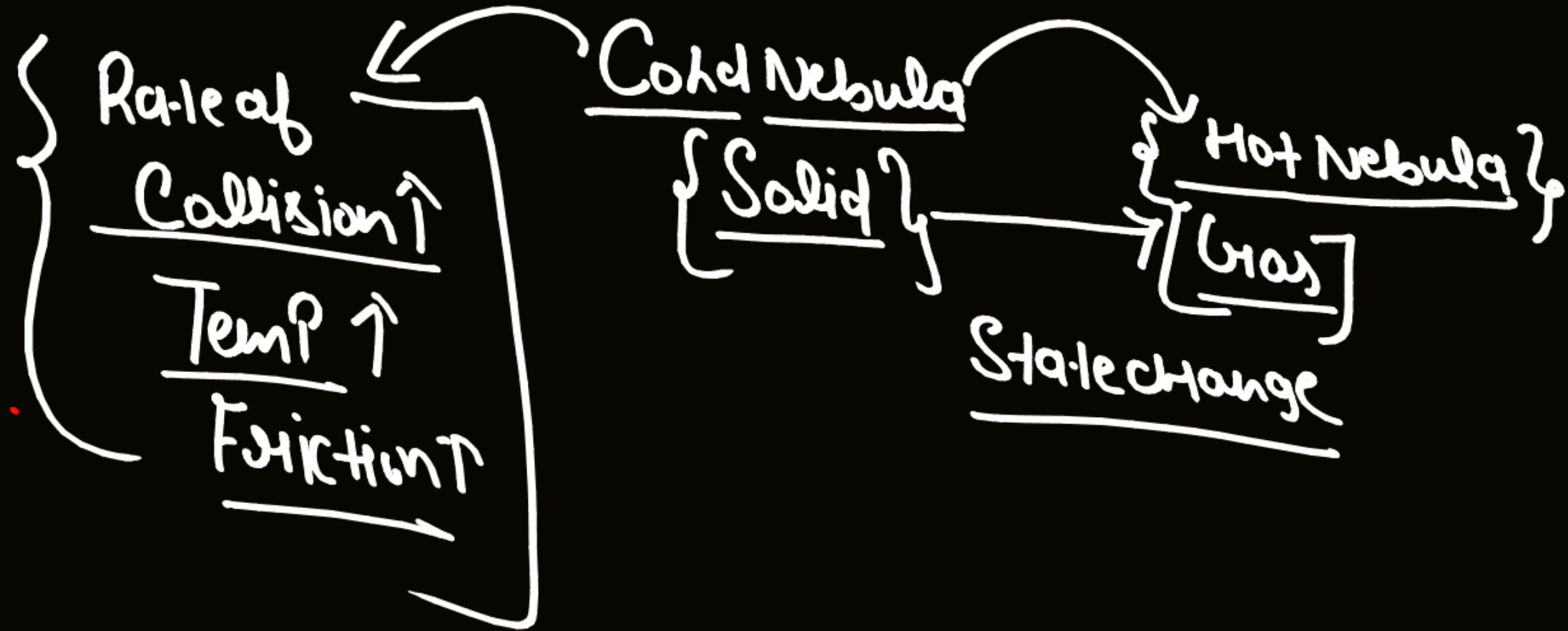
प्राचीन (Primitive)



Immense

Nebulae (Primal Matter) ^{ਪ੍ਰਾਈਮ}

Primal Matter: Collide (Collision of Particle)



Criticism: ① Source of 'Immaterial Matter'?

≈ ② Particle (Motionless → to Motion)?

5

LAPLACE: Cooler ^{XX} Nebula [Hot Nebula]

↳ No. of Planets

were going?

?

↳ Origin ÷ ? X

expand

↳ Source of Heat (friction)

↳ Centrifugal & Centripetal

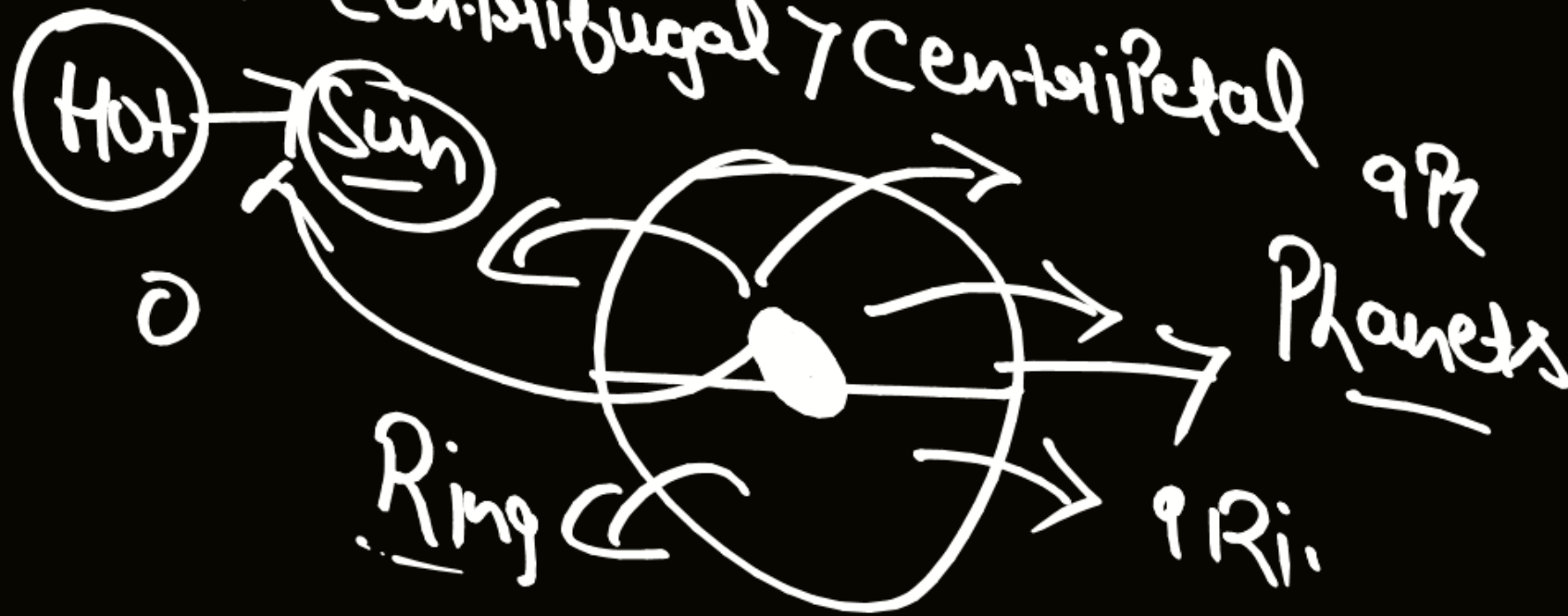
Hot Sun

0

Ring

9 P
Planets

9 Ri.



EARLY THEORIES

Origin of the Earth

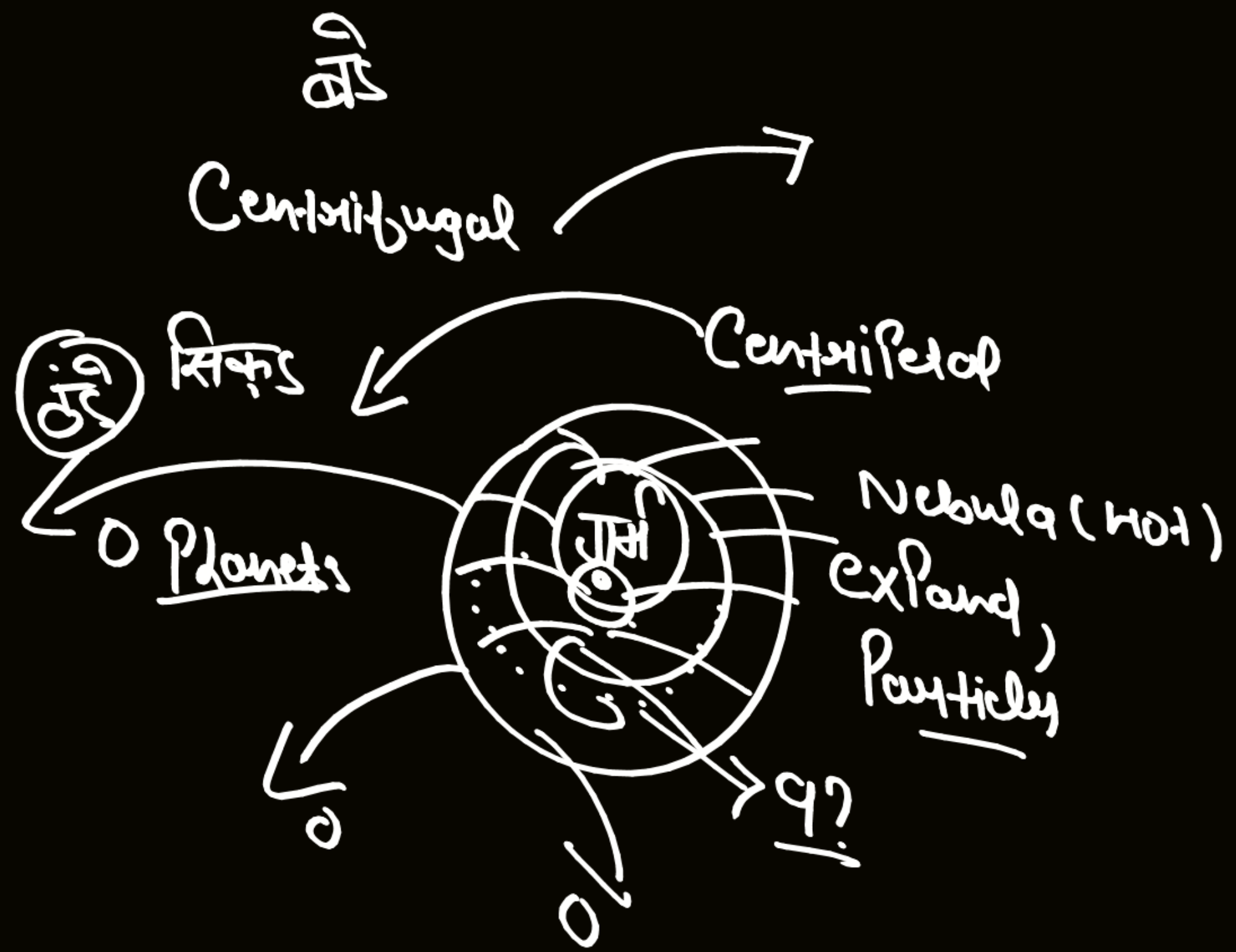
A large number of hypotheses were put forth by different philosophers and scientists regarding the origin of the earth. One of the earlier and popular arguments was by German philosopher Immanuel Kant. Mathematician Laplace revised it in 1796. It is known as Nebular Hypothesis. The hypothesis considered that the planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating. Later in 1900, Chamberlain and Moulton considered that a wandering star approached the sun. As a result, a cigar-shaped extension of material was separated from the solar surface. As the passing star moved away, the material separated from the solar surface continued to revolve around the sun and it slowly condensed into planets. Sir James Jeans and later Sir Harold Jeffrey supported this

that of just the earth or the planets.

MODERN THEORIES

Origin of the Universe

The most popular argument regarding the origin of the universe is the *Big Bang Theory*. It is also called *expanding universe hypothesis*. Edwin Hubble, in 1920, provided evidence that the universe is expanding. As time passes, galaxies move further and further apart. You can experiment and find what does the expanding universe mean. Take a balloon and mark some points on it to represent the galaxies. Now, if you start inflating the balloon, the points marked on the balloon will appear to be moving away from each other as the balloon expands. Similarly, the distance between the galaxies is also found to be increasing and thereby, the universe is considered to be expanding. However, you will find that besides the increase in the distances between the points on the



$$E=Mc^2 \rightarrow$$

law of conservation of Mass

↳ can neither be created



IMMANUEL KANT

રૂઝની જ્ઞાન



LAPLACE

balloon, the points themselves are expanding. This is not in accordance with the fact. Scientists believe that though the space between the galaxies is increasing, observations do not support the expansion of galaxies. So, the balloon example is only partially correct.

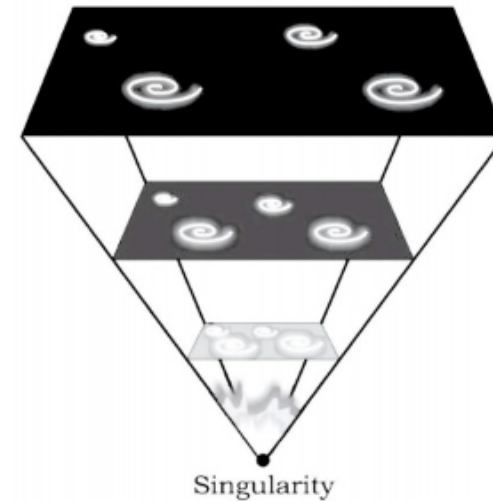


Figure 2.1 : The Big Bang

The Big Bang Theory considers the following stages in the development of the universe.

- (i) In the beginning, all matter forming the universe existed in one place in the form of a "tiny ball" (singular atom) with an unimaginably small volume, infinite temperature and infinite density.
- (ii) At the Big Bang the "tiny ball" exploded violently. This led to a huge expansion. It is now generally accepted that the event of big bang took place 13.7 billion years before the present. The expansion continues even to the present day. As it grew, some energy was converted into matter. There was particularly rapid expansion within fractions of a second after the bang. Thereafter, the expansion has slowed down. Within first three minutes from the Big Bang event, the first atom began to form.
- (iii) Within 300,000 years from the Big Bang, temperature dropped to 4,500 K (Kelvin) and gave rise to atomic matter. The universe became transparent.

The expansion of universe means increase in space between the galaxies. An alternative to this was Hoyle's concept of *steady state*. It considered the universe to be roughly the same at any point of time. However, with greater evidence becoming available about the expanding universe, scientific community at present favours argument of expanding universe.

The Star Formation

The distribution of matter and energy was not even in the early universe. These initial density differences gave rise to differences in gravitational forces and it caused the matter to get drawn together. These formed the bases for development of galaxies. A *galaxy* contains a large number of stars. Galaxies spread over vast distances that are measured in thousands of *light-years*. The diameters of individual galaxies range from 80,000-150,000 light years. A galaxy starts to form by accumulation of hydrogen gas in the form of a very large cloud called *nebula*. Eventually, growing nebula develops localised clumps of gas. These clumps continue to grow into even denser gaseous bodies, giving rise to formation of stars. The formation of stars is believed to have taken place some 5-6 billion years ago.

A light year is a measure of distance and not of time. Light travels at a speed of 300,000 km/second. Considering this, the distances the light will travel in one year is taken to be one light year. This equals to 9.461×10^{12} km. The mean distance between the sun and the earth is 149,598,000 km. In terms of light years, it is 8.311 minutes.

Formation of Planets

The following are considered to be the stages in the development of planets :

- (i) The stars are localised lumps of gas within a nebula. The gravitational force within the lumps leads to the formation of a core to the gas cloud and a huge rotating disc of gas and dust develops around the gas core.

- (ii) In the next stage, the gas cloud starts getting condensed and the matter around the core develops into small-rounded objects. These small-rounded objects by the process of cohesion develop into what is called *planetesimals*. Larger bodies start forming by collision, and gravitational attraction causes the material to stick together. Planetesimals are a large number of smaller bodies.
- (iii) In the final stage, these large number of small planetesimals accrete to form a fewer large bodies in the form of planets.

OUR SOLAR SYSTEM

Our Solar system consists of eight planets. The nebula from which our Solar system is supposed to have been formed, started its collapse and core formation some time 5-5.6 billion years ago and the planets were formed about 4.6 billion years ago. Our solar system consists of the sun (the star), 8 planets, 63 moons, millions of smaller bodies like *asteroids* and *comets* and huge quantity of dust-grains and gases.

Out of the eight planets, mercury, venus, earth and mars are called as the *inner planets* as they lie between the sun and the belt of asteroids the other four planets are called the *outer planets*. Alternatively, the first four are called *Terrestrial*, meaning earth-like as they are made up of rock and metals, and have relatively high densities. The rest four are called *Jovian* or Gas Giant planets. Jovian means jupiter-like. Most of them are much larger than the terrestrial planets and have thick atmosphere, mostly of helium and hydrogen. All the planets were formed

in the same period sometime about 4.6 billion years ago. Till recently (August 2006), Pluto was also considered a planet. However, in a meeting of the International Astronomical Union, a decision was taken that Pluto like other celestial objects (2003 UB₃₁₃) discovered in recent past may be called 'dwarf planet'. Some data regarding our solar system are given in the box below.

Why are the inner planets rocky while others are mostly in gaseous form?

The difference between terrestrial and jovian planets can be attributed to the following conditions:

- (i) The terrestrial planets were formed in the close vicinity of the parent star where it was too warm for gases to condense to solid particles. Jovian planets were formed at quite a distant location.
- (ii) The solar wind was most intense nearer the sun; so, it blew off lots of gas and dust from the terrestrial planets. The solar winds were not all that intense to cause similar removal of gases from the Jovian planets.
- (iii) The terrestrial planets are smaller and their lower gravity could not hold the escaping gases.

The Moon

The moon is the only natural satellite of the earth. Like the origin of the earth, there have been attempts to explain how the moon was formed. In 1838, Sir George Darwin suggested that initially, the earth and the moon formed a single rapidly rotating body. The whole mass

The Solar System

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Distance*	0.387	0.723	1.000	1.524	5.203	9.539	19.182	30.058
Density@	5.44	5.245	5.517	3.945	1.33	0.70	1.17	1.66
Radius#	0.383	0.949	1.000	0.533	11.19	9.460	4.11	3.88
Satellites	0	0	1	2	about 53	about 53	about 27	13

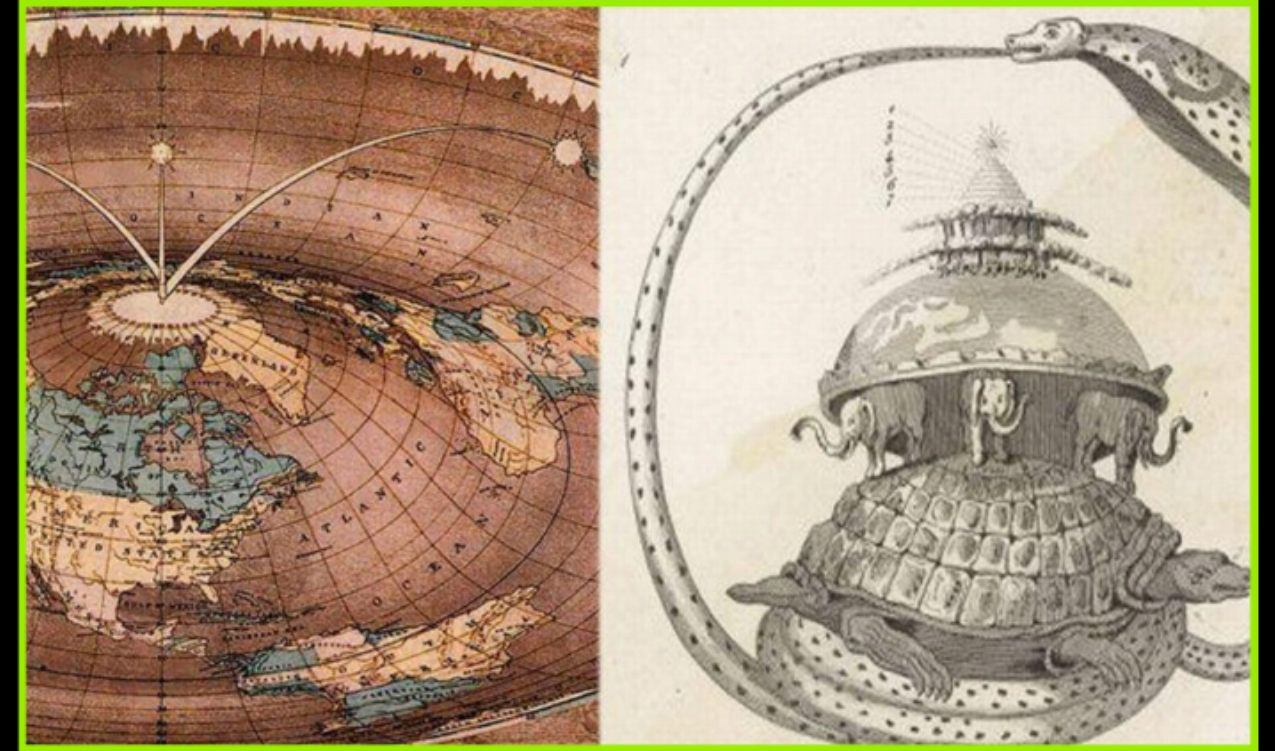
* Distance from the sun in astronomical unit i.e. average mean distance of the earth is 149,598,000 km = 1 @ Density in gm/cm³

Radius: Equatorial radius 6378.137 km = 1

Source: <http://planetarnames.wr.usgs.gov/page/planets>

EARLY THEORIES

- A large number of hypotheses were put forth by different philosophers and scientists regarding the origin of the earth.
- One of the earlier and popular arguments was by German philosopher Immanuel Kant. Mathematician Laplace revised it in 1796.
- It is known as Nebular Hypothesis. The hypothesis considered that the planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating.



EARLY THEORIES

- In 1950, Otto Schmidt in Russia and Carl Weizascar in Germany somewhat revised the 'nebular hypothesis', though differing in details. They considered that the sun was surrounded by solar nebula containing mostly the hydrogen and helium along with what may be termed as dust.

EARLY THEORIES

- The friction and collision of particles led to formation of a disk-shaped cloud and the planets were formed through the process of accretion.
- However, scientists in later period took up the problems of origin of universe rather than that of just the earth or the planets.

EARLY THEORIES

- Nebular Hypothesis
- Given by German philosopher Immanuel Kant
- Mathematician Laplace revised it in 1796 .

The hypothesis considered that-

- The planets were formed out of a cloud of material.
- Associated with a youthful sun.
- Which was slowly rotating.

IMPORTANT

