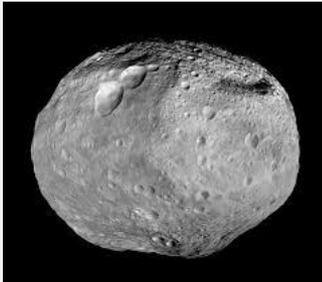


## Asteroids, Comets & Meteors

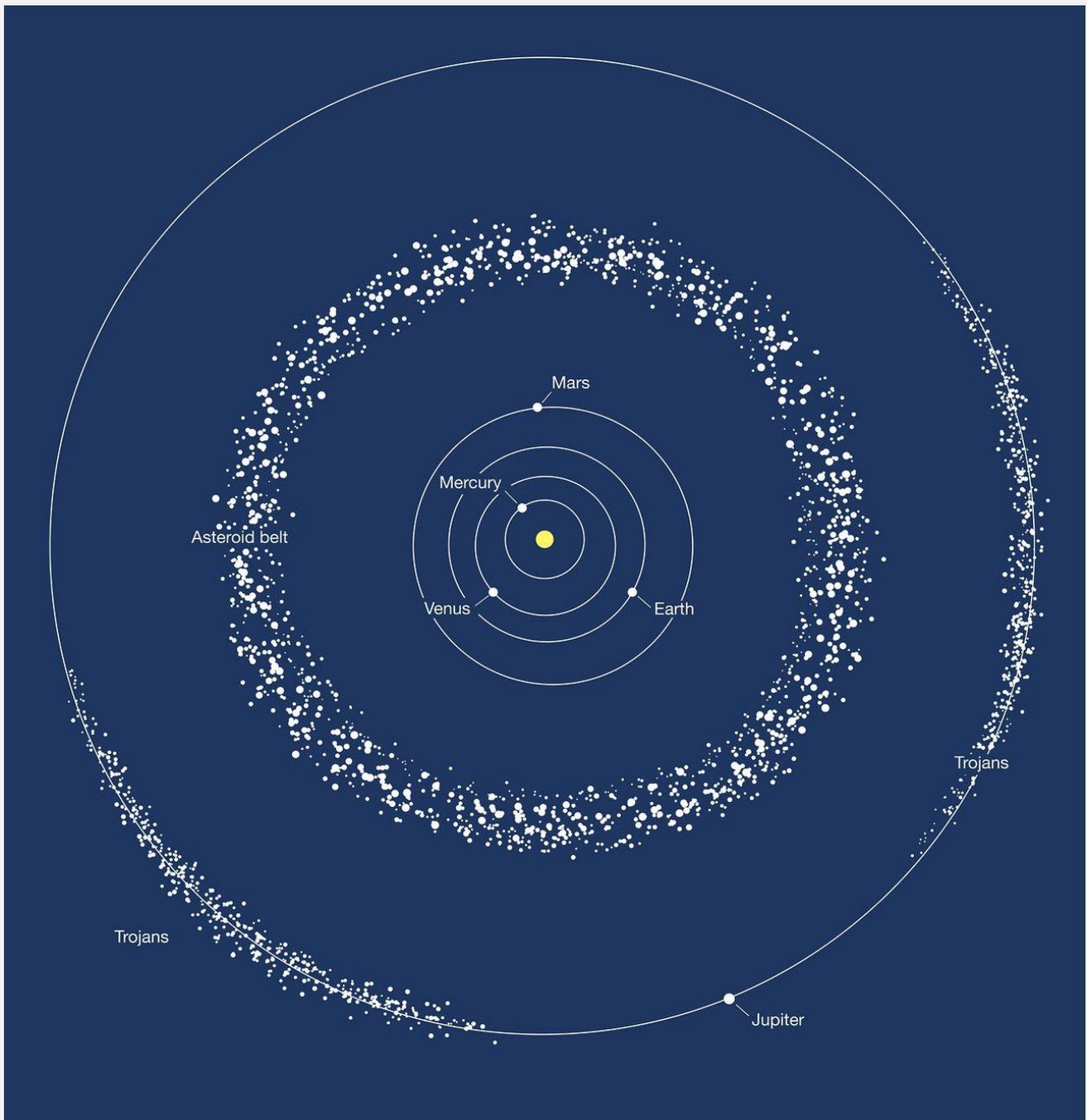
### 1. Asteroids

- **Asteroids** are remnants of **planetary formation** that failed to form a planet due to **Jupiter's strong gravitational pull**
- Also called **planetoids**
- Composition:
  - Rocky and metallic minerals
  - Some ice
- Size:
  - From microscopic particles to hundreds of kilometres



### 2. Asteroid Belt

- A **circular zone of asteroids** orbiting the Sun
- Located **between Mars and Jupiter**
- Distance from Sun: **2.3 AU to 3.3 AU**
- Reason for formation:
  - Jupiter's gravity prevented planet formation
- Mostly contains **rocky bodies**
- The asteroid belt is **NOT between Jupiter and Saturn**



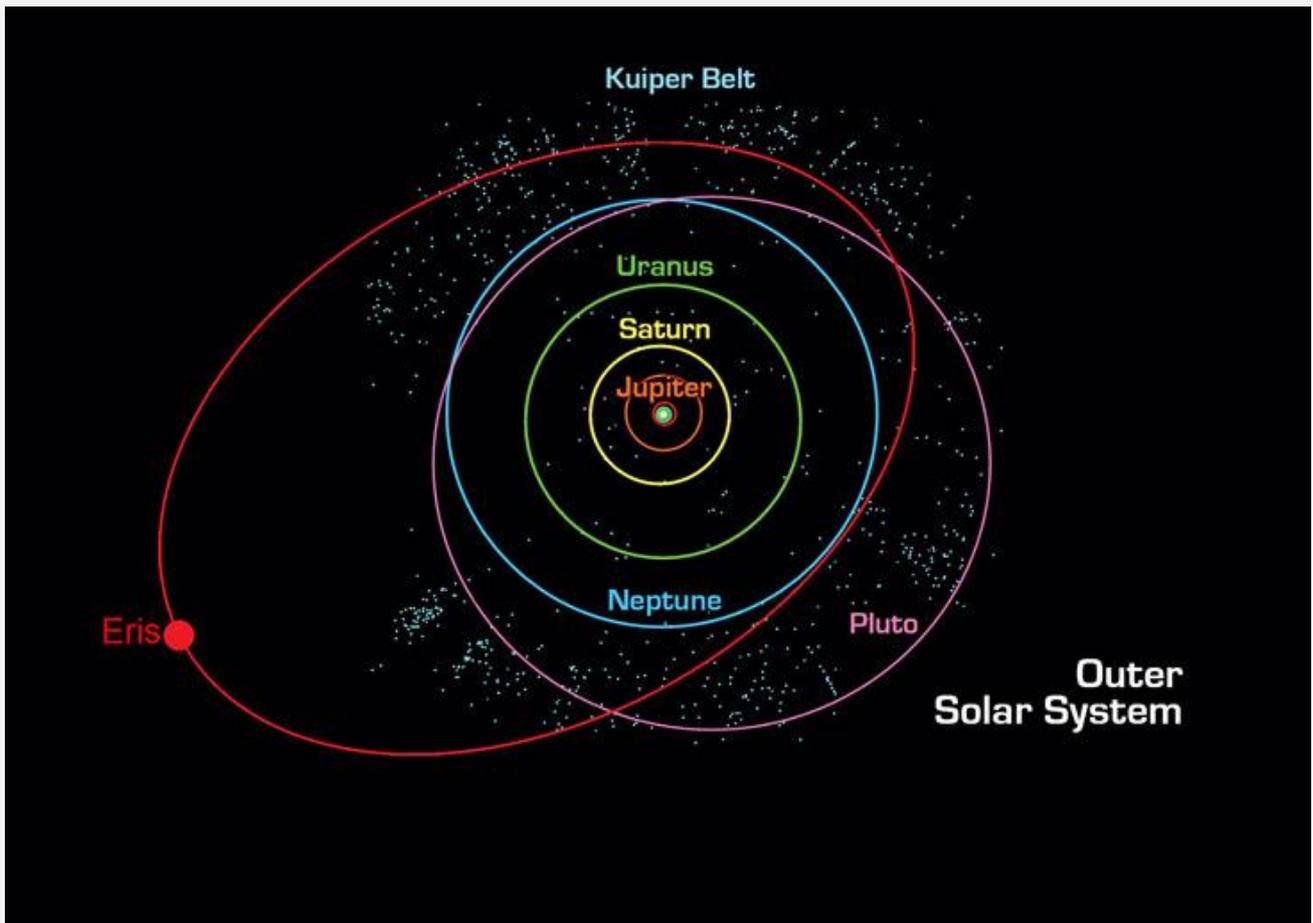
### 3. Ceres

- **Largest asteroid**
- Distance from Sun: **2.77 AU**
- Diameter: **946 km**
- Classified as:
  - **Dwarf planet**
  - **Protoplanet**
- Only an asteroid large enough to become **nearly spherical**
- All other asteroids → **Small Solar System Bodies**
- Ceres is to **the asteroid belt** what Pluto is to the **Kuiper Belt**



#### 4. Kuiper Belt

- A ring of icy objects beyond Neptune
- Extends from 30 AU to 50 AU
- Composition:
  - Mostly ice + rocky material
- Similar to the asteroid belt, but:
  - Farther
  - Icy instead of rocky



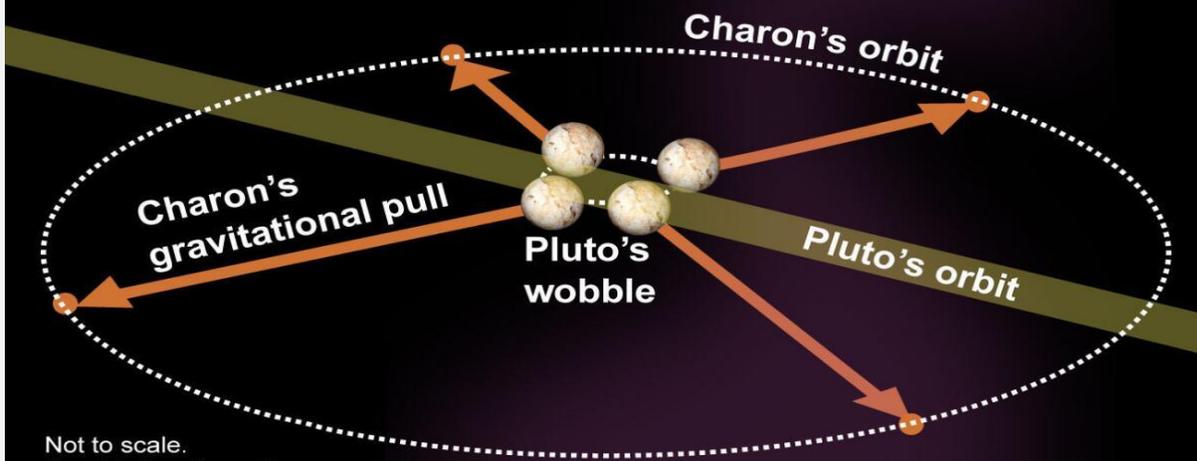
### 5. Pluto and Charon

- **Pluto:**
  - Distance: **39 AU**
  - Largest known Kuiper Belt Object
  - Diameter: **2,377 km**
  - Declared **Dwarf Planet (2006)**
- **Charon:**
  - The largest moon of Pluto



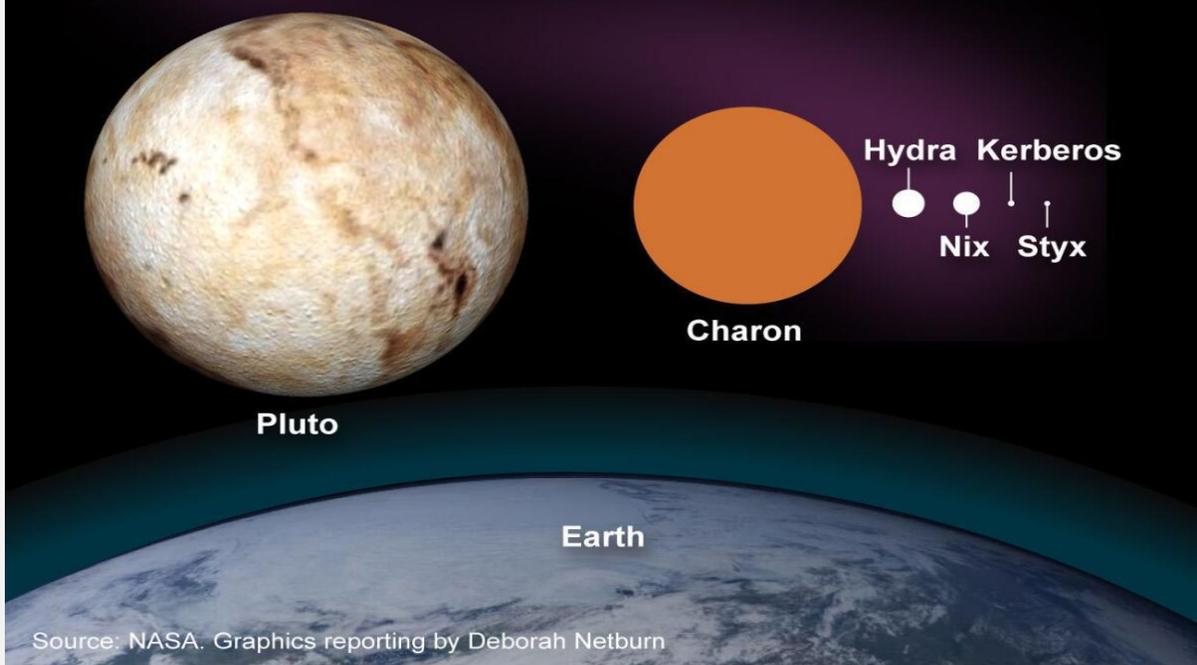
## Pluto and Charon – a binary planet

Pluto and its largest moon Charon form what astronomers call a binary planet. Instead of the moon orbiting around the dwarf planet, Charon and Pluto orbit around a gravitational point between the two bodies.



Not to scale.  
Graphic is schematic.

## How big is Charon?



Source: NASA. Graphics reporting by Deborah Netburn

### IAU Definition of a Planet

A planet must:

- Orbit the Sun
- Be nearly spherical
- Not be a satellite
- **Clear its orbital neighbourhood**

Pluto fails the **last condition**

### Dwarf Planet

- Meets all criteria **except clearing debris**
- Examples:
  - **Ceres**
  - **Pluto**
  - **Eris (2,326 km)**

### 6. Comets

- Made of:
  - Frozen gases (water, ammonia, methane, CO<sub>2</sub>)
  - Rocky and metallic material
- Orbits:
  - **Highly elliptical**
- When near the Sun:
  - Solar wind causes heating
  - Forms **coma and tail**



### Types of Comets

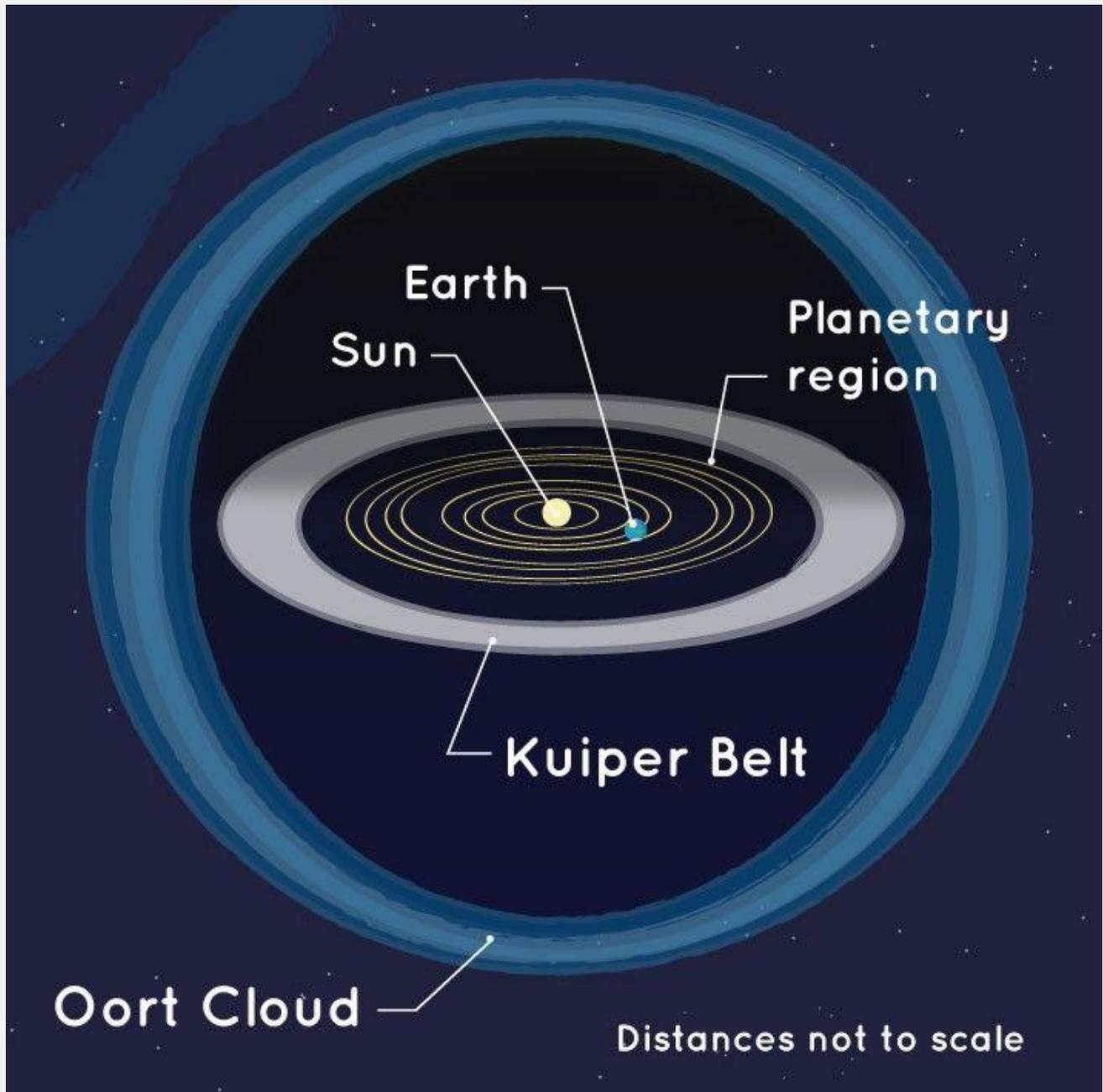
- **Short-period comets**
  - Origin: **Kuiper Belt**
  - Period: a few hundred years
- **Long-period comets**
  - Origin: **Oort Cloud**
  - Period: thousands of years

### 7. Oort Cloud

- A **giant spherical shell of icy bodies**



- Surrounds the solar system
- Distance:
  - **5,000 AU to 100,000 AU**
- Source of **long-period comets**



### 8. Halley's Comet

- One of the largest known comets
- Orbital period: **76 years**
- Last visited Earth: **1986**

# Orbit of Halley's Comet



9. Meteoroid, Meteor & Meteorite

Aspire with



## Meteors and Meteorites

### Comet

Icy body that releases gases as it orbits the Sun



### Meteoroid

Rocky or metallic fragment of an asteroid, comet, or planet



### Asteroid

Rocky body smaller than a planet that orbits the Sun



### Meteor

Streak of light seen when a meteoroid heats up in the atmosphere

### Meteorite

Meteor fragment that reaches the ground



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### Meteoroid

- Small solid debris from:
  - Asteroids
  - Comets
- Moves in interplanetary space

### Meteor

- When a meteoroid enters Earth's atmosphere
- Burns due to friction in the **mesosphere (~200 km)**
- Appears as:
  - **Shooting star / falling star**

### Meteorite

- Part of a meteoroid that:
  - **Survives atmospheric burning**
  - Reaches Earth's surface

### 10. Meteorite Craters

- Circular depressions formed by a meteorite impact

- Common on:
  - **Moon and Mercury**
  - Reason: negligible atmosphere + geological inactivity

#### **Largest Meteor Crater (World)**

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- **Arizona, USA**
- Depth: **1,300 m**
- Age: over **10,000 years**

#### **11. Chicxulub Crater**

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- Location: **Yucatan Peninsula, Mexico**
- Cause:
  - Massive meteor impact
- Impact:
  - **Mass extinction of dinosaurs**
  - End of the **Cretaceous period (65 million years ago)**

#### **12. Meteorite Craters in India**

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- **Lonar Lake (Maharashtra)**
  - Diameter: **1.8 km**
  - Ramsar Site
- **Dhala Crater (Madhya Pradesh)**
  - Diameter: **14 km**
- **Ramgarh Crater (Rajasthan)**
  - Diameter: **3.5 km**
  - Potential meteorite crater