

# Conférence Elbereth Édition 2020

27/02/2020

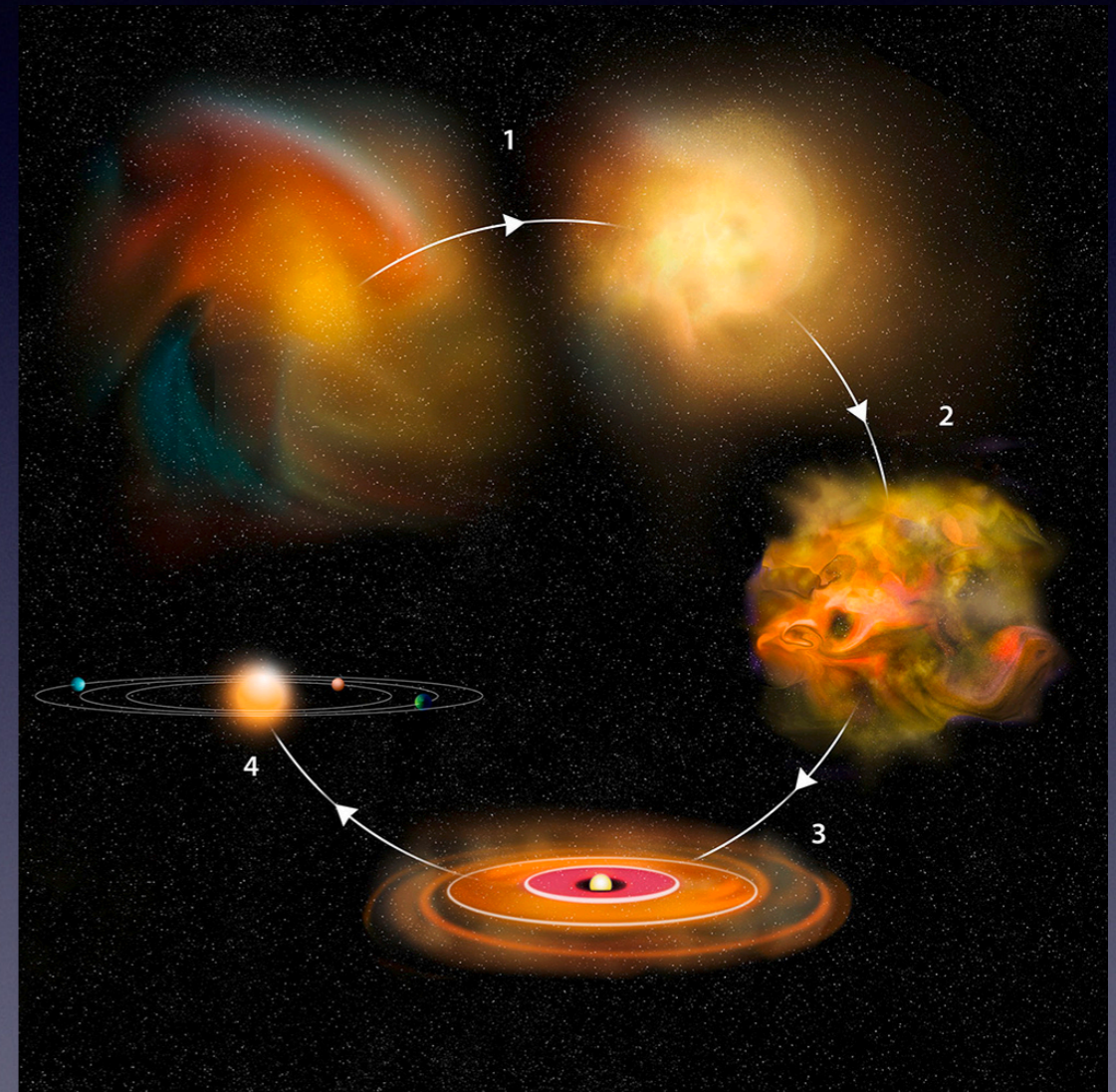


**« Composition of primordial asteroids: remnants of the planetesimal populations and members of the oldest asteroids families »**

Jules Bourdelle de Micas

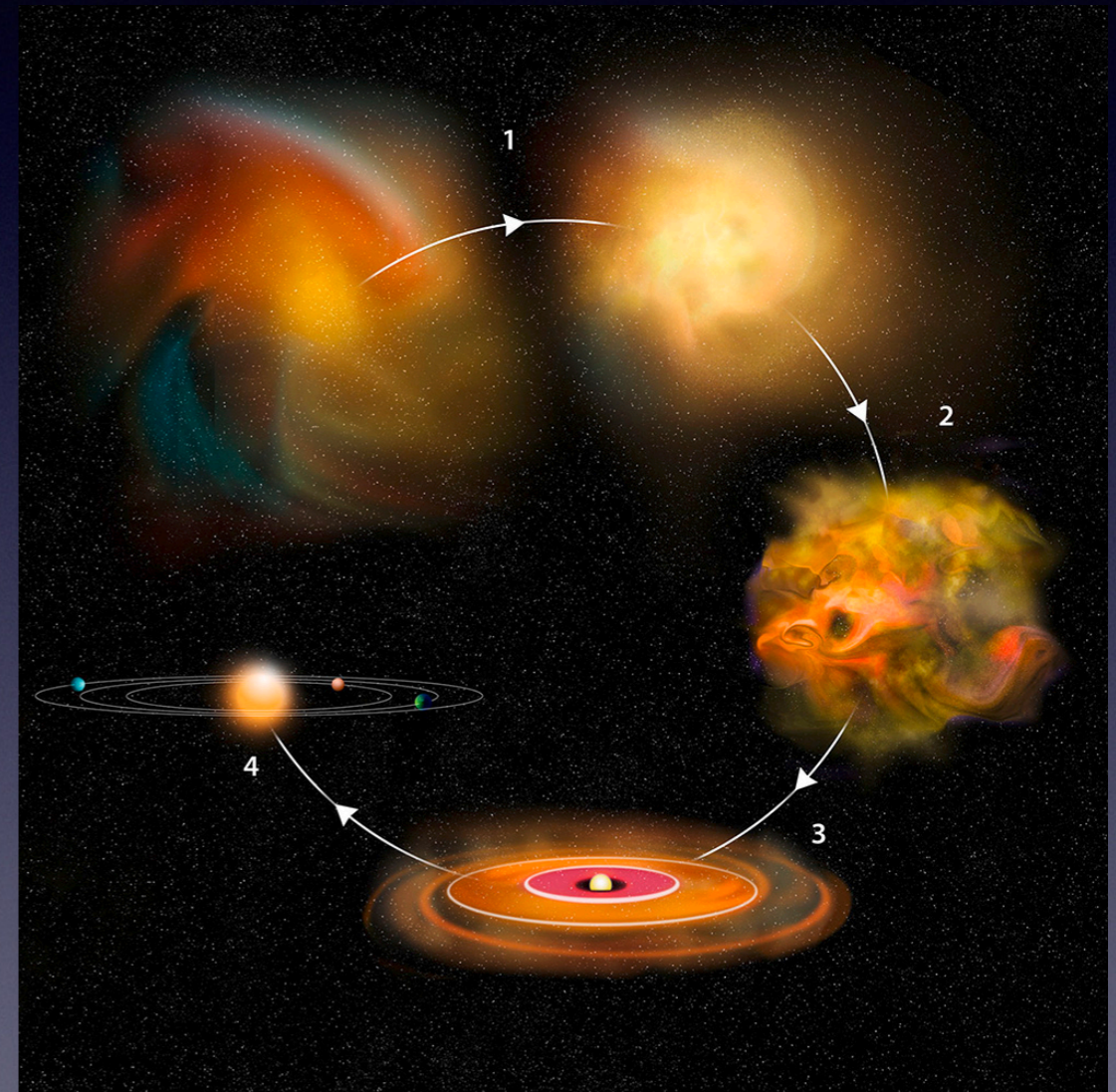
# Why study small bodies ?

- Small bodies : witnesses of the primordial Solar System formation  
→ remnant of planetesimal and proto-planets



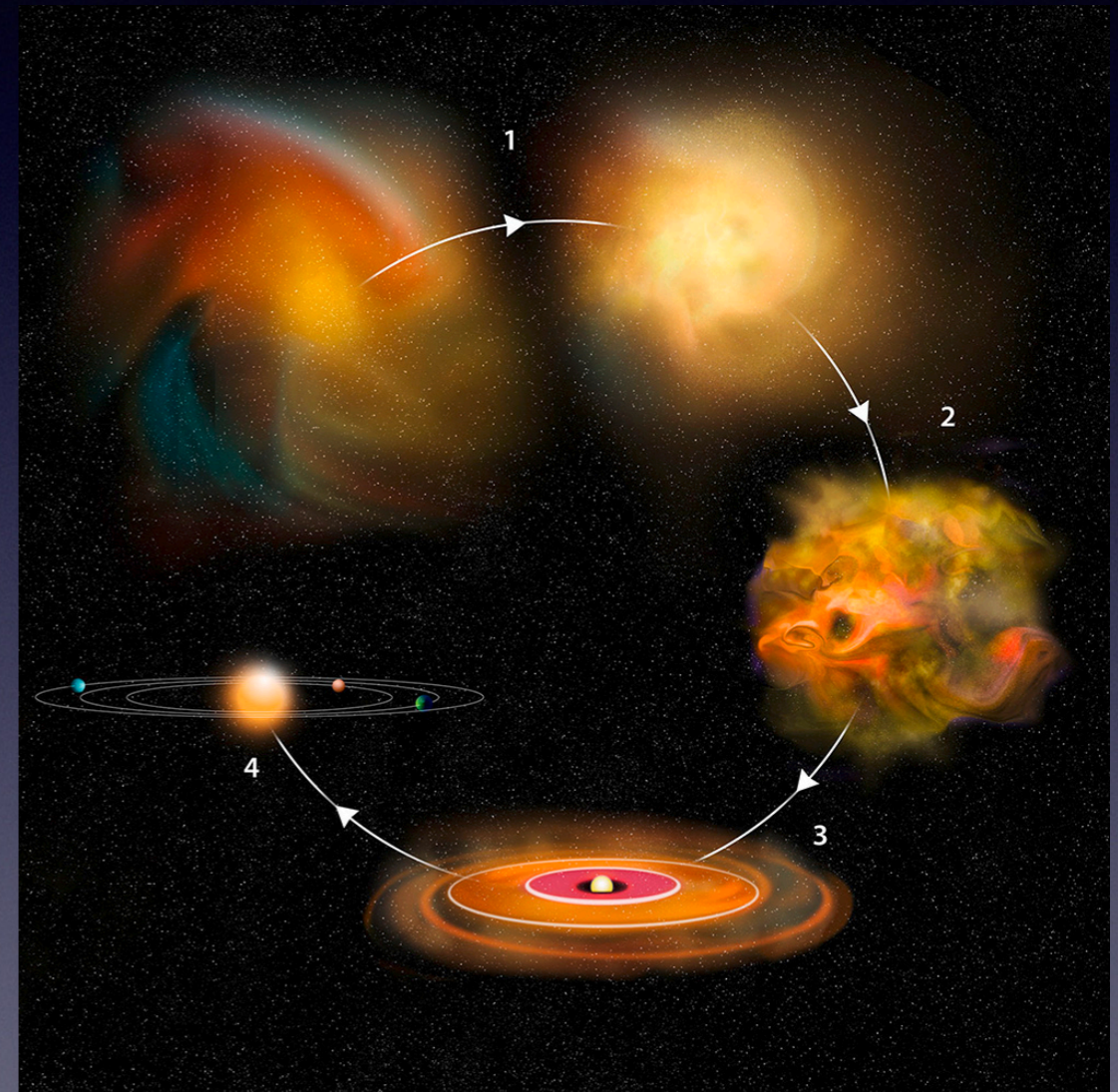
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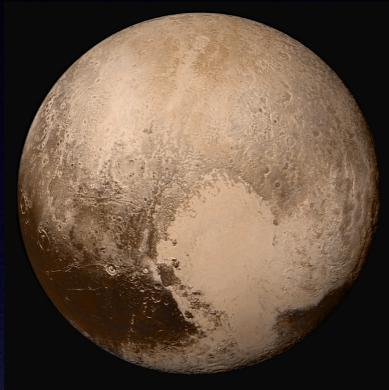
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- Information about primordial chemical composition from which planets and exoplanetary systems have formed
- Involvement in bringing water and organic matter on Earth



# Different kind of small bodies

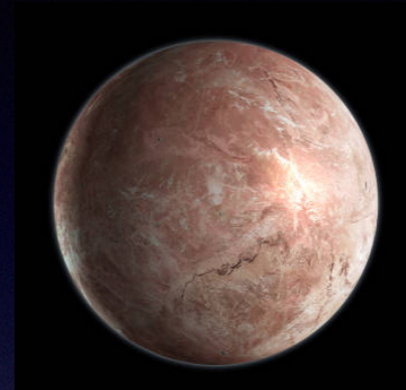
## Transneptunian Objects



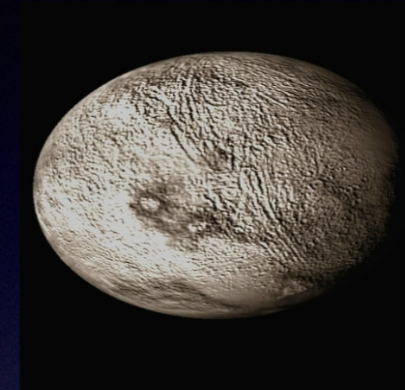
Pluto



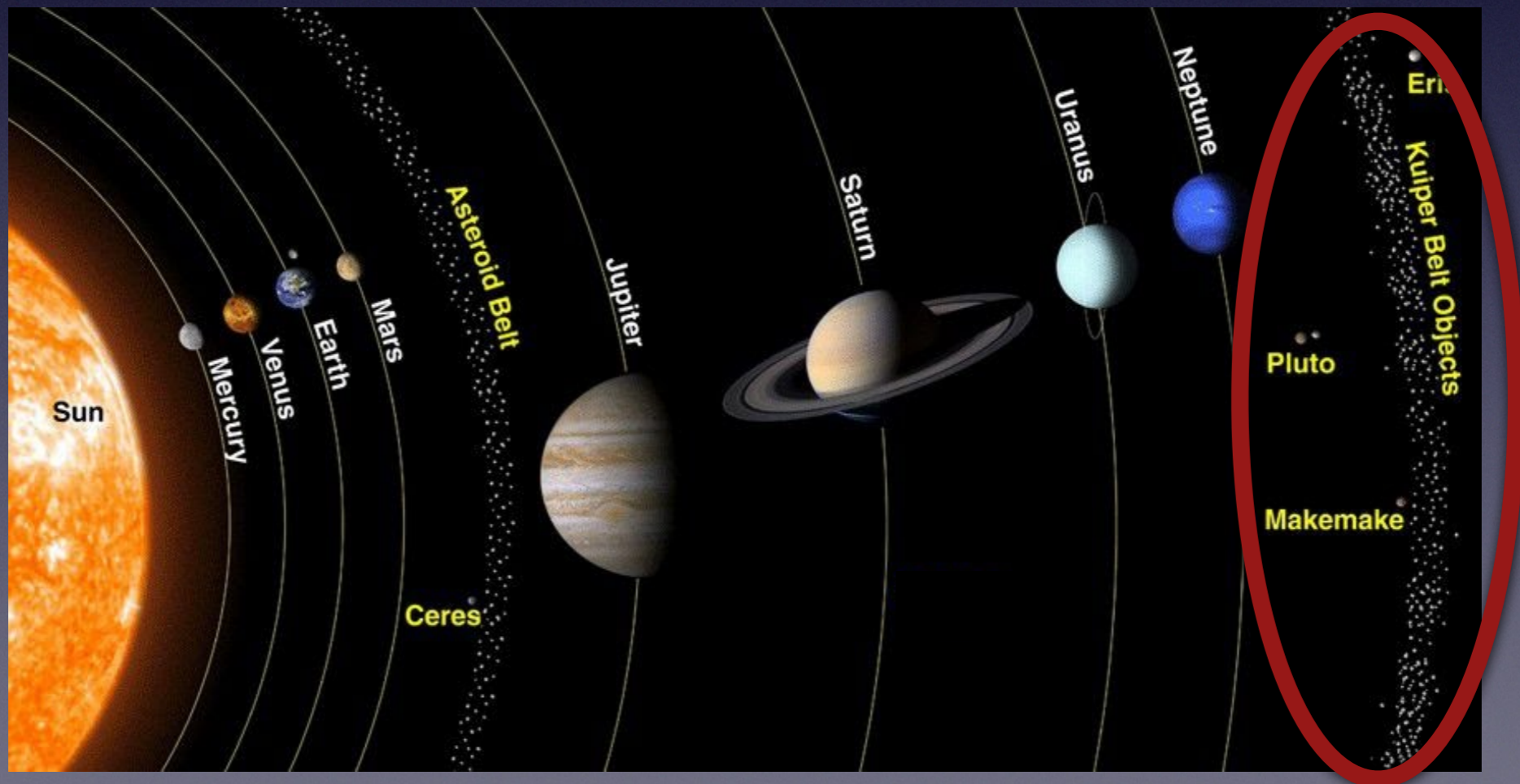
Eris



Makémaké



Haumea

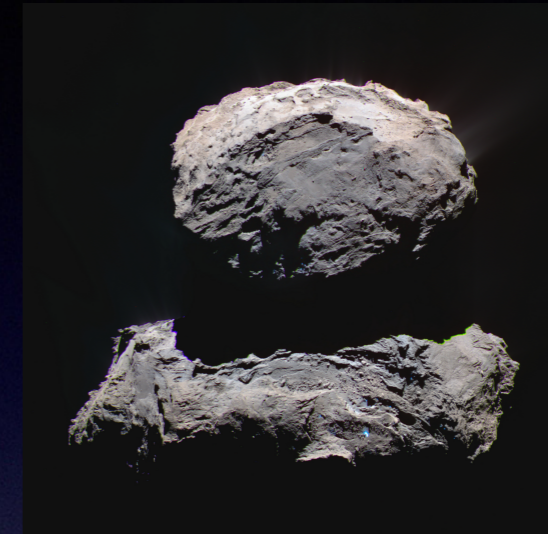


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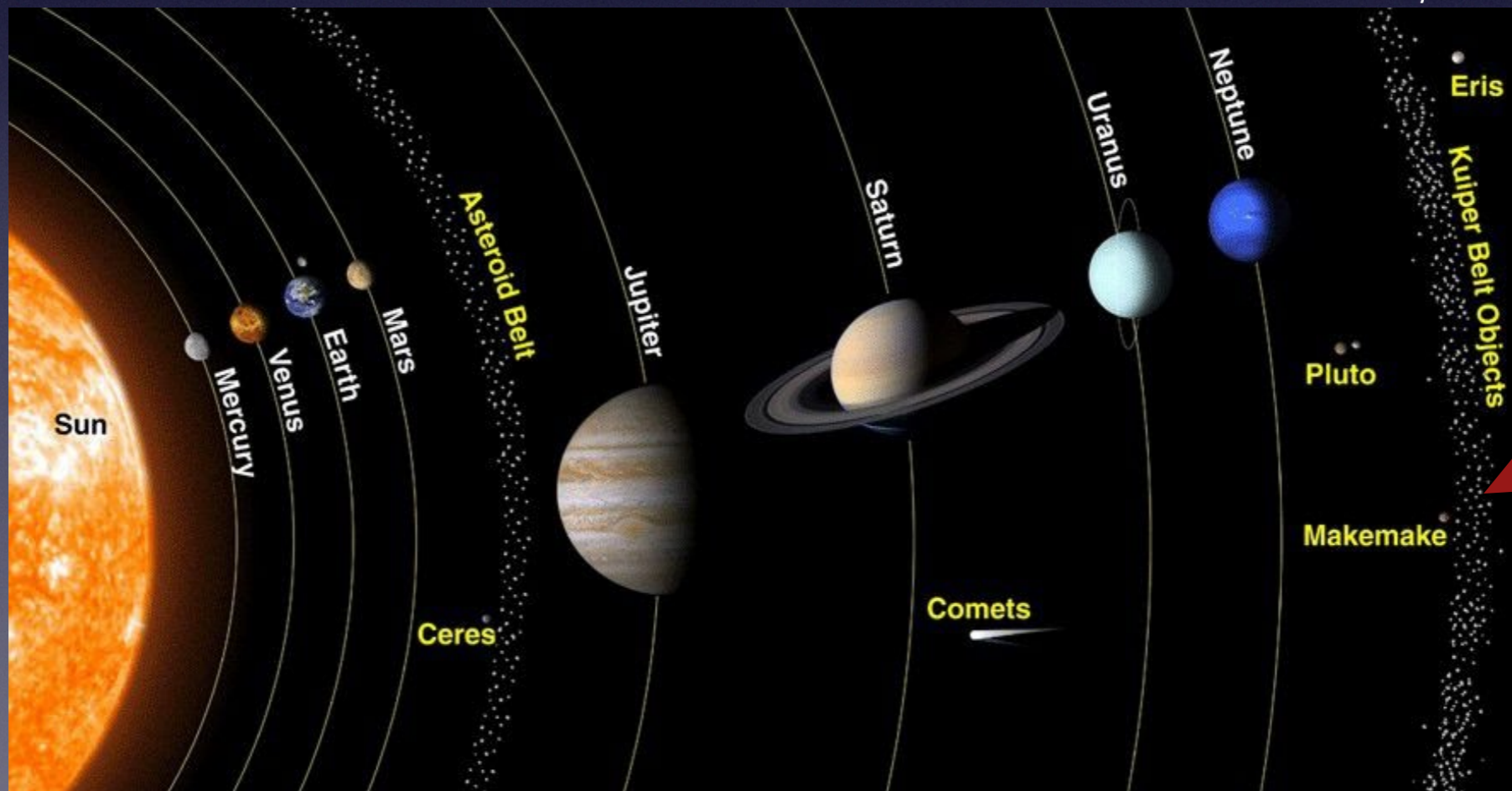
## Comets



Hale-Bopp

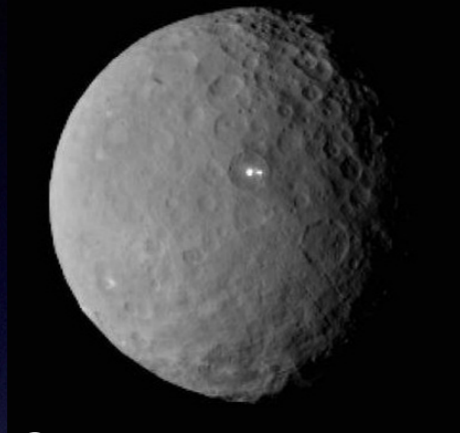


67P/C-G

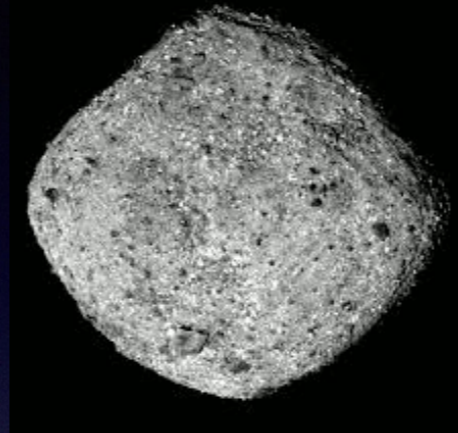


# Different kind of small bodies

## Asteroids



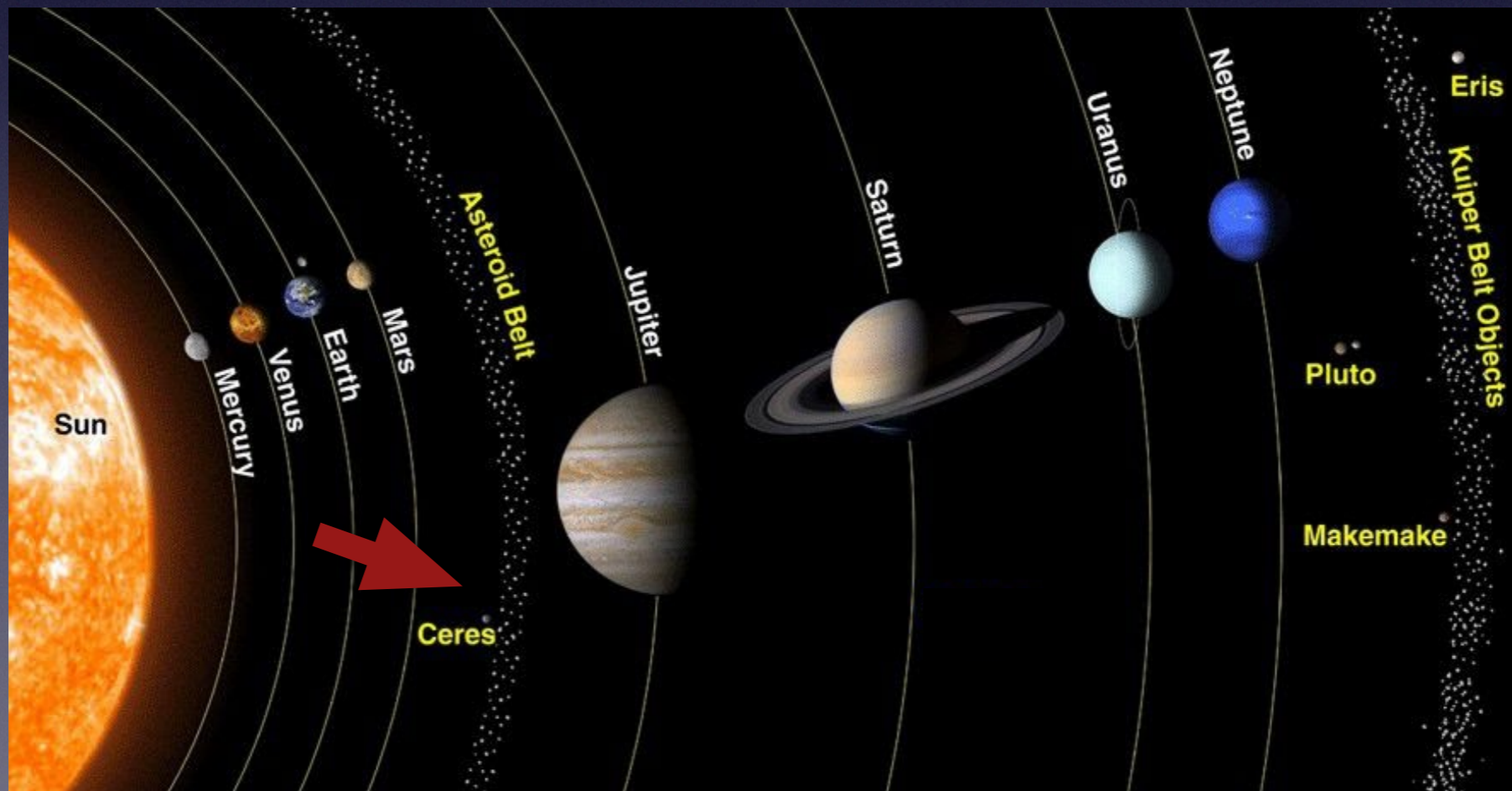
Ceres



Bennu

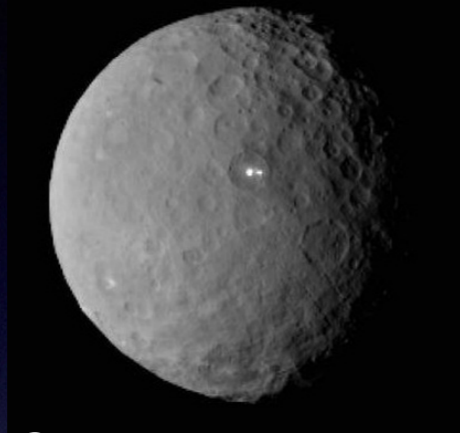


Arrokoth

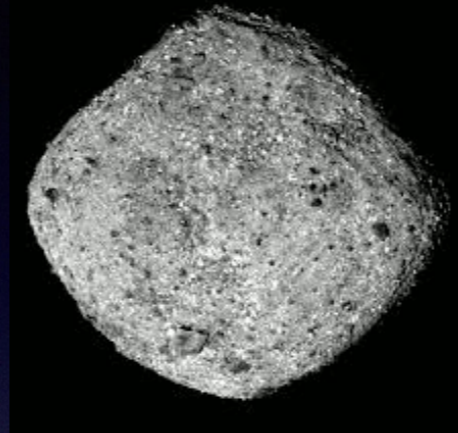


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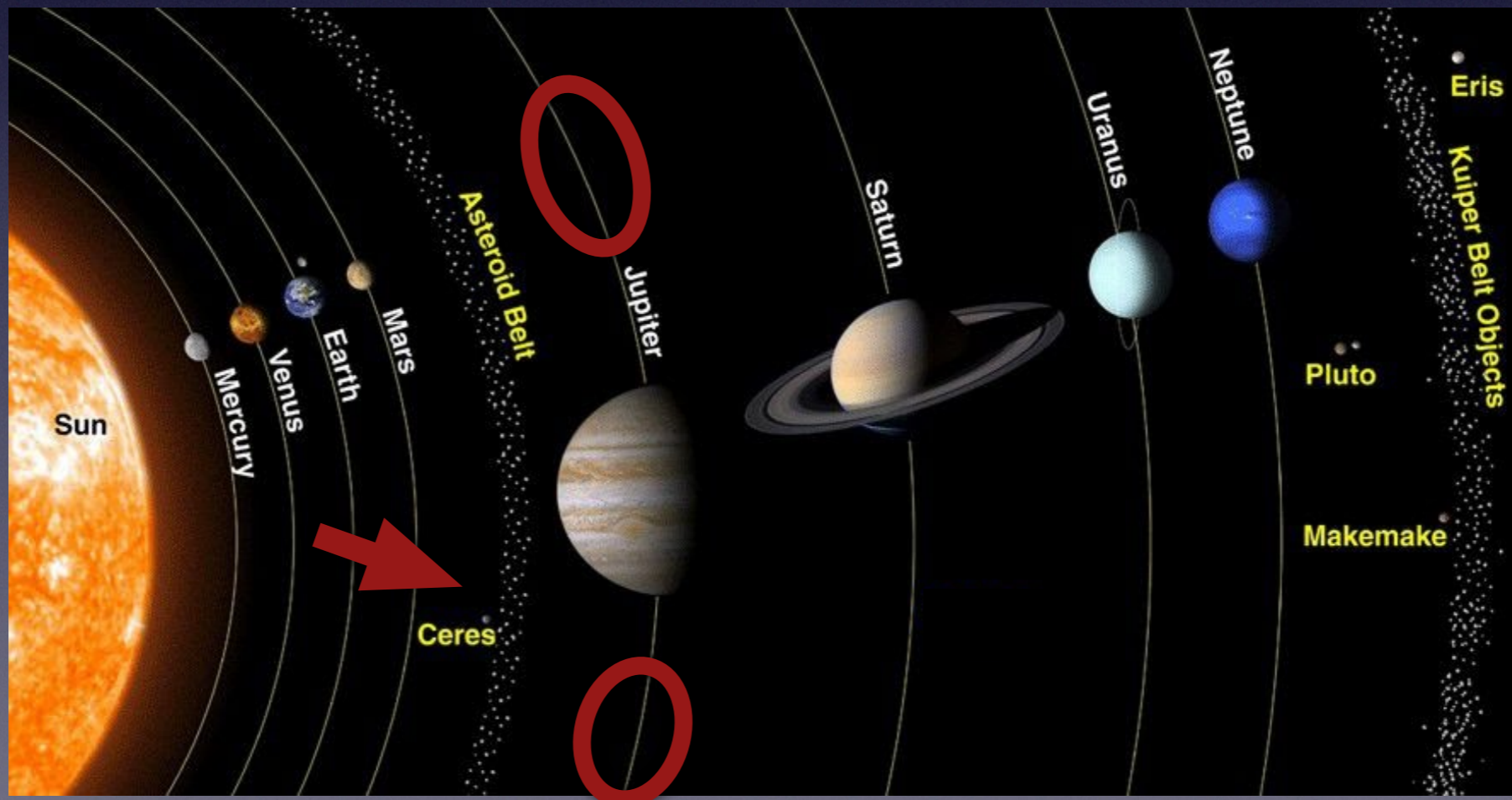
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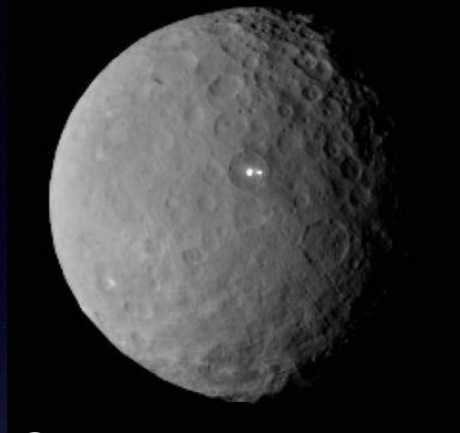
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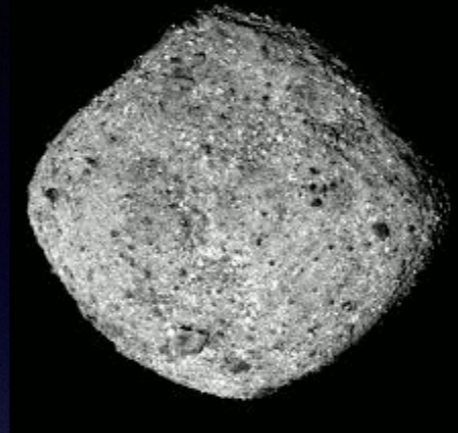


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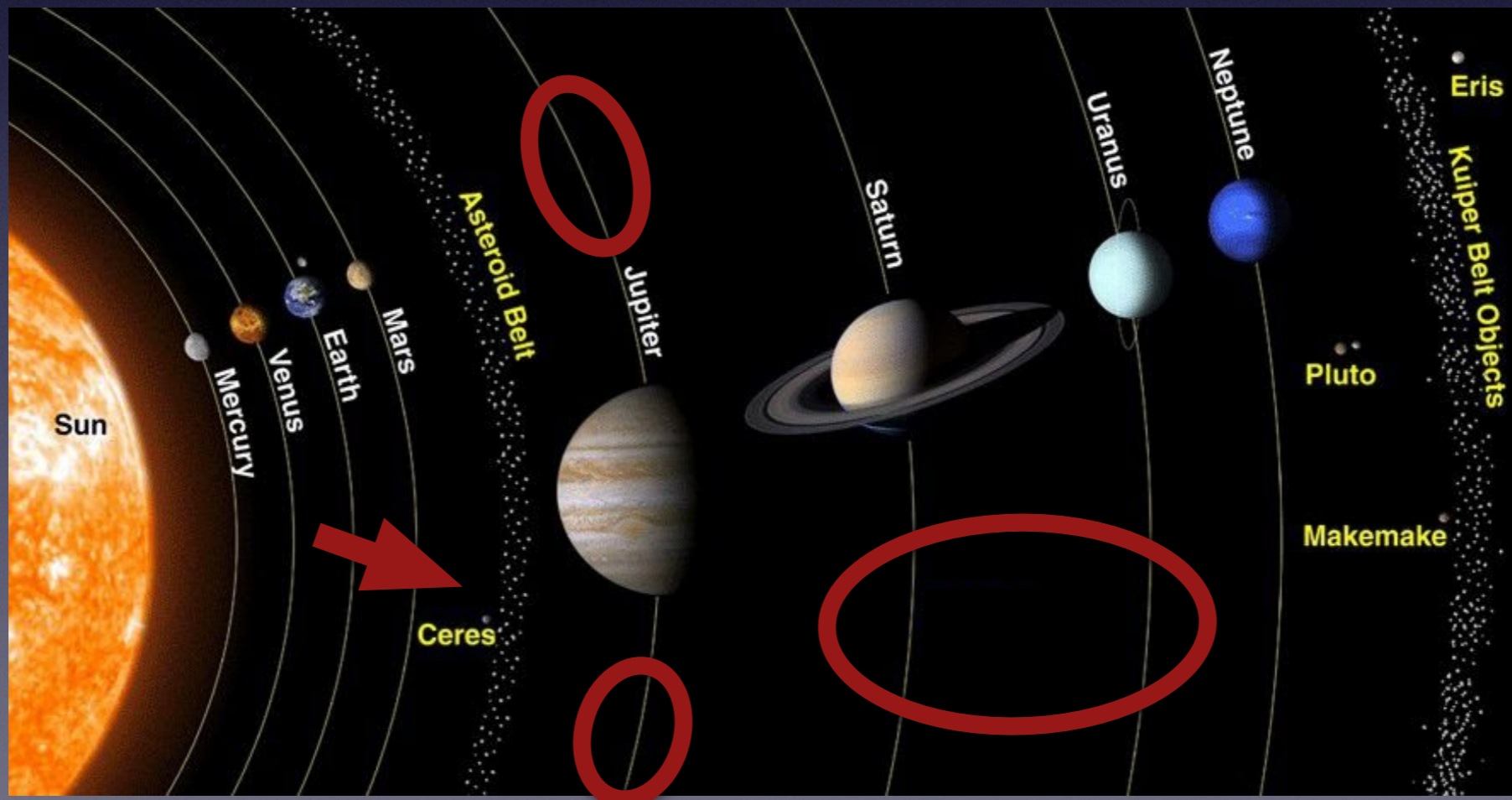
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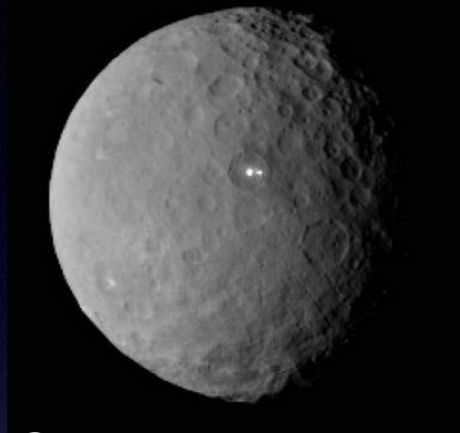


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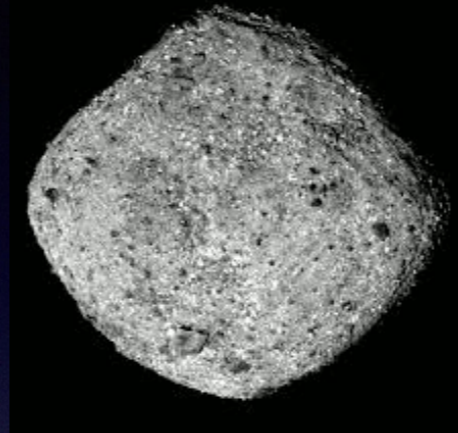


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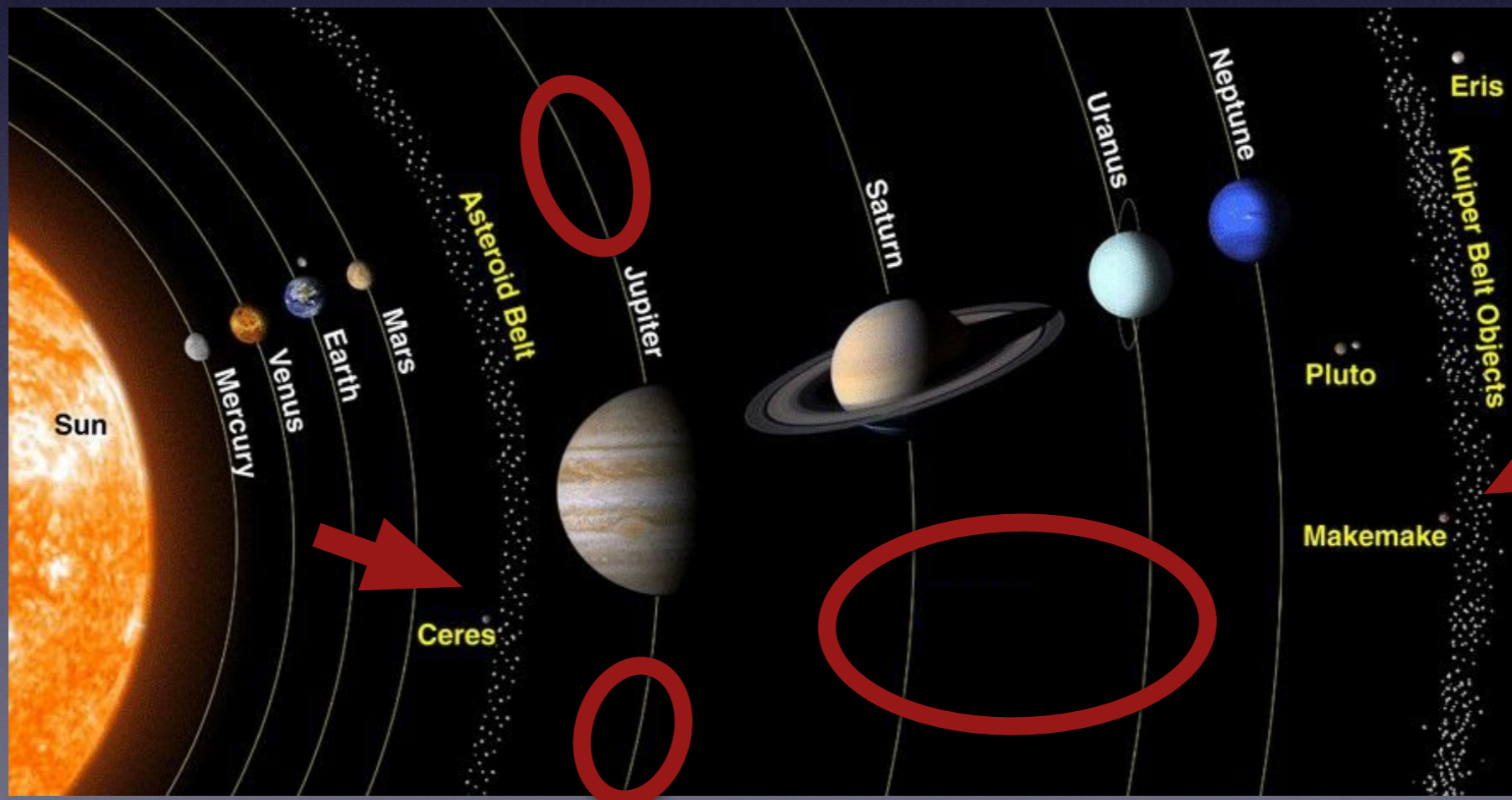
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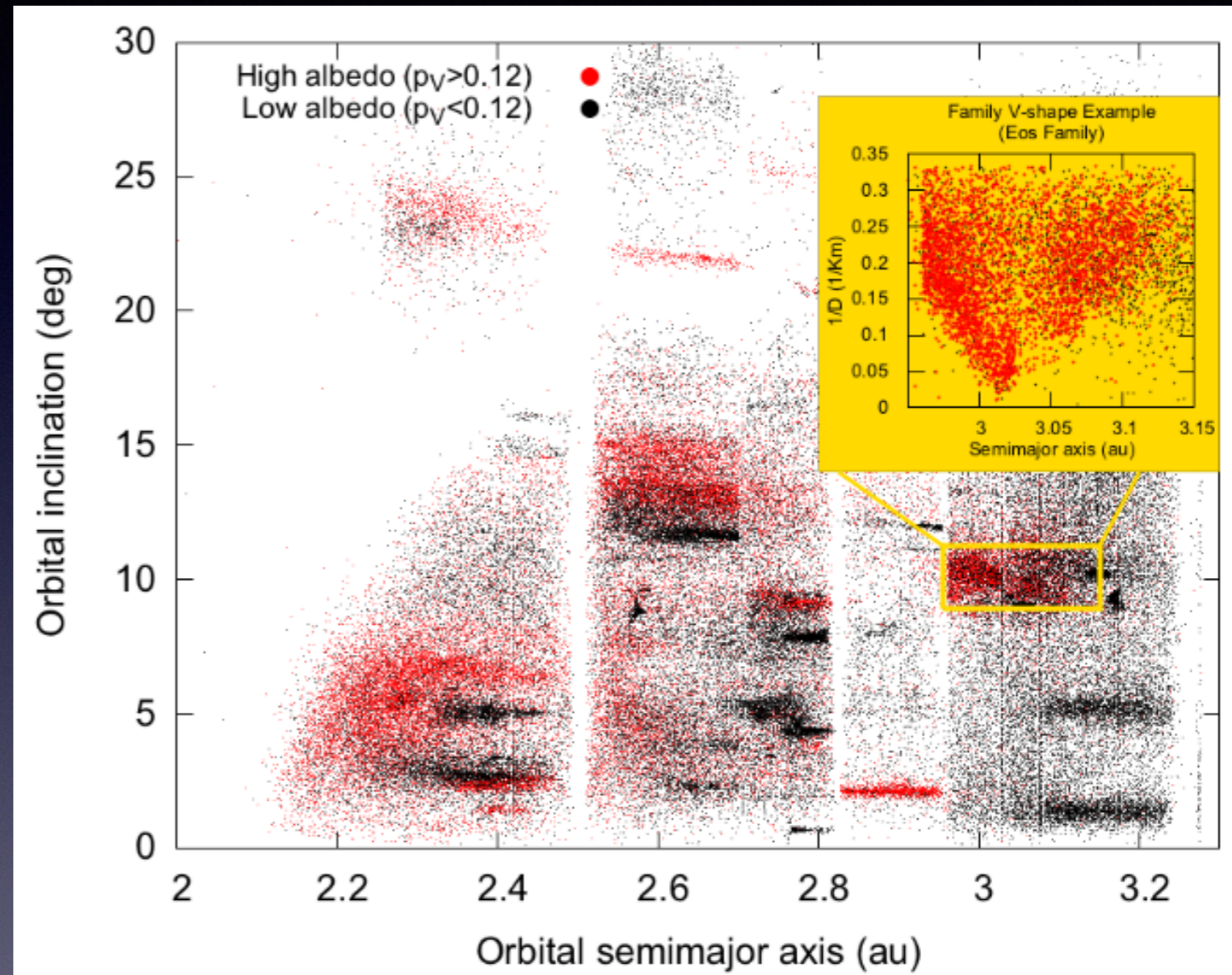
# Asteroids

- Exist since the formation of the planets ( $\sim 4.5$  Gyr)
- Most of them was planetesimals ( $D > 100$  km)
- Since their formation : several events like collision  $\rightarrow$  modification of properties (diameter, composition, albedo)
- Creation of clusters from fragments of parent body  $\rightarrow$  asteroid families

# Asteroids

## Member of a family:

- Same composition
- Same spectra
- Same albedo
- Same orbital parameters



Delbò et al, 2019

# Current problems

Methods cannot detect families older than 2 Gyr !!!!

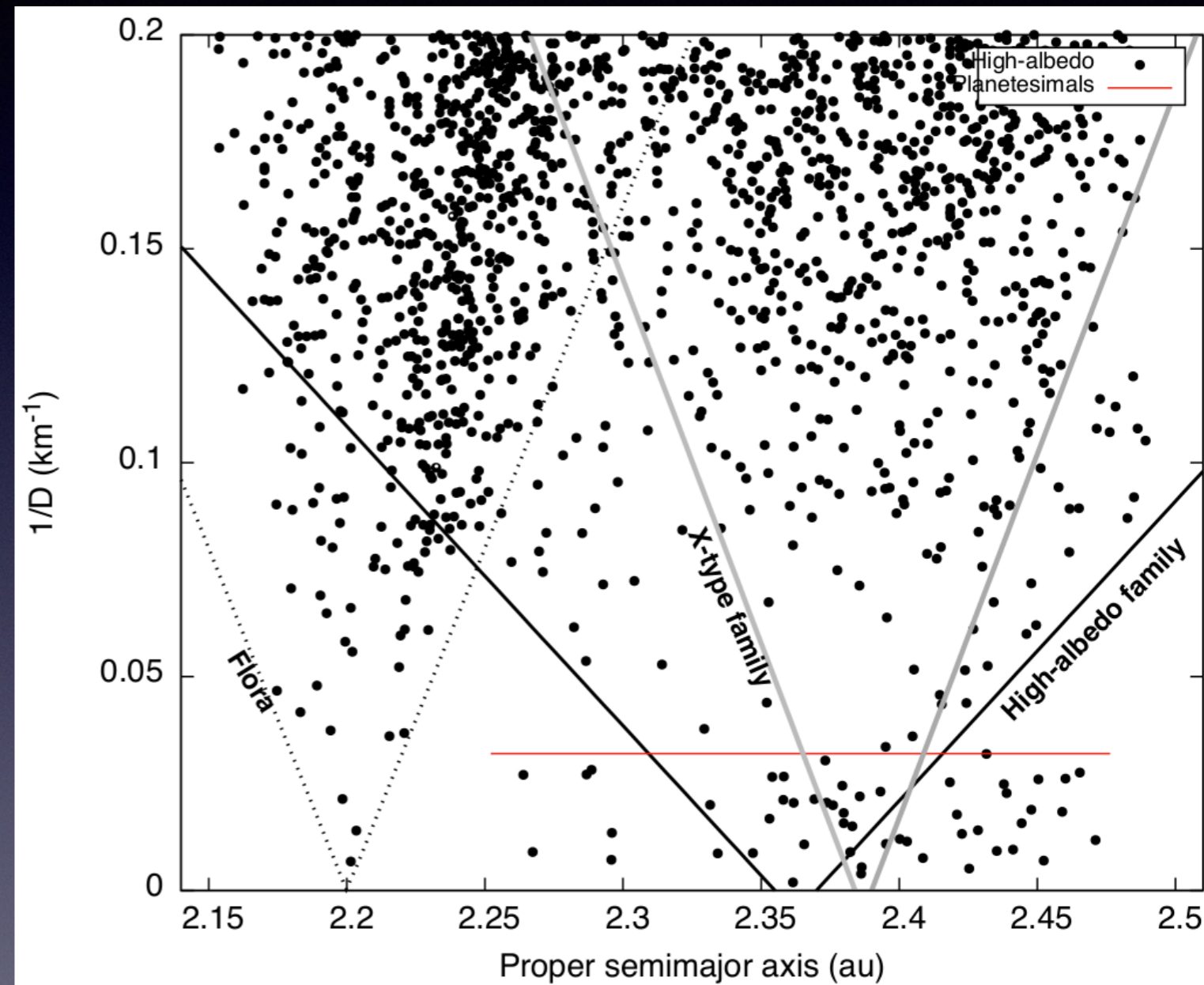
**How can we detect nowadays old families & planetesimals?**

# A new method: V-shape model

**Yarkovsky effect** : influence of Sun over time

Correlations in the plane  $1/D$  vs  $a$  :

- Inside the V : family members
- Slope of the V : age of the family
- Outside the V : interloper (probably planetesimal)



# Study of planetesimals

## Detection

Identify all the family → « clean » the Main Belt and keep remnant

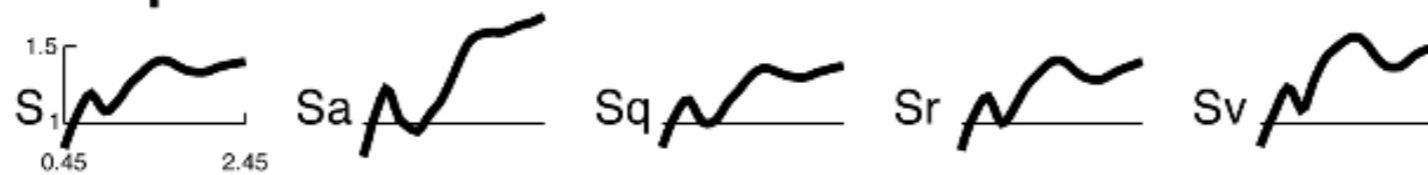
## Work

Spectroscopy of remnant → characterization of surface composition and classification following DeMeo scheme

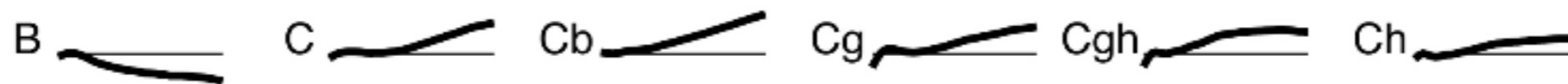
# DeMeo Classification

## Bus-DeMeo Taxonomy Key

### S-Complex



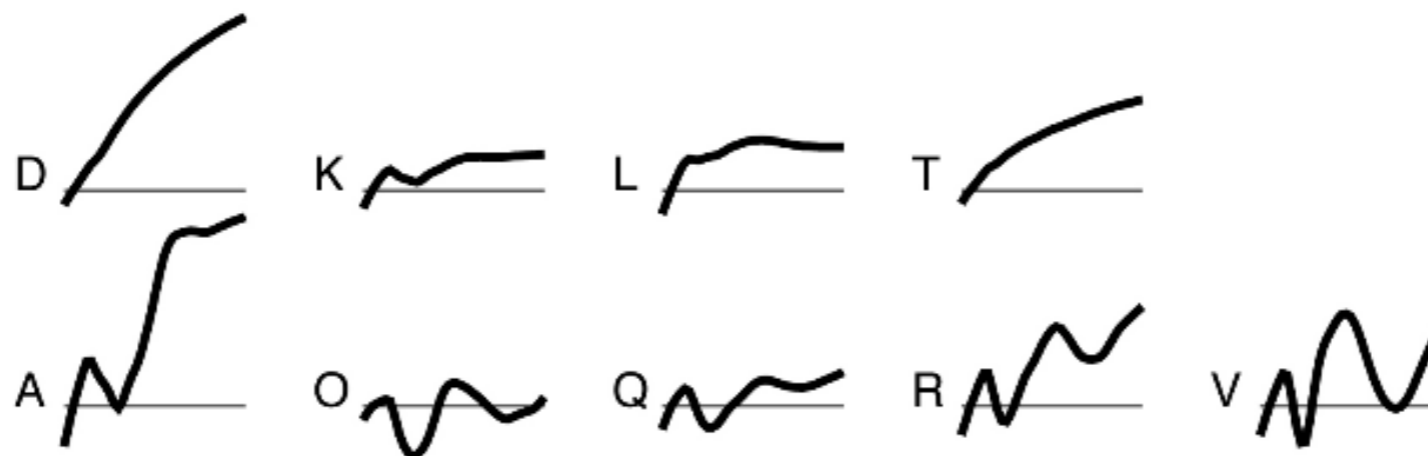
### C-Complex



### X-Complex



### End Members



<http://smass.mit.edu/busdemeoclass.html>

F. E. DeMeo, R. P. Binzel, S. M. Slivan, and S. J. Bus. Icarus 202 (2009) 160-180



# Partner Telescopes



Discovery Channel Telescope (DCT)  
Arizona, USA

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Copernico Telescopio  
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Other telescopes?

# Expected Results

- Classification of observed objects : planetesimals or old member of a family?

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- Have a better understanding of the primordial environment in which planets were formed
- Develop and update an asteroid catalog (MP3C)



*That's all Folks!*