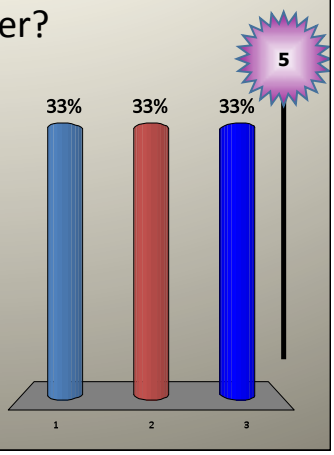
Welcome to Class 4:
Our Solar System
(and a bit of cosmology)

What is the difference between:
dark ENERGY and dark MATTER?

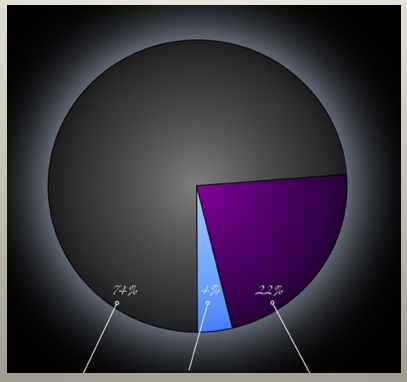
Is Earth unique, or might Earth-like objects form elsewhere?

Which learning objectives do you find most difficult to answer?

1. Compare/Contrast Dark Matter/Energy give evidence of them.
2. Label/Describe the four stages of Nebular Theory
3. List 5 pieces of evidence for Nebular Theory from observed solar system properties.

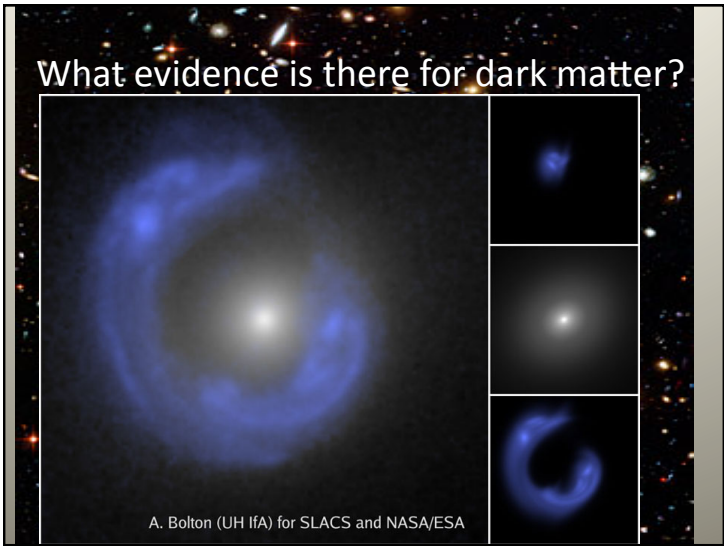


What is our Universe made up of?



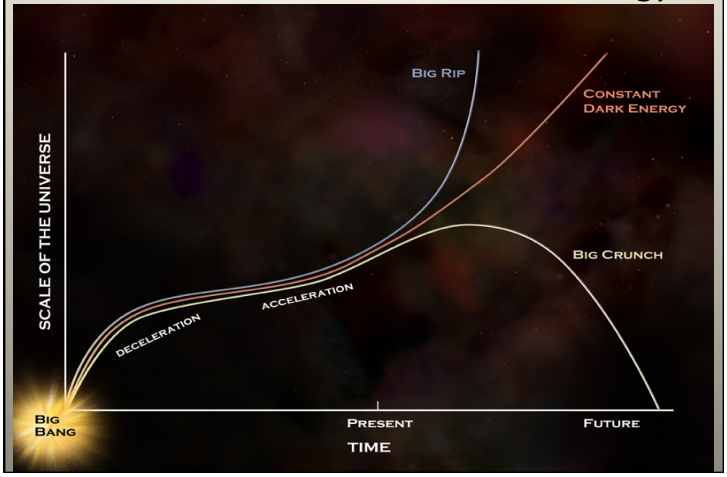
Dark Energy Normal Matter Dark Matter

What evidence is there for dark matter?



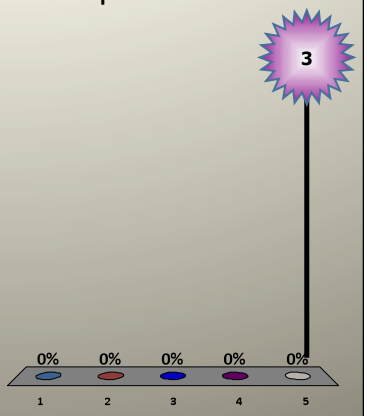
Dark matter (blue) vs.
`dark' Normal Matter (pink)

What evidence is there for Dark Energy?



Discuss then answer with your PRS: Which is not a 'Terrestrial' planet?

1. Saturn
2. Mercury
3. Mars
4. Venus
5. Earth



Working in groups, fill in this chart in your notes:

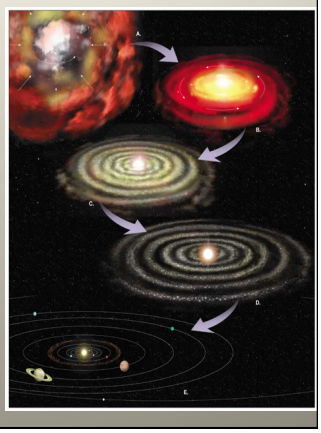
Characteristics	Terrestrial Planets	Jovian Planets
Location in Solar System		
Composition		
Mass (high or low?)		
Radius (large or small?)		
Distances between neighboring planets		

The `Nebular Theory' of planet formation

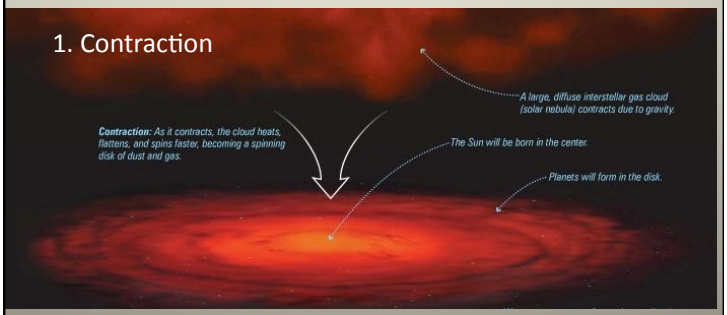
Used to explain all observations: the *differences* & the *similarities* between planets.

Basically:
Our solar system was born from the gravitational collapse of an interstellar cloud, or nebular, of gas and dust.

This cloud/nebula is referred to as the 'solar nebula'.

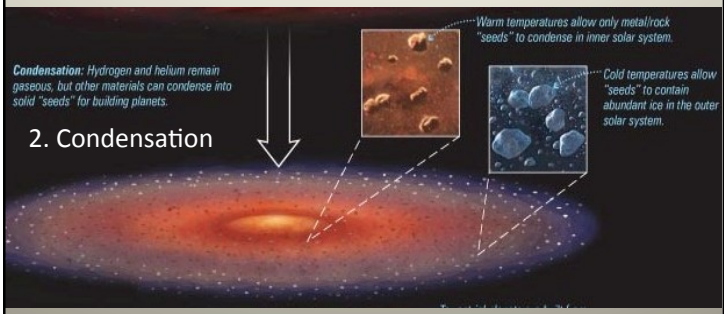


A massive cloud collapses under its own gravity and spins up due to conservation of angular momentum. This creates a flat, spinning disk, with most of the mass at the center.



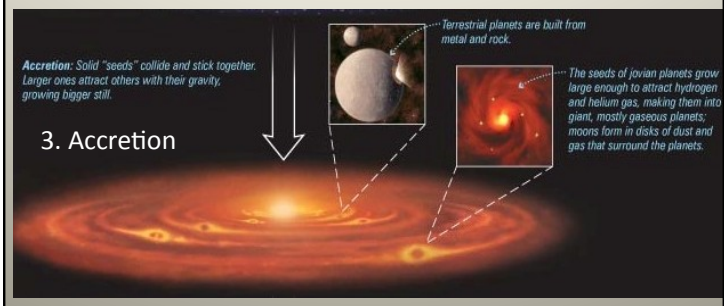
Which characteristics does this stage explain?

The nebula center remains hot and dense, the outer regions cool and tenuous



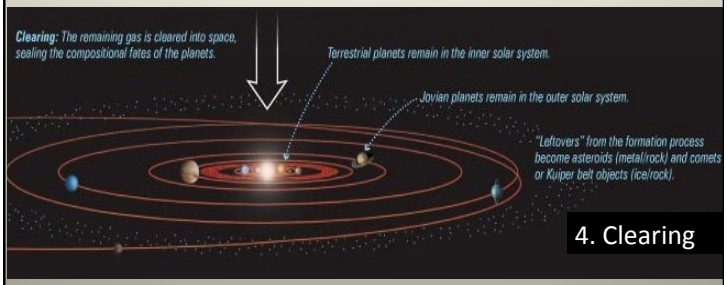
Which characteristics does this stage explain?

Planetesimals accrete to build up planets from the local material available



Which characteristics does this stage explain?

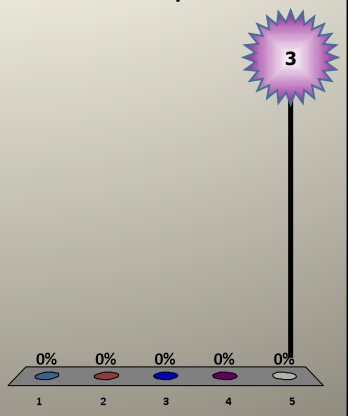
The rest of the smaller debris is blown away once the Sun 'turns on'



Which characteristics does this stage explain?

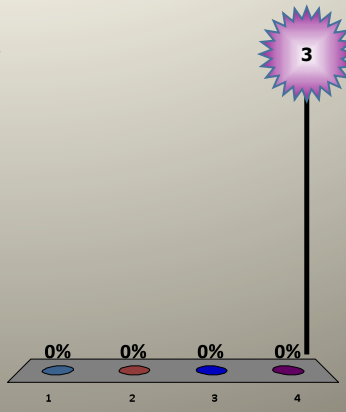
PRS: What Solar System characteristic is not explained by the Nebular Theory?

1. Planets orbit in the same direction
2. The inner planets are rocky
3. The sun lies at the center
4. The planets lie in a flat plane
5. Venus's backward revolution



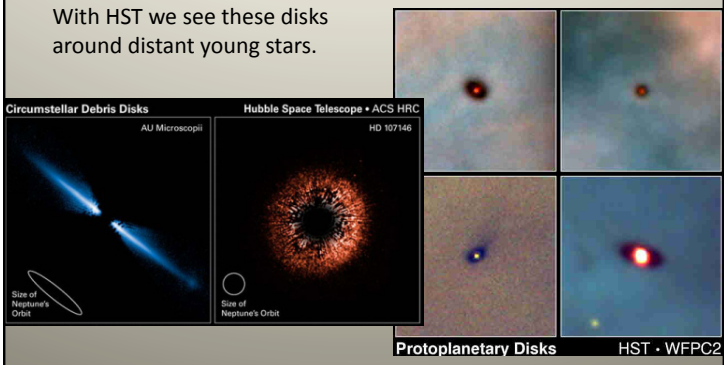
PRS: Why did the Jovian planets get so big?

1. They formed planet `seeds' of rock, but also mixed with the very abundant ices available.
2. These massive rock/ice seeds formed larger planetesimals.
3. Their planetesimals grew very large very quickly, to capture H and He before the Sun turned on and blew it away.
4. All of the above.



What is the relevance of the 'Nebular Theory' for searching for life in the Universe?

With HST we see these disks around distant young stars.

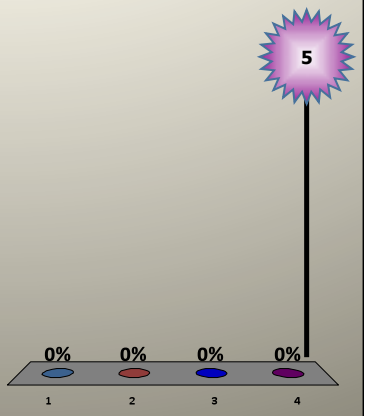


Let's test your understanding of today's learning objectives.

Please take this test alone.

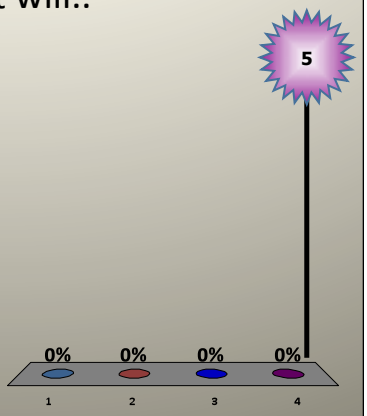
1. What is most of our Universe made of?

1. Protons & Electrons
2. Normal Matter
3. Dark Matter
4. Dark Energy



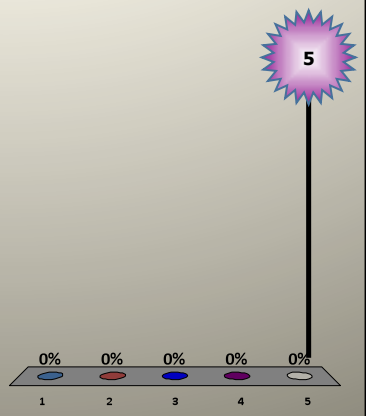
2. If the universe continues on its present course it will..

1. Expand forever
2. Collapse to a small crunch
3. Expand for a time, but then fall back to a small crunch
4. The present course is uncertain.



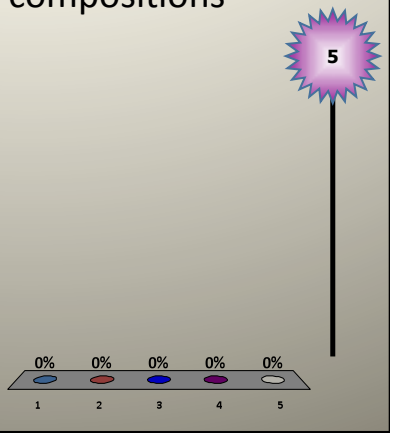
3. Which is not a stage in the Nebular Theory?

1. Contraction
2. Division
3. Condensation
4. Accretion
5. Clearing



4. In what stage do we see the two differing planetary compositions begin to form?

1. Contraction
2. Division
3. Condensation
4. Accretion
5. Clearing



5. Terrestrial and Jovian planets are similar in what characteristic?

1. Chemical Composition
2. Mass
3. Radius
4. Orbital properties