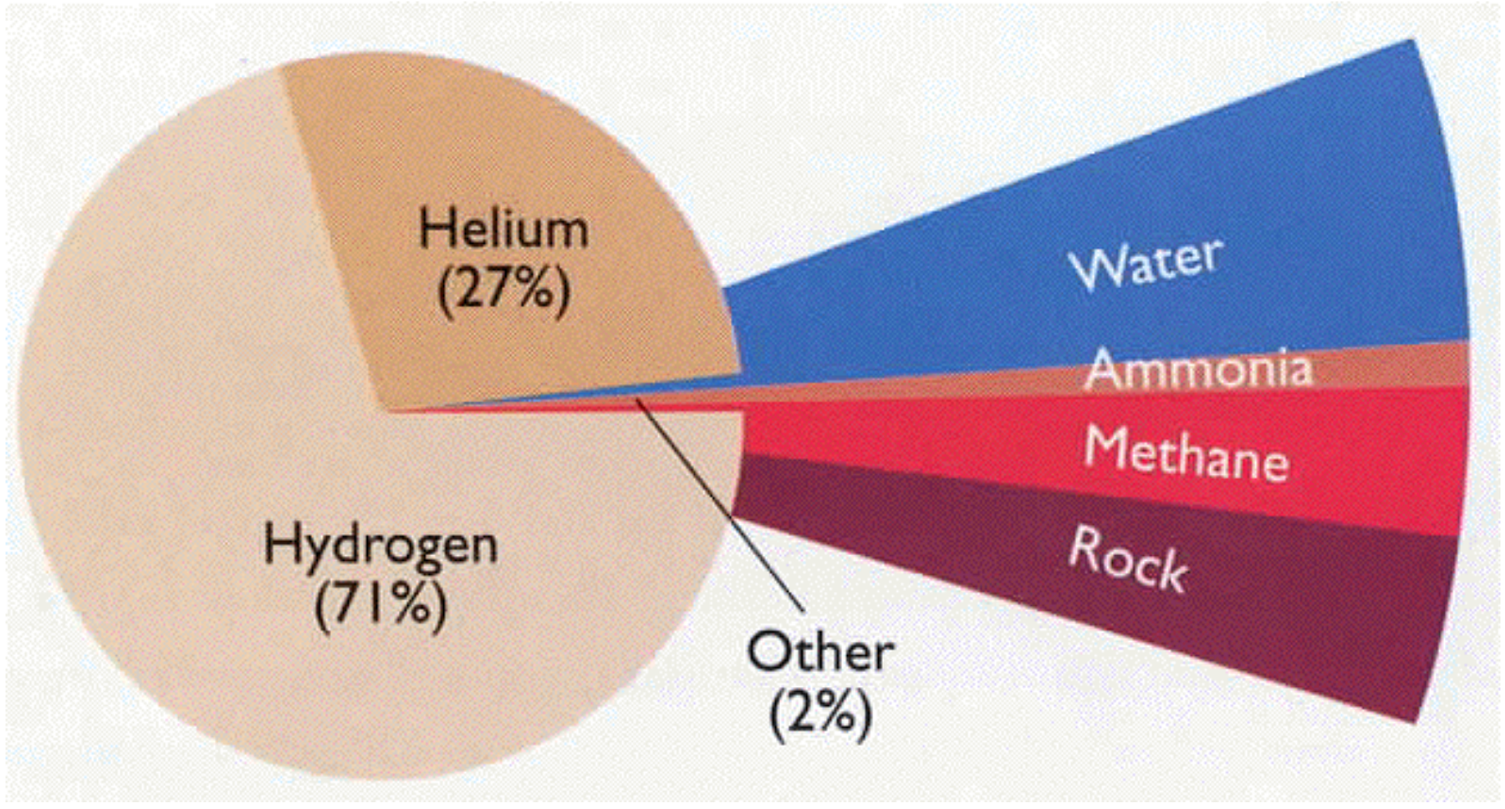
Formation and Evolution of the Solar System

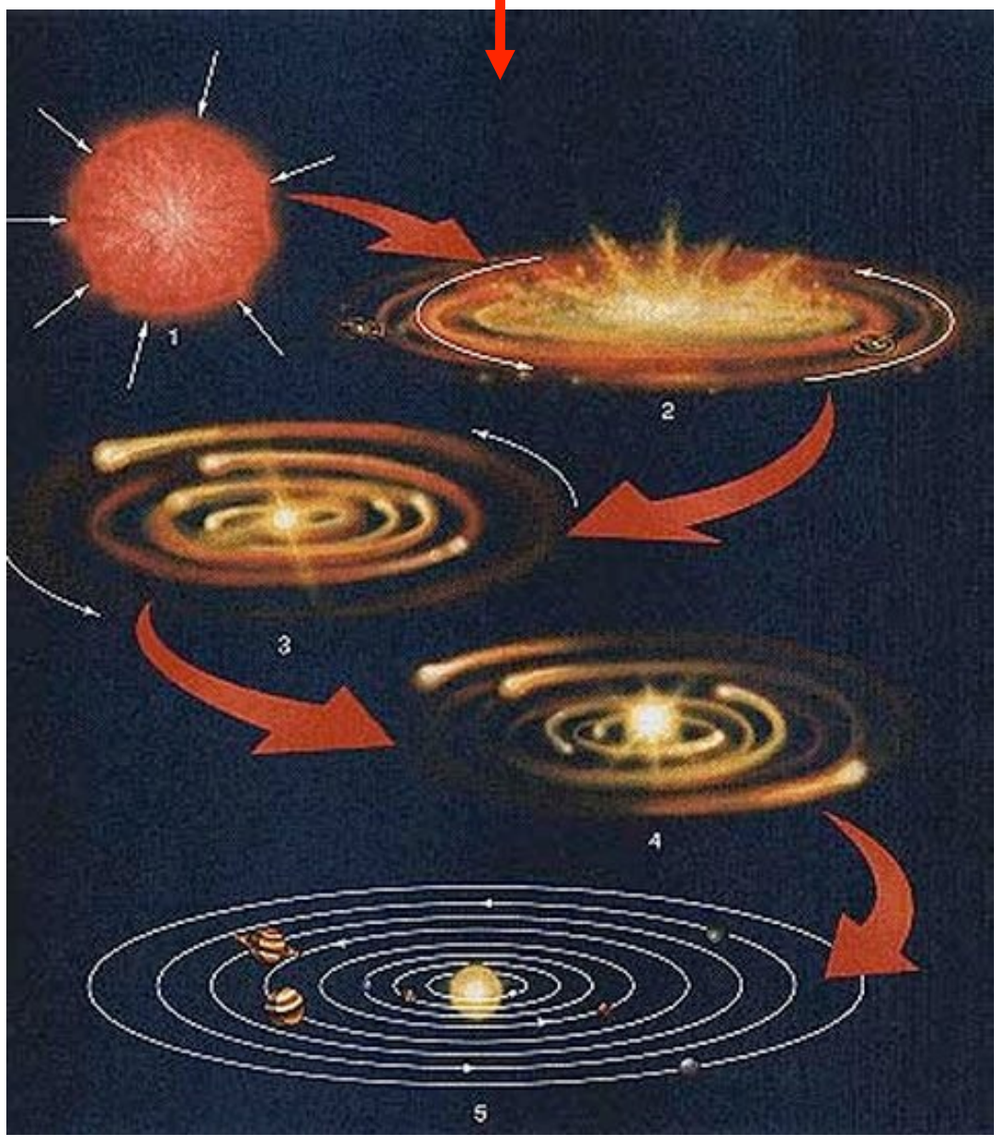
What's Initially Available:



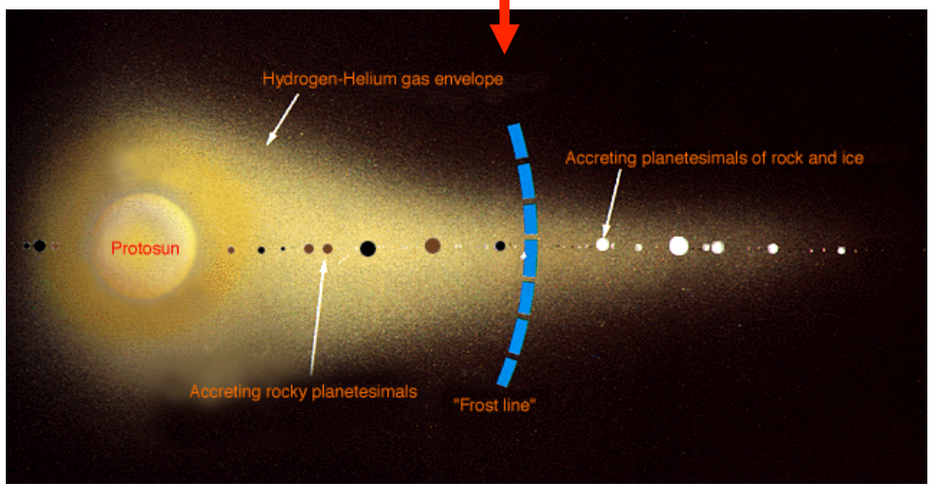
Solar Nebula - Composition

Nebular Model

Planets gradually form out of the rotating disk of gas & dust



Beyond the “frost line”, ices can condense, allowing more massive planets to form



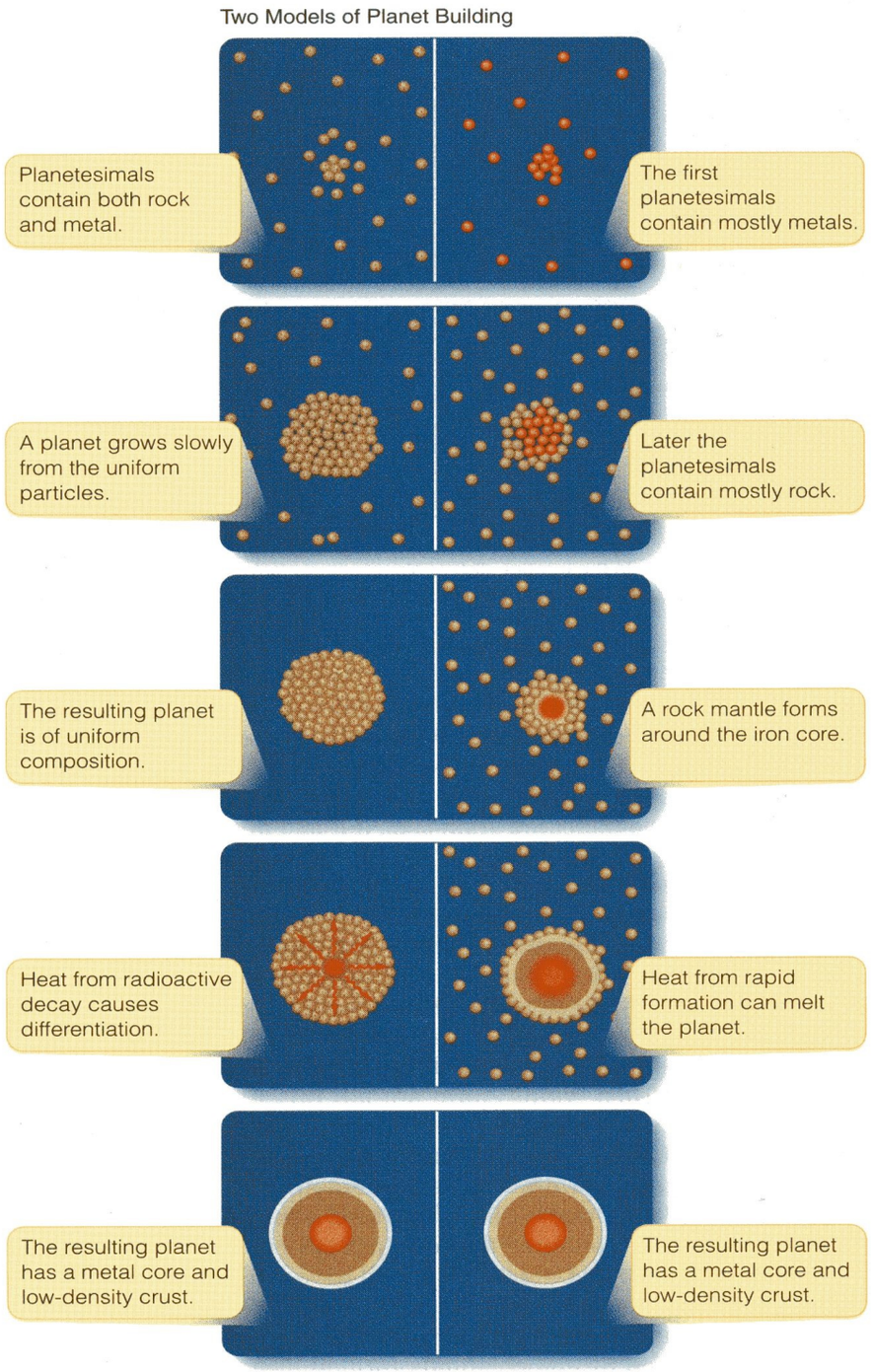
Refractories (rock, metal)

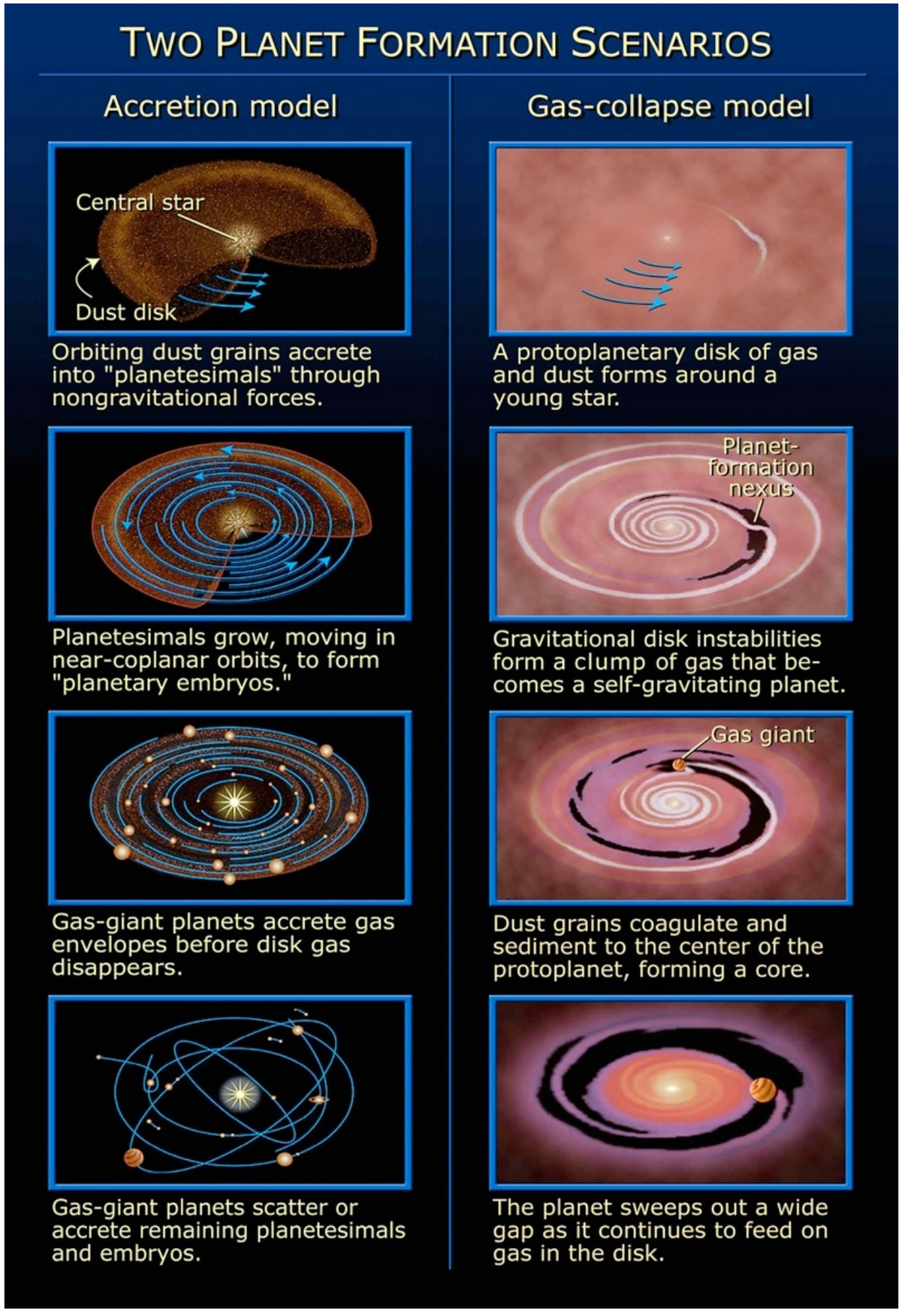
volatiles (ices & gas) and refractories

- Two possible sequences of formation of terrestrial (rocky) planets:
- Merge homogeneous collection of planetesimals, then differentiate
- Form planets while condensation is still happening

Table 5-3 The Condensation Sequence

Temperature (K)	Condensate	Planet (Estimated Temperature of Formation; K)
1500	Metal oxides	Mercury (1400)
1300	Metallic iron and nickel	
1200	Silicates	
1000	Feldspars	Venus (900)
680	Troilite (FeS)	Earth (600)
		Mars (450)
175	H_2O ice	Jovian (175)
150	Ammonia–water ice	
120	Methane–water ice	
65	Argon–neon ice	Pluto (65)

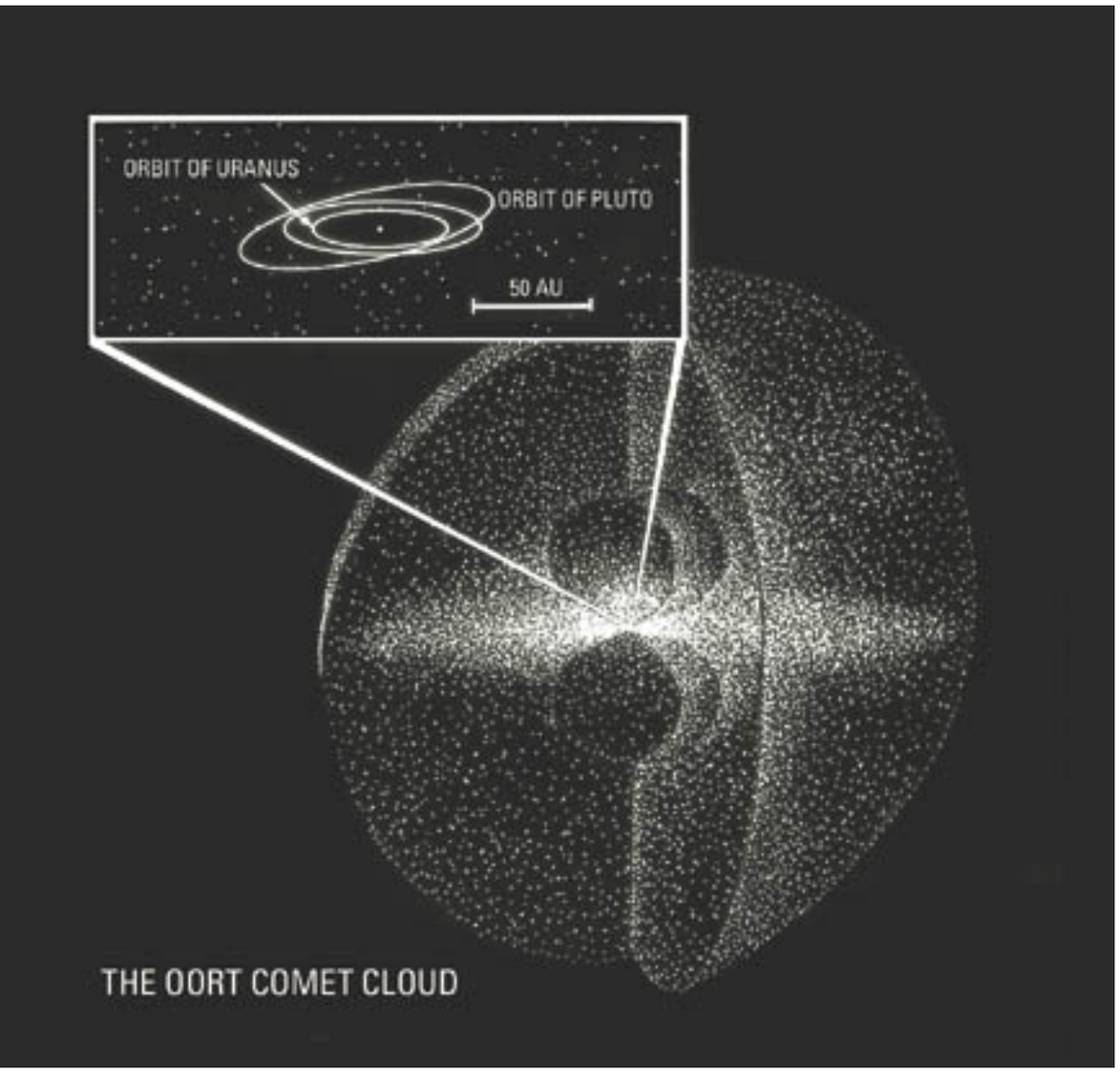


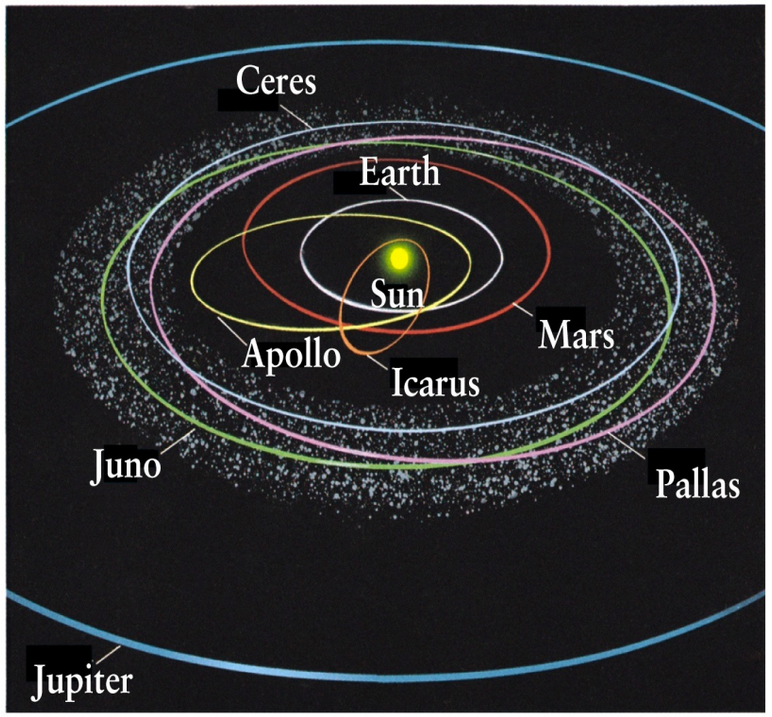


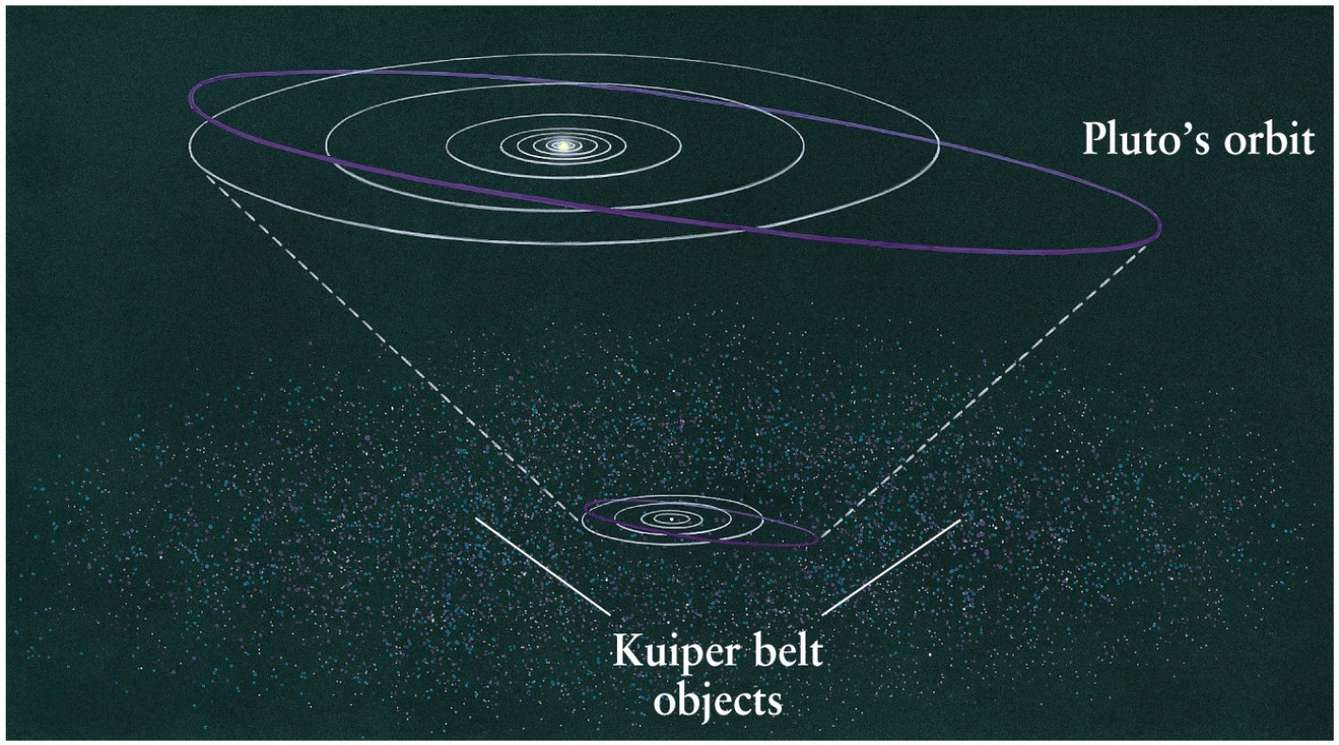
For Jovians:

- Accrete cores first, then lighter material
- Rapid catastrophic disk collapse

Planets, asteroids (minor planets), Kuiper Belt Objects (another form of minor planet)

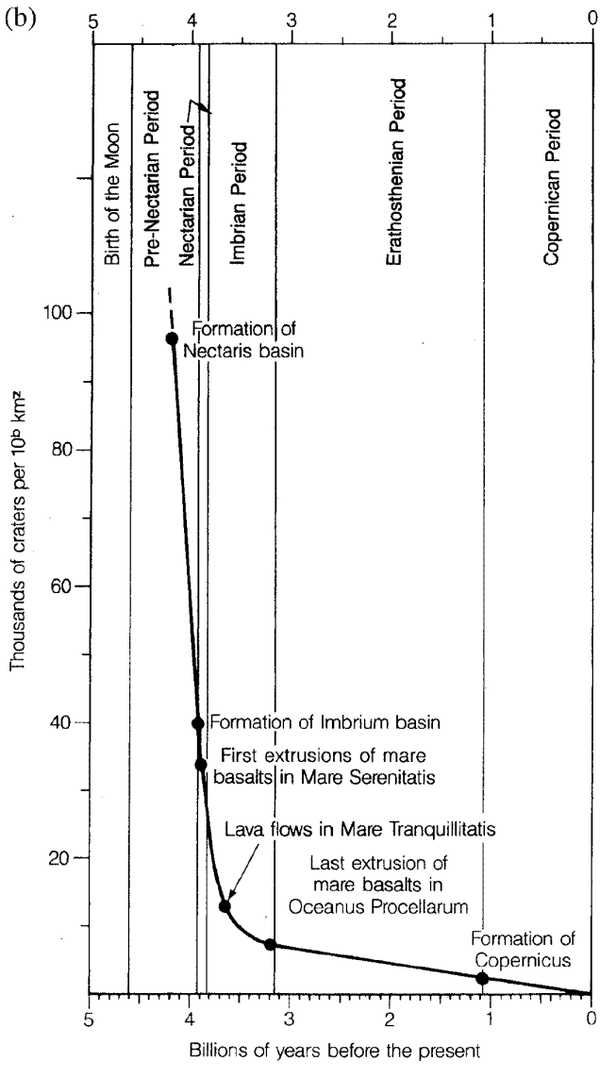


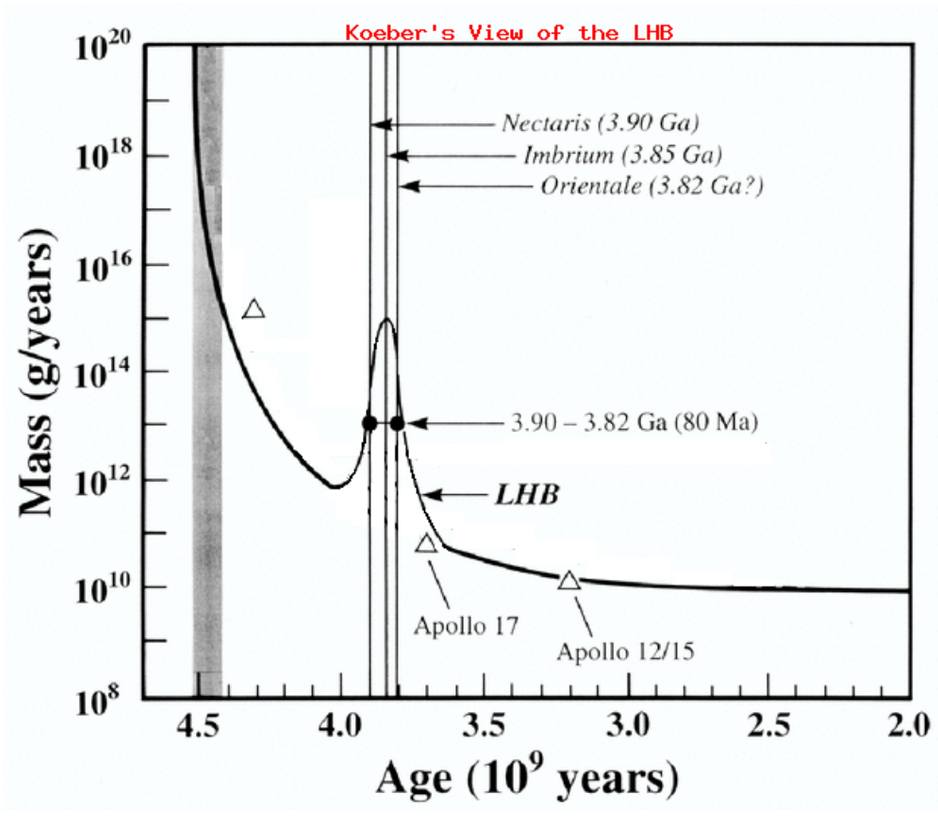




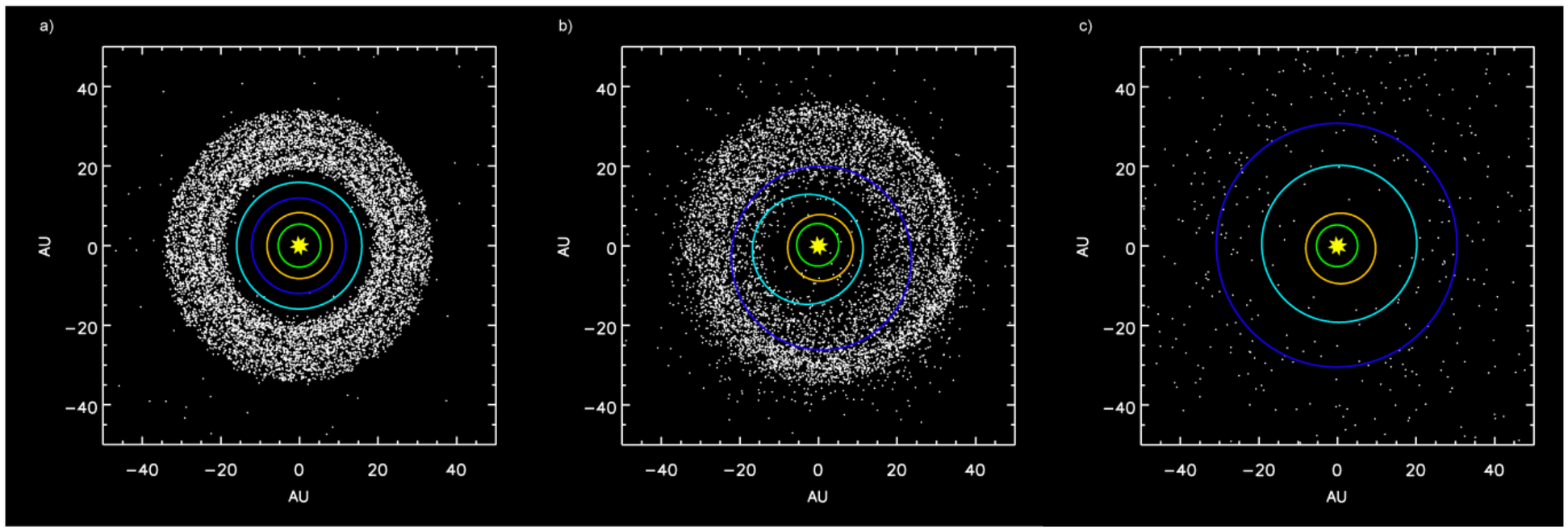
The History of the Solar System is Written on the Face of the Moon

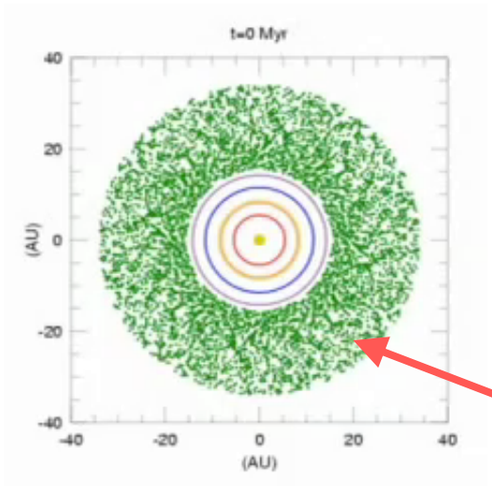
What Does the Moon Tell Us?
Two views





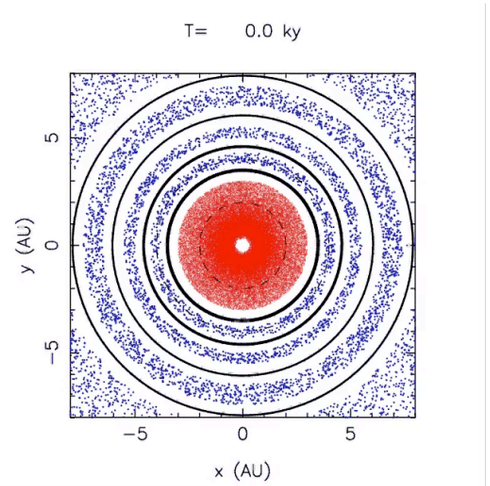
Mixing via Planetary Migration





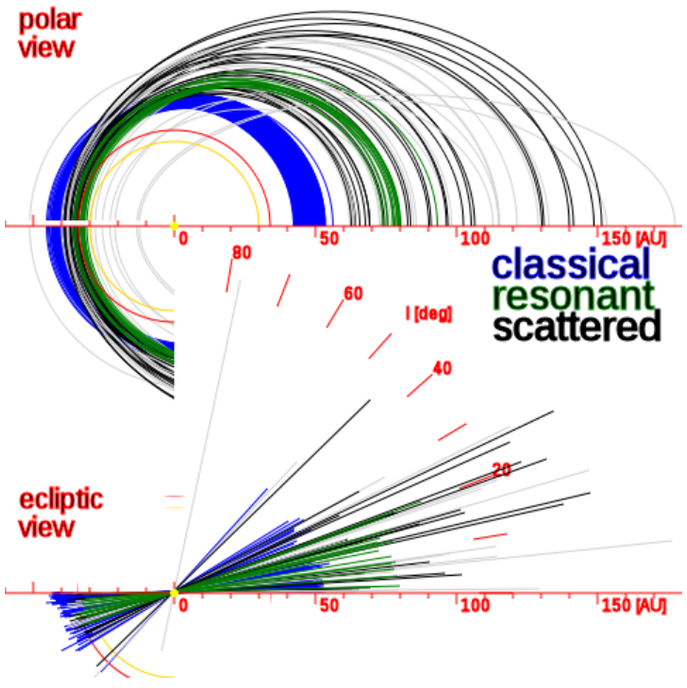
“Nice Model”

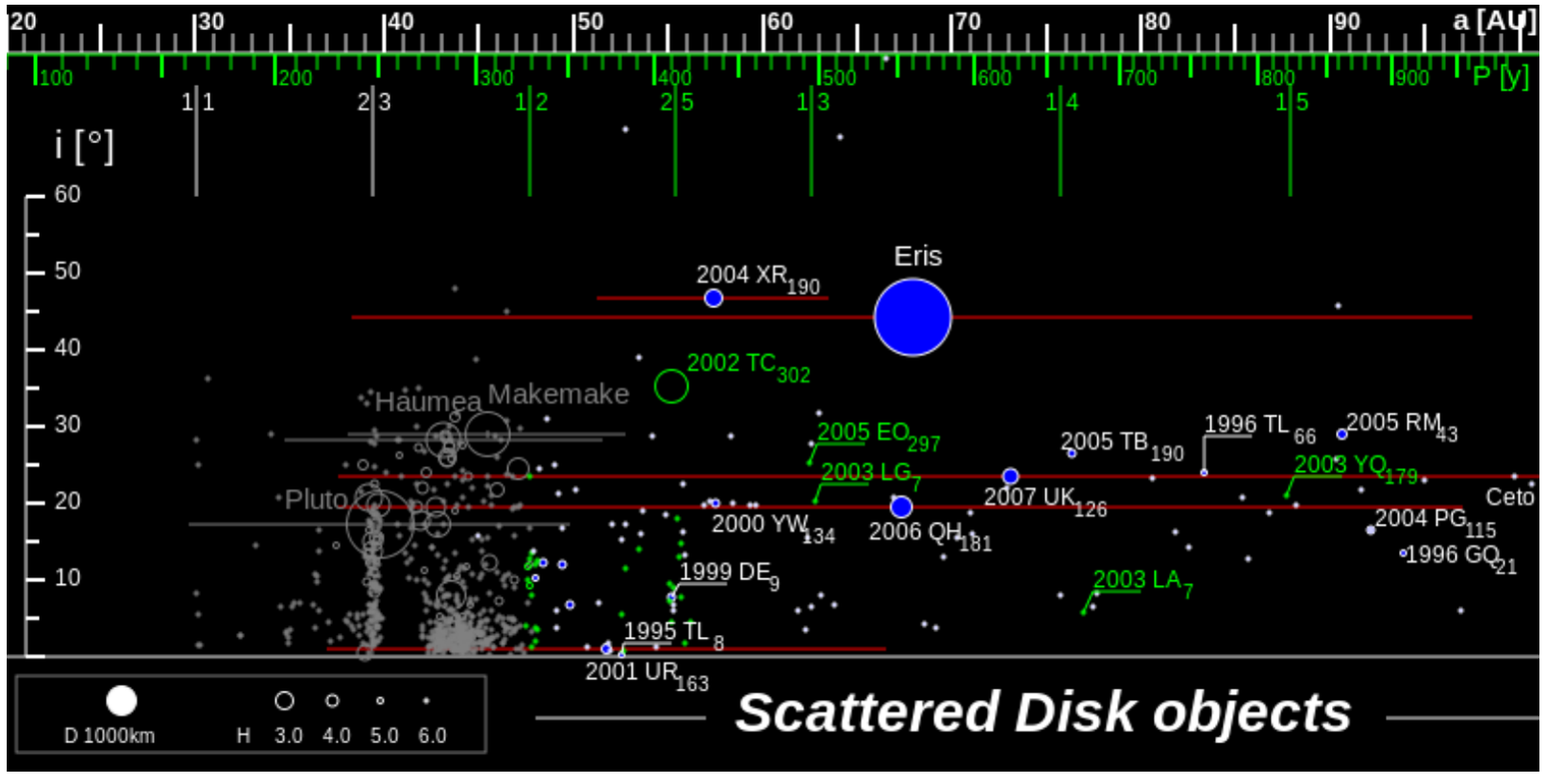
“Grand Tack”



Kuiper Belt Objects
(Pluto, Eris, etc.)

Scattered Kuiper Belt Population

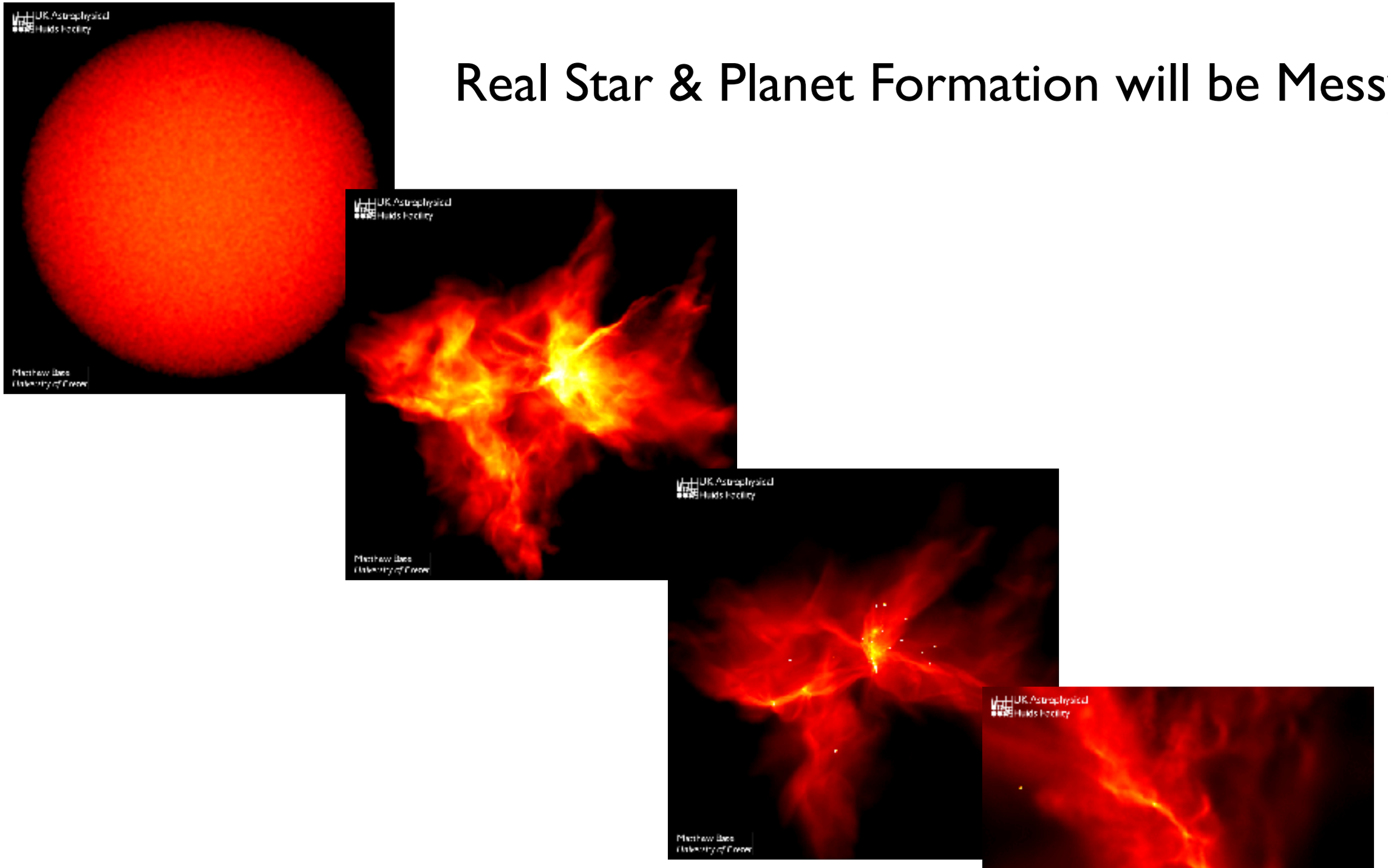




We will come back to some of these topics when looking more deeply into asteroids, comets, "exodisks", and the like.

The Zodiacal Light

Real Star & Planet Formation will be Messy!



Simulation & visualization by Matthew Bate, University of Exeter.

http://www.astro.ex.ac.uk/people/mbate/Animations/