PLANET FORMATION

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outline

- First idea about Planet formation
- Formation stage of Planet
- Solar system
- Star birth and protoplanetary disk
- Growth of grains
- Planetesimals
- Terresterial Planets
- Gianets
- Favoured theory for small planet about terresterial Planets and Giant Planets
- Method which used for extrasolar observation.

First idea about planet formation

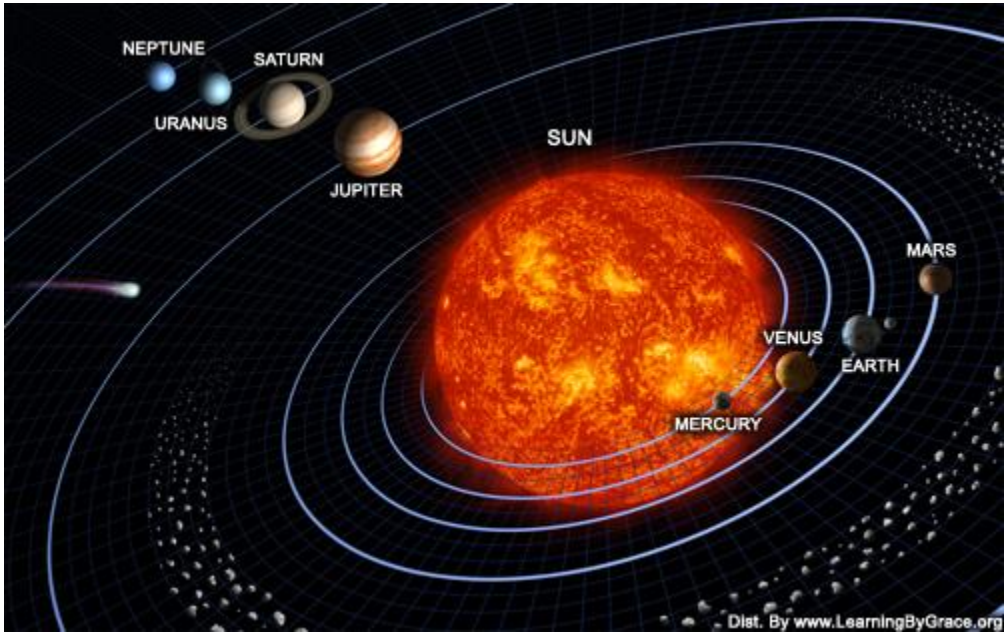
- First idea which was suggested by Kant and Laplace told us that planet in a rotating around the Sun before they had any knowladge about a extrasolar Planet like Uranus and Neptune where asteroids and Comets comes from.Later when we learn more about star rotating disc seemed like a natural product around the forming stars.

Step of planet formation

- 1).The growth of grains to planetesimals.
- 2).Planetesimals to protoplanet.
- 3).Protoplanet to Planet

- Note: They shouldn't necessarily happen at the same time or separate from each other.

Solar system



Solar system (Cont).

- Solar system is consist of the sun and Celestial objects, which are bound it by gravity, and all of them formed from the collapse of giant molecular cloud.
- We can Divide it in two part.
- 1) Inner solar system.
- 2) Outer solar system.(Gas giant and ice giant)

Star birth and Protoplanetary discs!

- Note: The beginning of a planet system start with a birth of star.
- Star are born in a big interstellar clouds, mostly made of hydregen and helyom.
- A small fraction of hevier elements produced in a star that has ended his life in a supernova explosion spreading the element in a big intersteller cloud where it can be recycle in aformation of new star.

Star birth and Protoplanetary discs!(Cont)

- Star starts to form in the cloud when the perturbation get so dense that the pressure can't stop it from collapsing under it 's own gravity .

- And also the process in forming star will also lead to formation of rotating disc around the star.

Star birth and Protoplanetary disk!

Star Forming Region

Growth of grains

- Note: Planet don't start to grow directly from the gas in the disc.

- When the small drops of matter (matter which grows into the planet)condense out of the gas they start to grow into the grains by mutually collision to eventually become Kilometer size of object and they will go through the phase we call a dangerous phase.

Growth of grains

- Note: The composition of planet is depend on which element condese out of the gas at radius where they grow , which depends only on temperture.

Planetesimals:

- What is Planetesimals?
- Are solid object thought to exist in protoplanetery disc.

- The growth of grains to planetesimals goes through the phase we called runaway growth when the largest planetesimals get their effective collision the cross section will be enlarge by their large mass gravitational effect on their neighboors, that they will be fast grow by consuming everything in their reach.

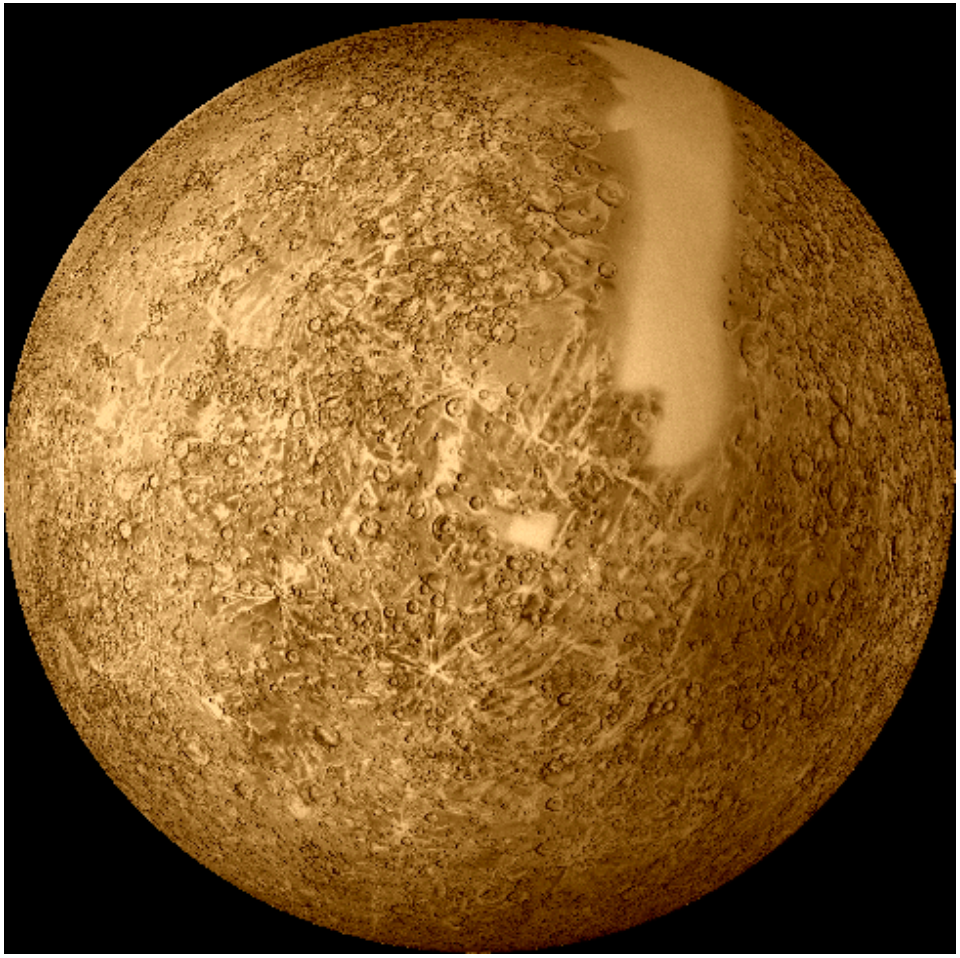
Planetesimal

Terrestrial Planets

- What is terrestrial Planets?
- Is a planet that is primiarily composed of silicate rocks.
- Note: Terrestrial Planet are the closest planet to the Sun.

- The runaway growth phase made protoplanets with low eccentricity of protoplanets to grow into the planets we know today they must have pertub eachother into the colliding orbit.

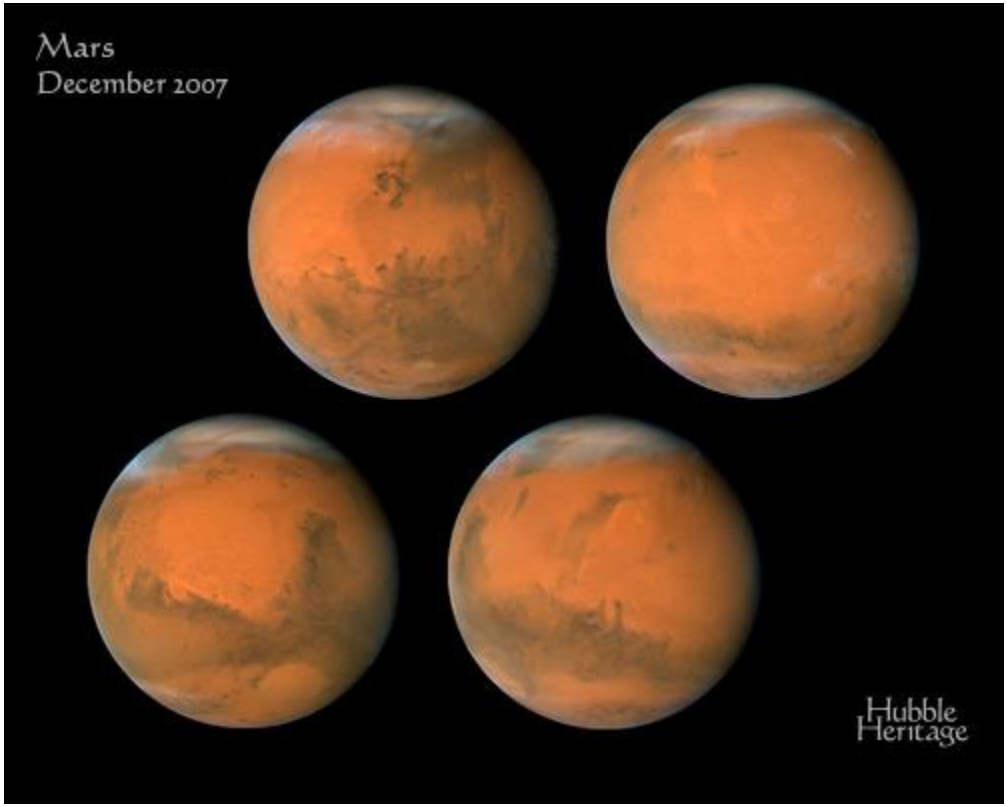
Mercury



Venus

Earth

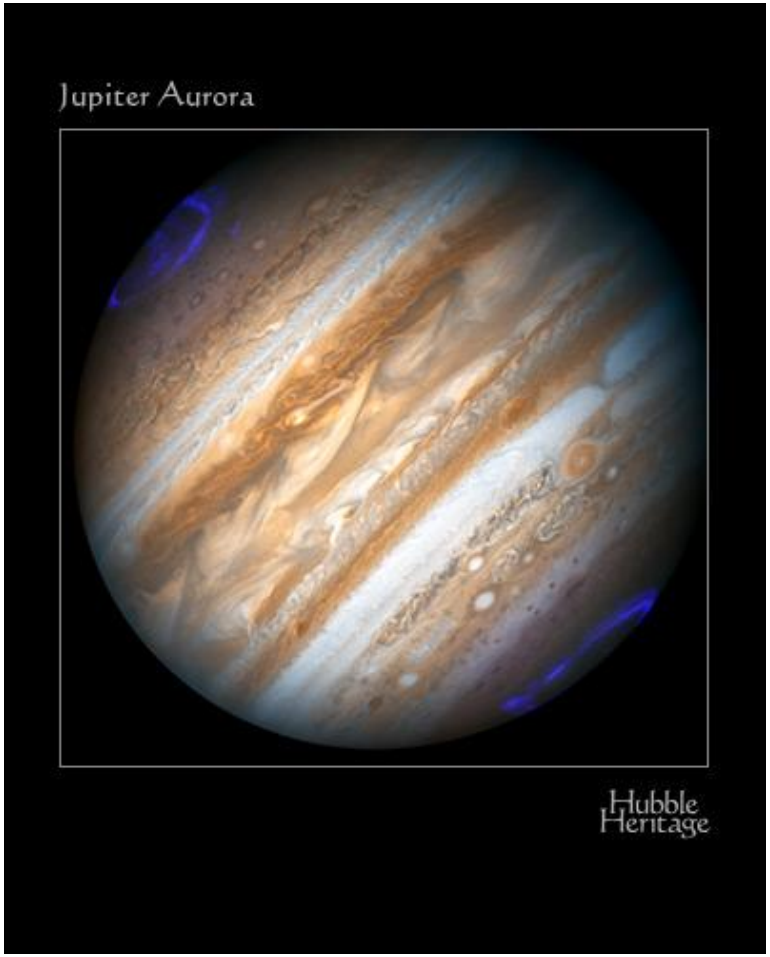
Mars



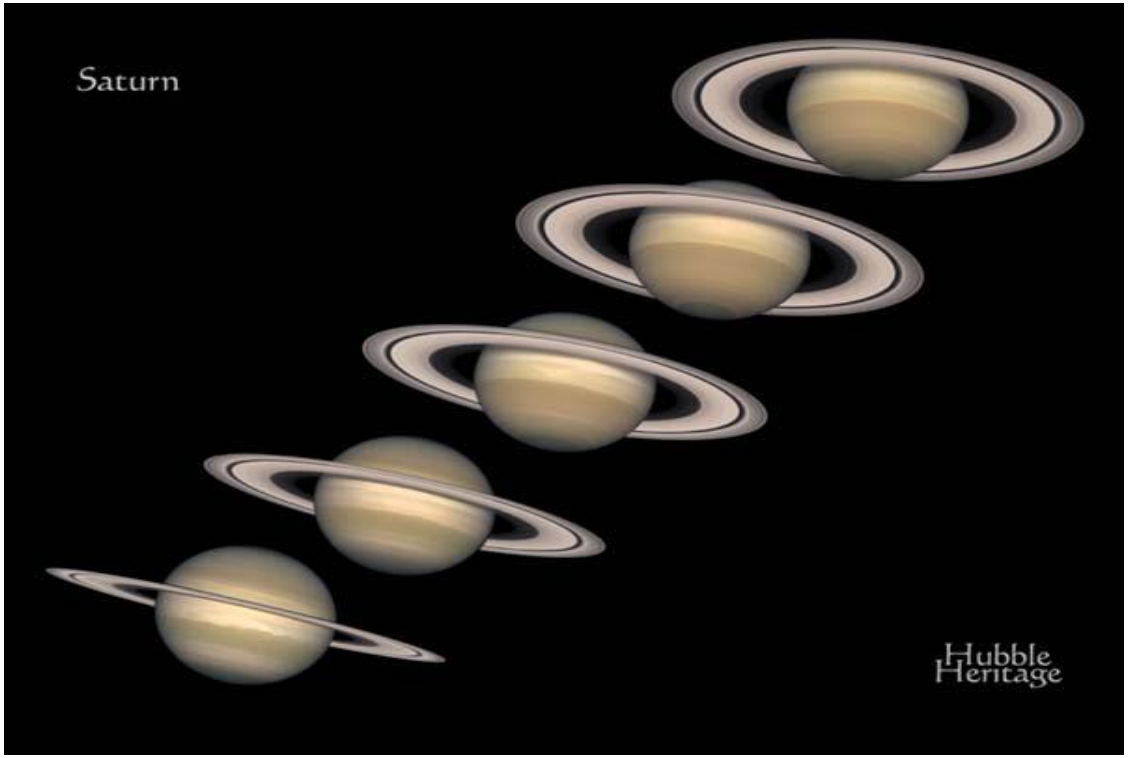
Giants:

- Giants star like Jupitor and Saturn start their growth in a similar way as the terresterial planets but here there is also ice in the solid material for growing planetesimals so planetesimals and protoplanets grow larger.

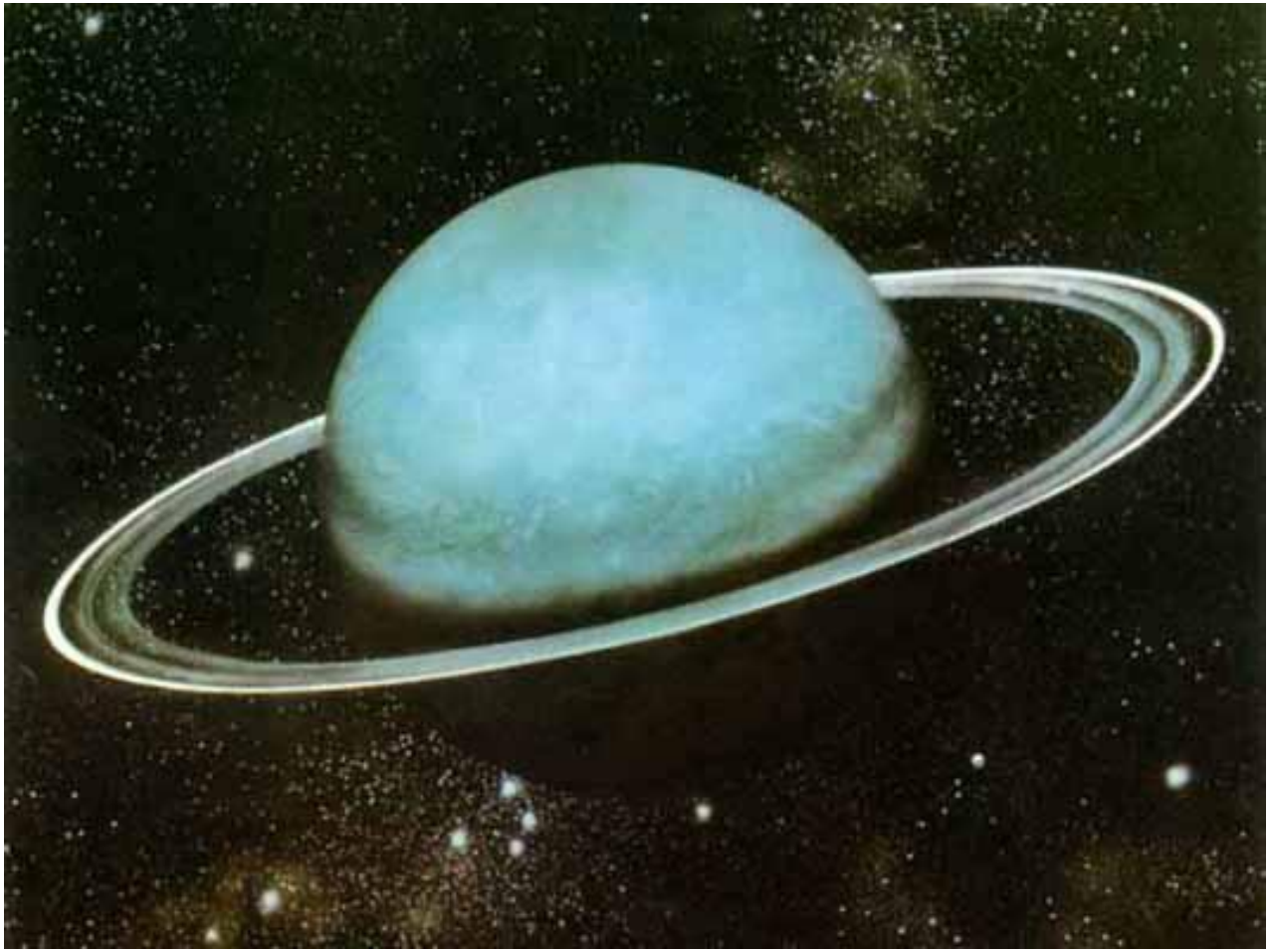
Jupiter



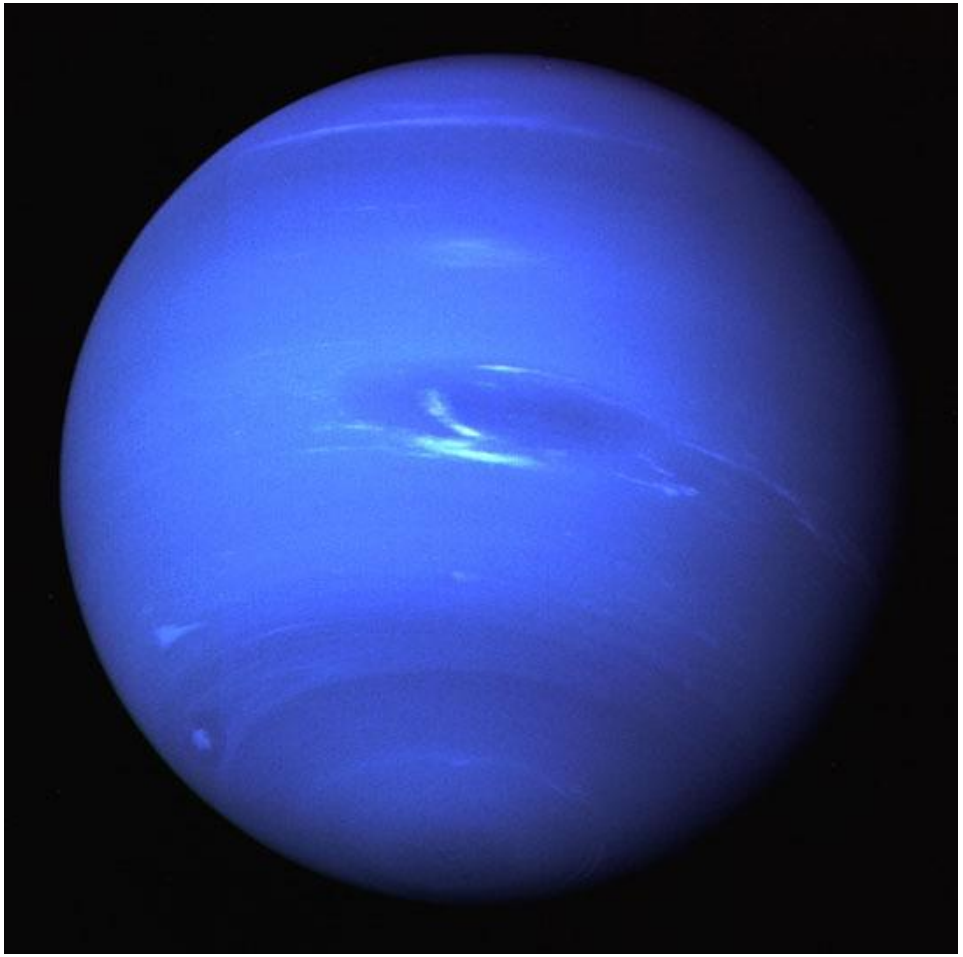
Saturn



Uranus



Neptune



Favoured theory for planet

- 1). Collisional Accumulation(Small Planet)
- 2). Core Accretion(Giant Planet)

- 3). Disc Instabilites(Giant Planet)

Collision Accumulation

- Small particle in the disc orbiting the star begin

to stick together, and forming slightly larger structures. After some times the matter is generally concentrated to rocks uniformily distributed in the around the star. From here the rocks continue to grow through the gravitational interaction until they reach a stage where they refered to as 'Planetesimals' with a size on order of kilometer.

Collision accumulation.(Cont)

- At this point the system is more like center star and different asteroid belt at various distance from the star with relatively empty space between them.

Core accretion

- If the Planetesimal reaches a certain critical mass, it will start accreting gas with high pace. And finally the gas Giant is formed.
- But in this method we have a some problem.

- Better method is disk insteability.

Disc instablities:

- In this method the dic is cooled and for this reason disc will become gravitational unstable , its fregments , and each fragment collapse toward the center of its mass untill it dense end and hot enough so that the collapse ends, at which point we have a planet.

- Note: But still this method has it owns problem.

Extrasolar observation

- Detecting extrasolar planet is difficult task and also a young field of research _ roughly since ten years ago.

Radial velocity:

- One of the most sucessful detection method in the terms number of detection.
- The first extrasolar planetary companion to a sun_like star was detected using very useful method by Mayor and Ovelor.
- And since then alot of planet have been seen in this method.

Astrometry

- Just like radial velocity, astrometry involve observing the motion of a star caused by the gravitational perturbation from a planetary companion, but whereas in radial velocity searches, the movement parallell to the line of sight is studied, Astrometery means studying the movement in the plane perpendicular to the line of sight.

Transits:

- When a Planet passes between a star and observer, some of the light of star is obviously blocked as seen from observer. If the luminosity diffrence caused by this event is large enough, such a planet can be detected. And it will be drown about a properties of the planet.(This known as transits method).

Direct Imaging

- Perhapse one of the most informative and certainly the most intuitive method to detect extrasolar planets is to directly study the light that are emitt

END

- Thanks For Your attention