

# **Population of the Oort Cloud**

**Katherine Shepard**

**Advisor: Dr. Nathan Kaib**

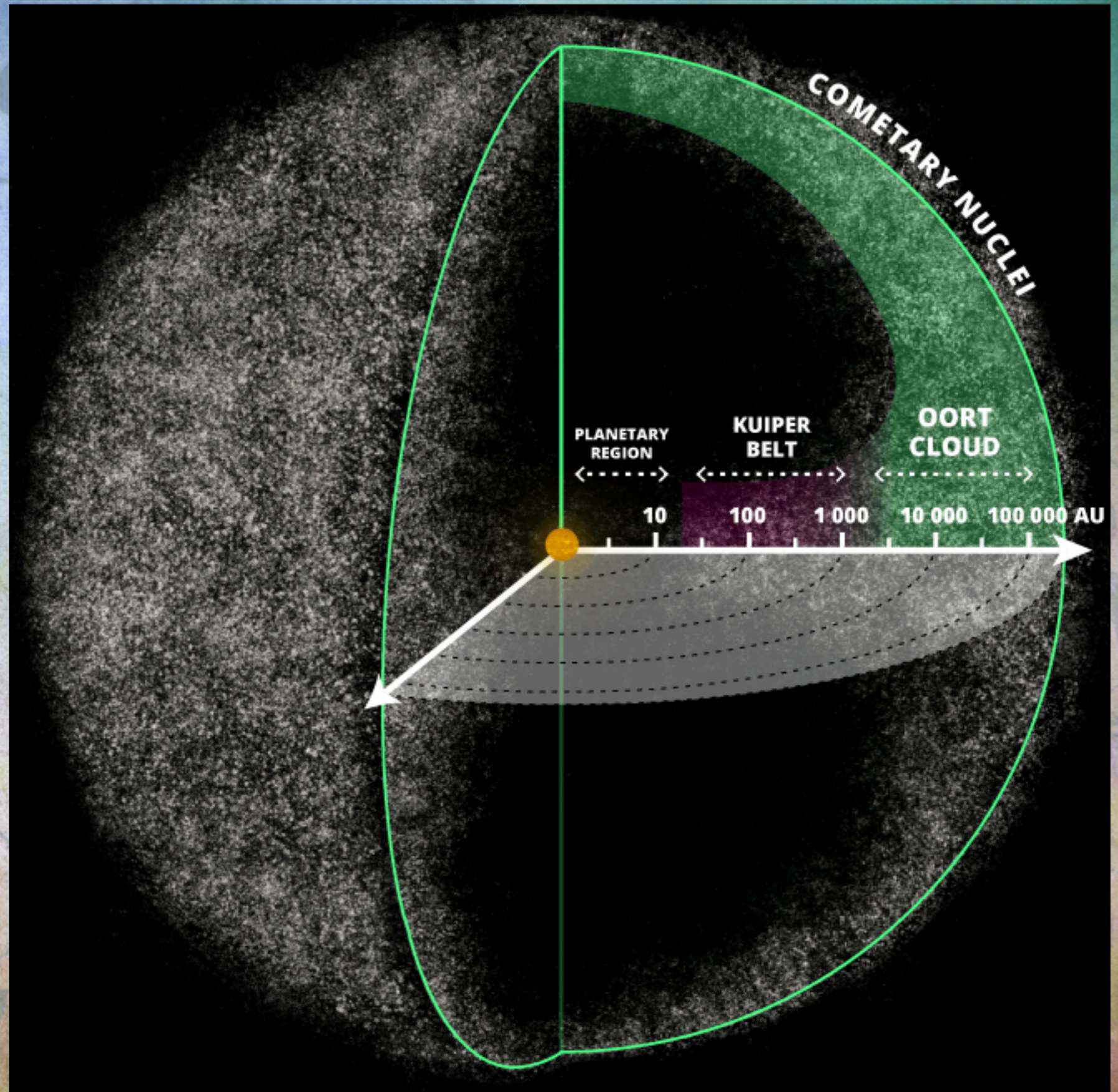
**Astrophysics**

# Vocabulary

- AU - Astronomical Units
- Galactic Tide - The Gravitational pull of the Milky Way disk
- Binary Star System
- Perihelion - Closest point of orbit to the Primary body
- Semi-major axis - Radius of an orbit at the two furthest points
- Planetesimals - Cometary Bodies
- Eccentricity - Amount that orbiting body deviates from a circular orbit

# Recap

- Theoretical
- $10^{11}$ - $10^{12}$
- 10 - 100 x greater than simulations
- Formed by planets



# Control Simulation

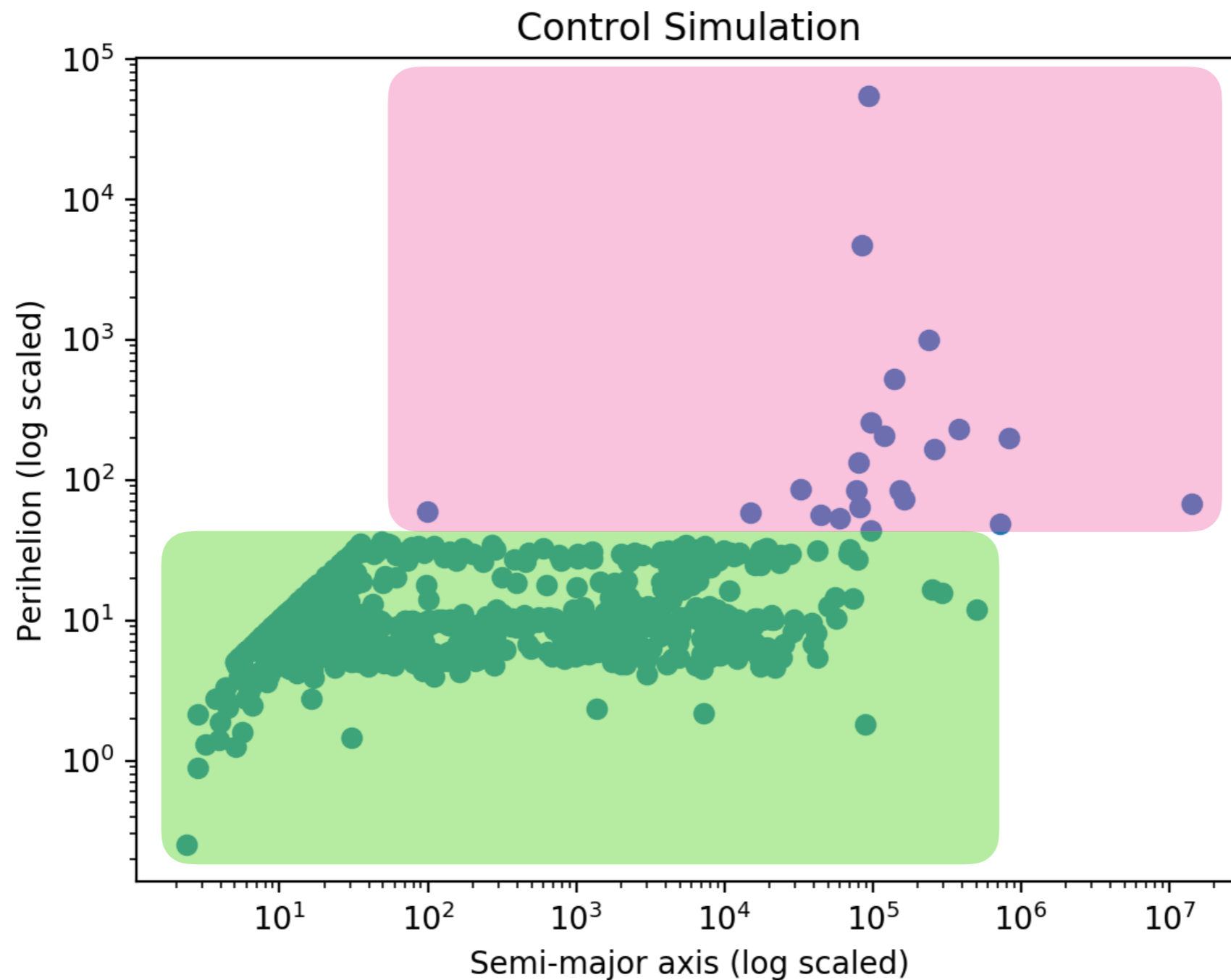
- 4 Giant Planets
- Sun
- 1000 Planetesimals
- Stellar Passages
- Galactic Tide
- 500 Myr
- Perihelion 45 AU<

## Vocab Reminders:

- Planetesimals: Cometary Bodies
- Galactic Tide: Gravitational force of Milky Way
- Perihelion: Closest point of orbit to Sun
- AU: Astronomical Units

# Control Simulation

- 2% of planetesimals in Oort Cloud



# Binary Simulations

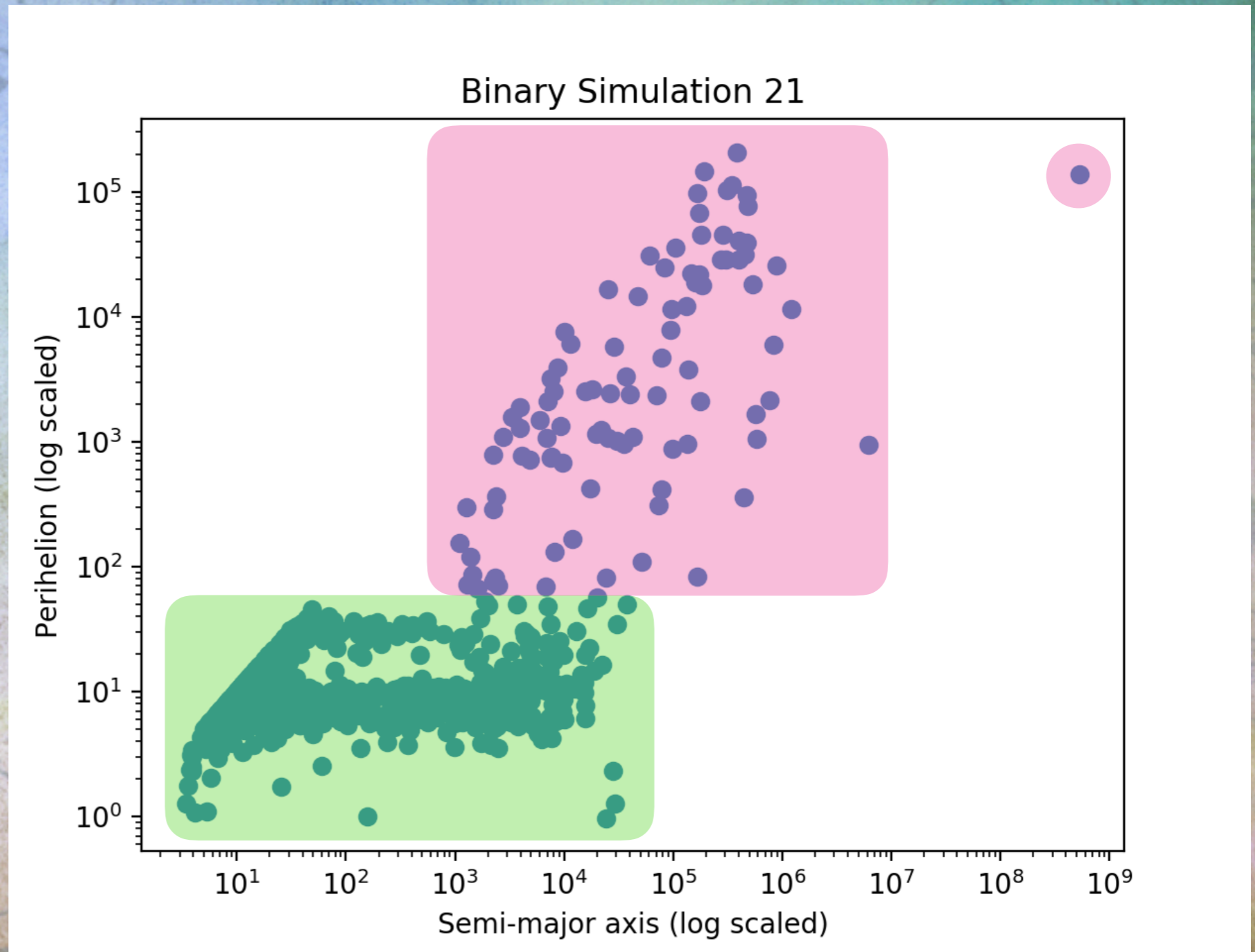
- 4 Giant Planets
- Sun
- Binary Star (mass = .4 solar masses)
- 1000 Planetesimals
- Stellar Passages
- Galactic Tide
- 500 Myr
- Perihelion 45 AU<

## Vocab Reminders:

- Planetesimals: Cometary Bodies
- Galactic Tide: Gravitational force of Milky Way
- Perihelion: Closest point of orbit to Sun
- AU: Astronomical Units

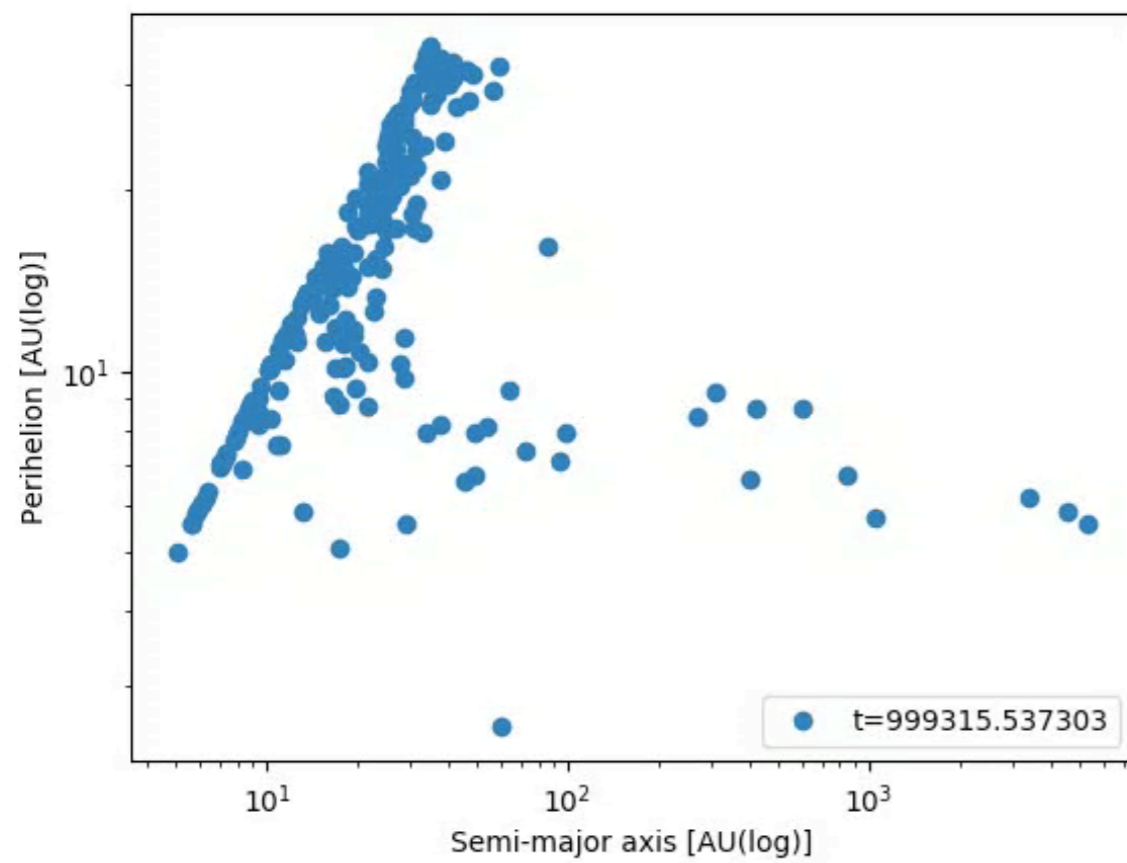
# Binary Simulation 21

- $a = 80,000$
- $\text{ecc} = 0.9$
- 9.9% of Planetesimals in Oort Cloud

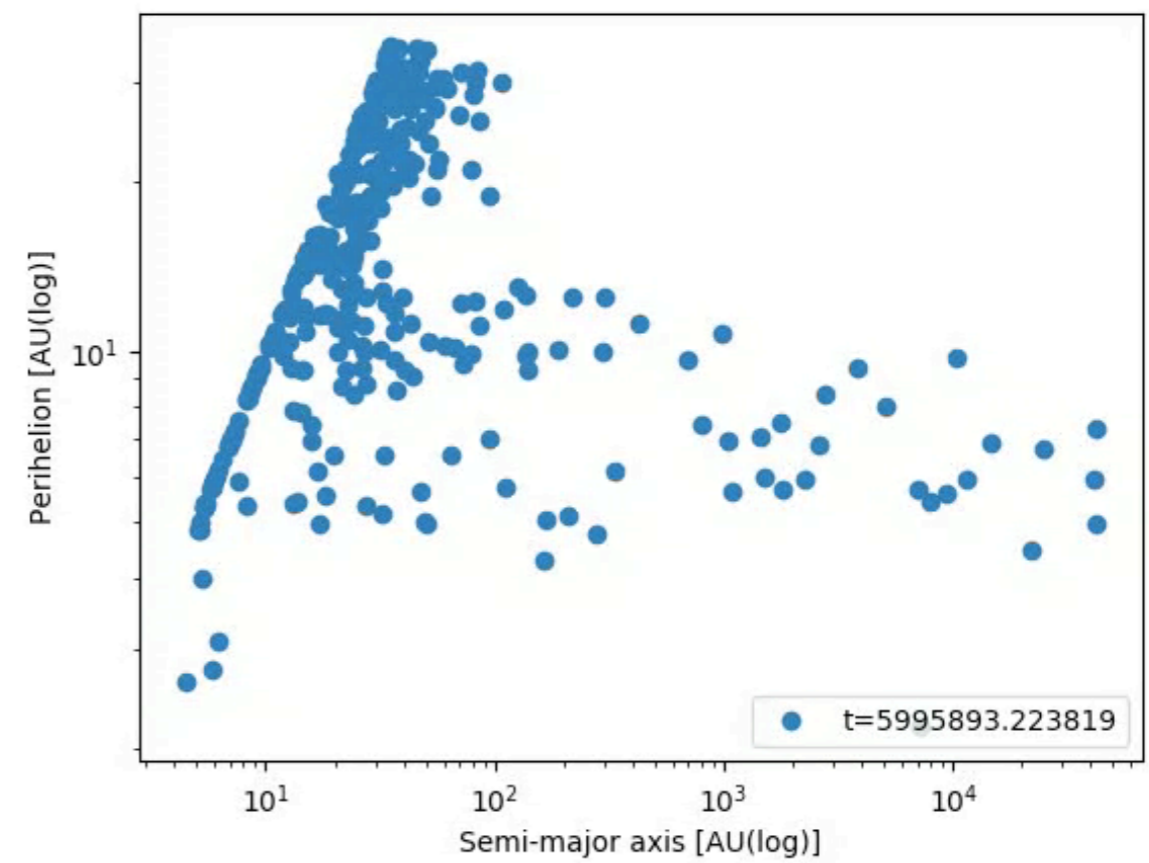


# Movie

Binary Simulation

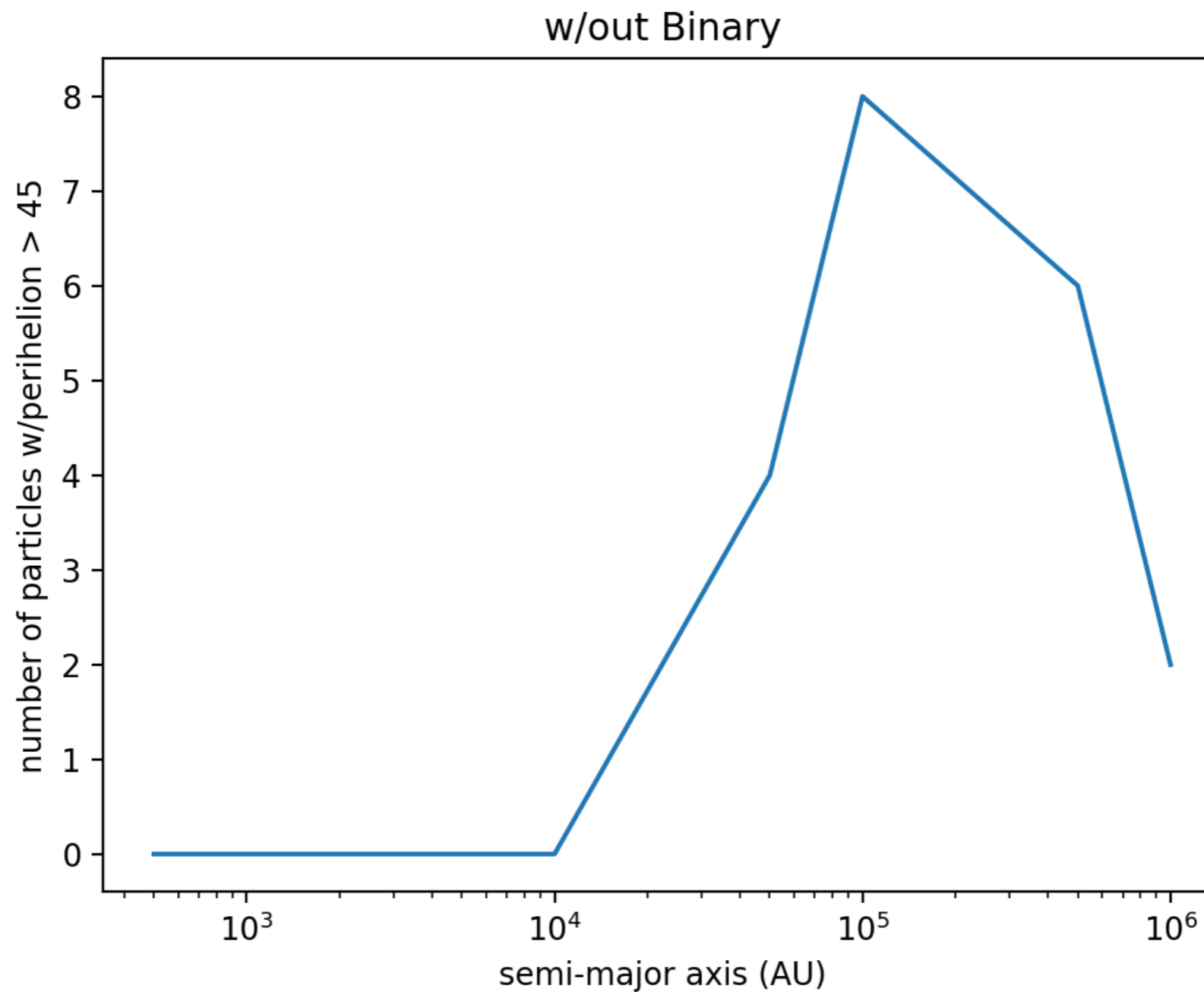


Control Simulation

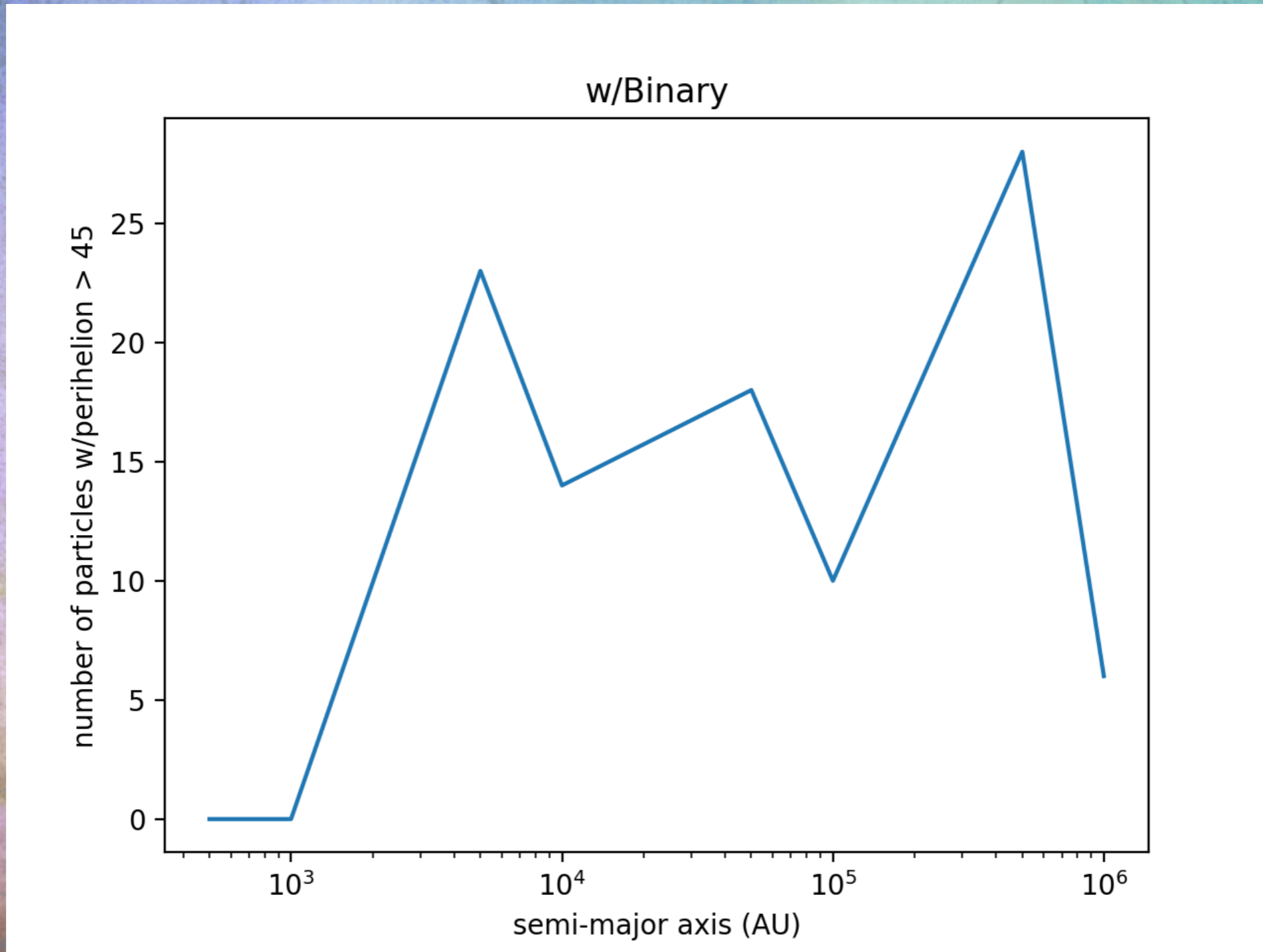




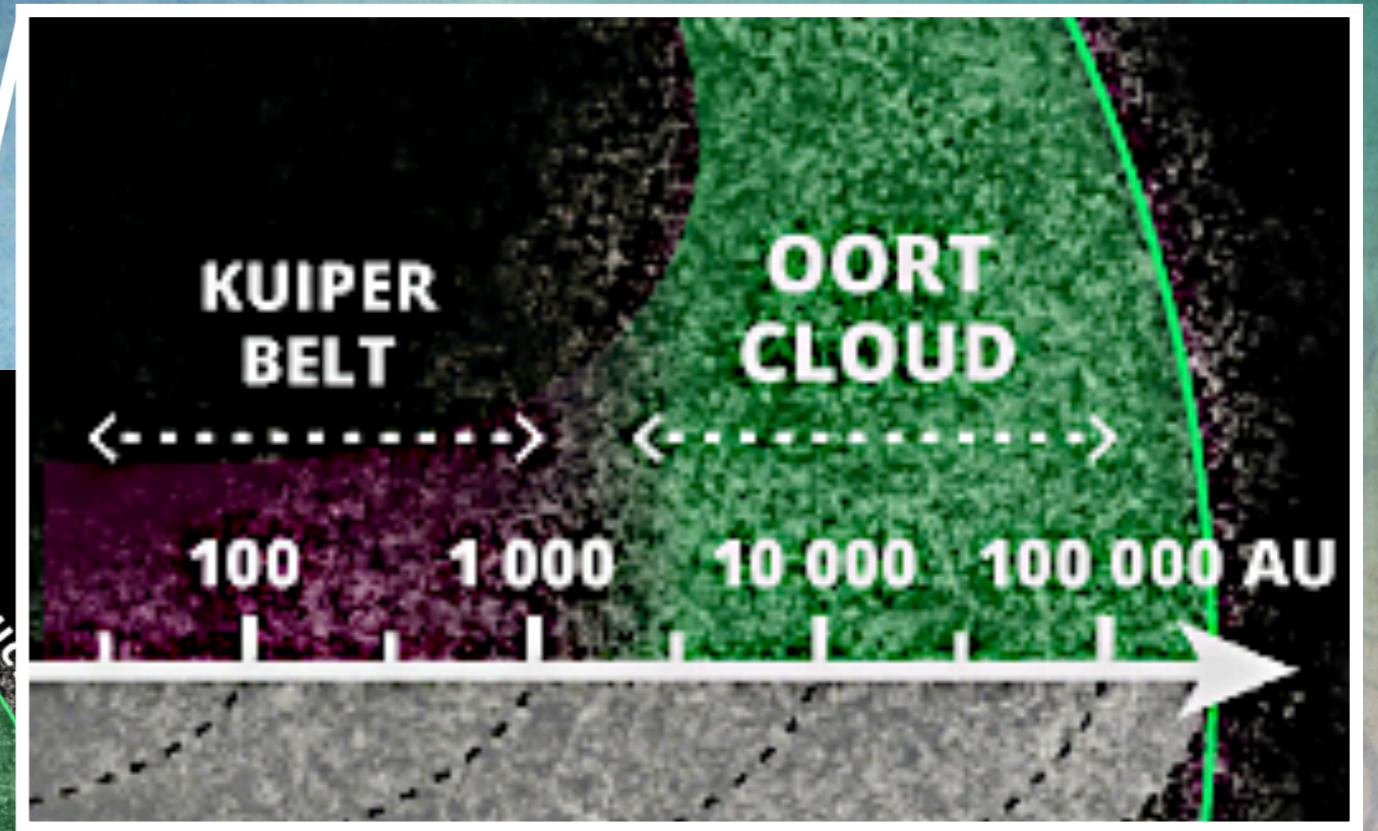
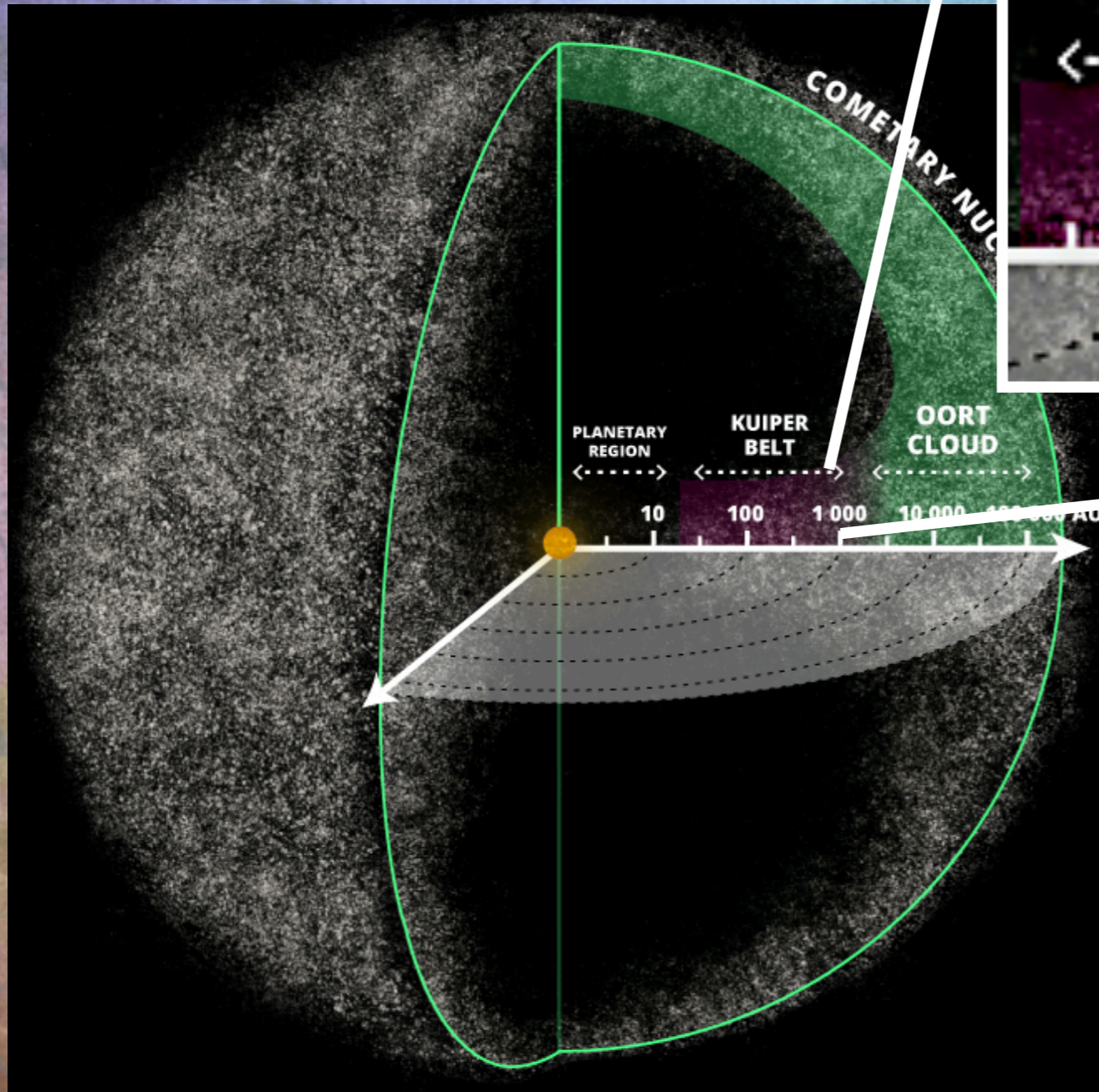
# Distribution of Oort Cloud Objects - Control



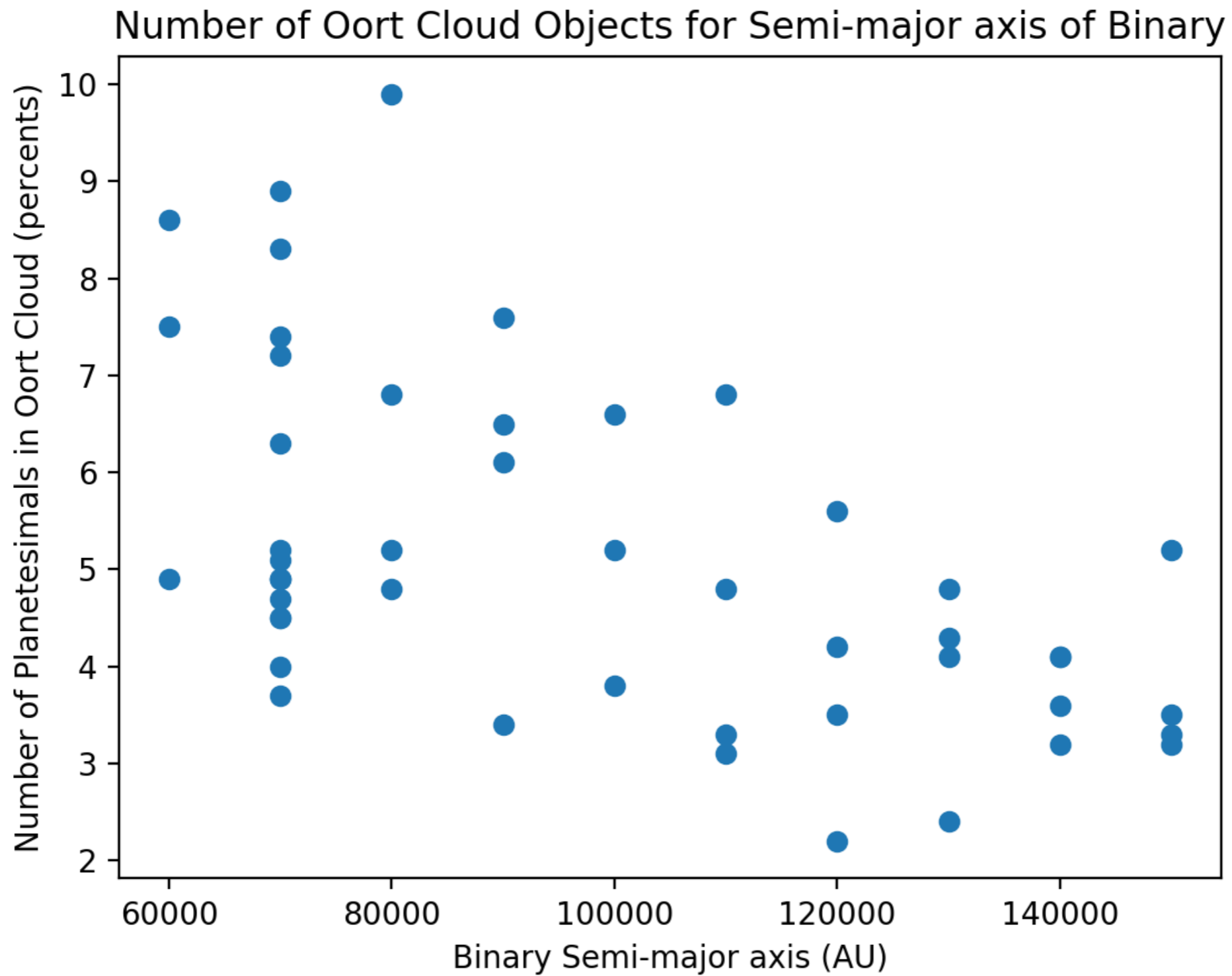
# Distribution of Oort Cloud Objects - Binary



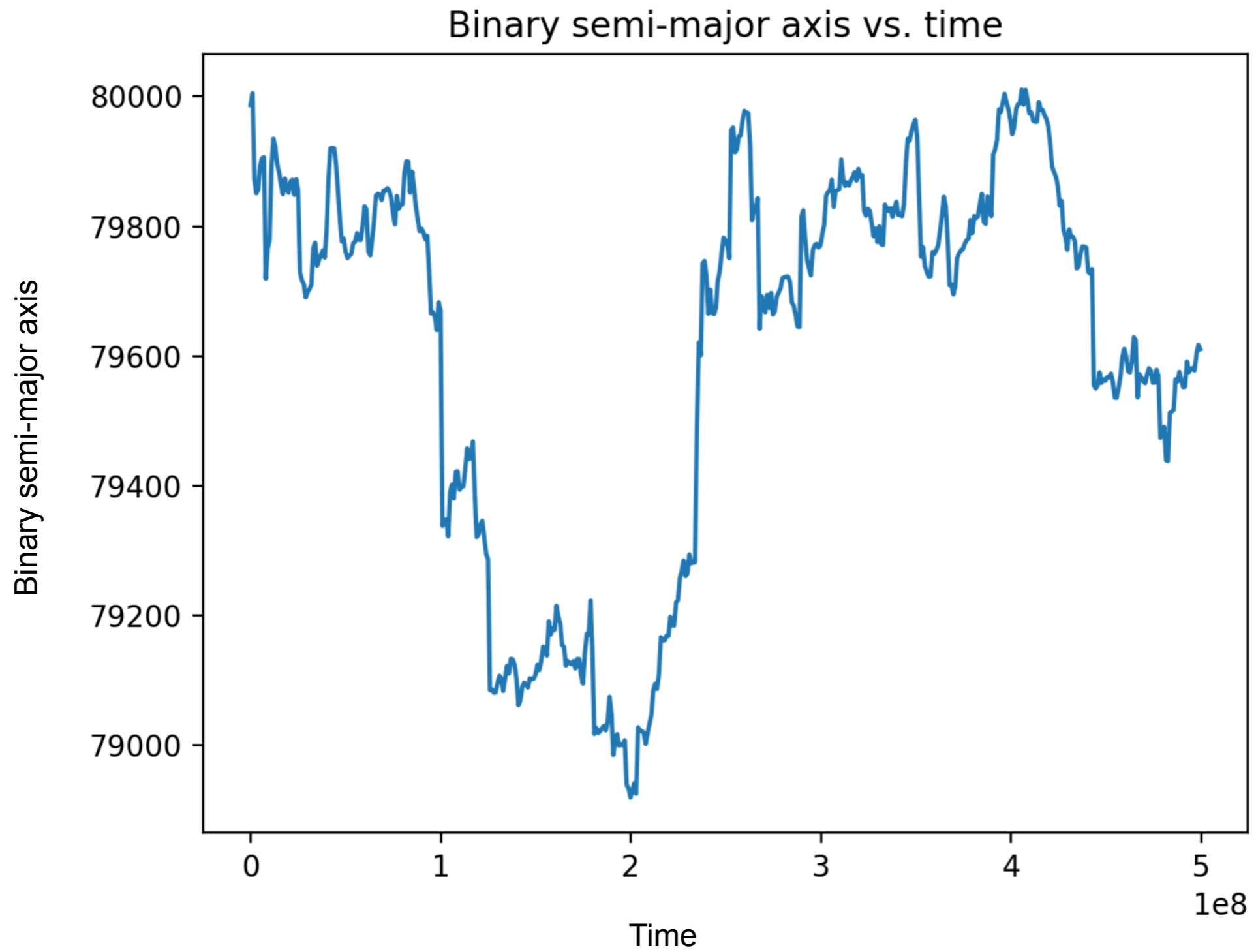
# Refer back...



# Trends

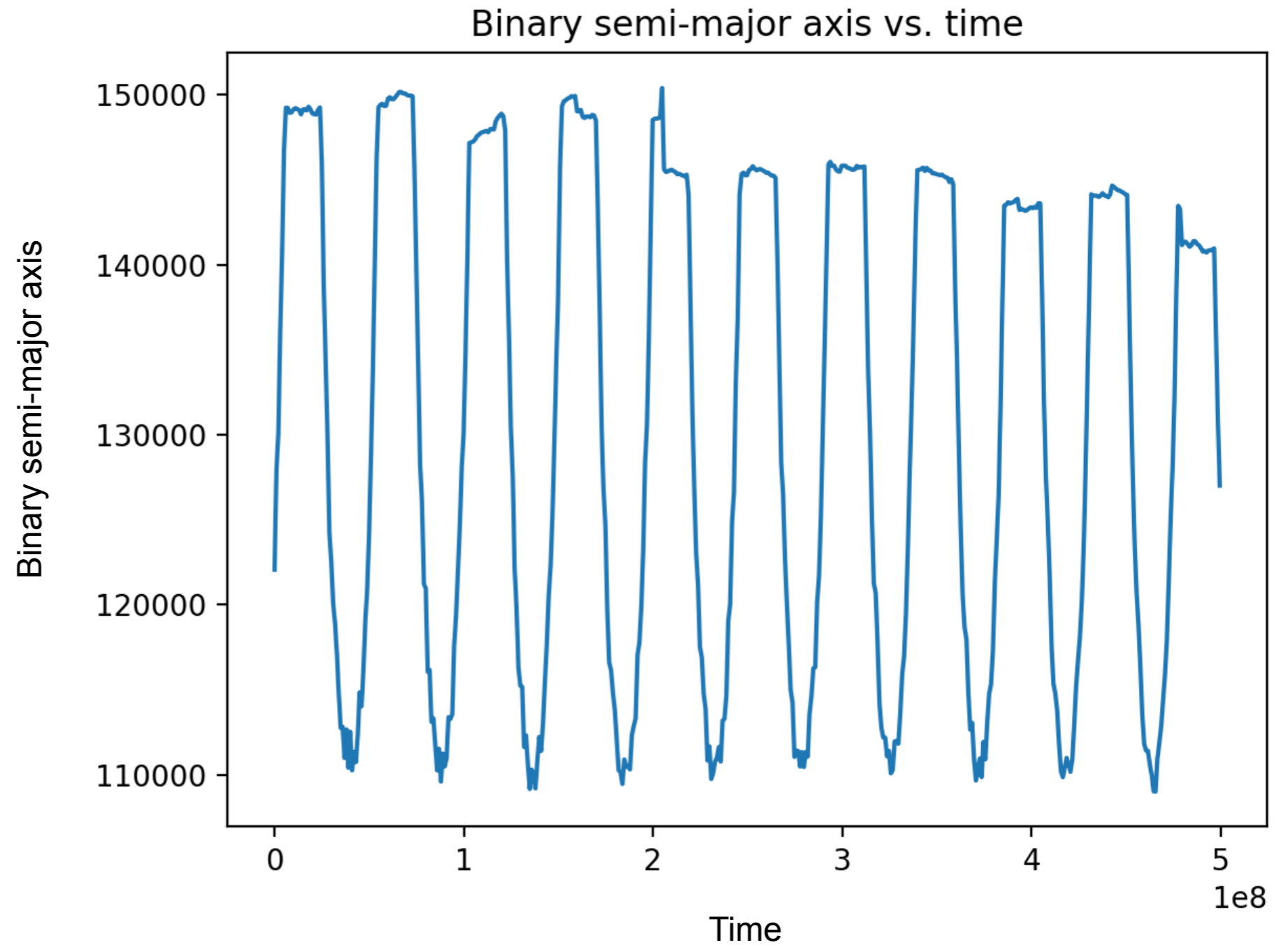


# Binary Lifetime



# Simulation 46:

- $a = 150,000\text{AU}$
- $\text{ecc} = 0.9$



# Success?

- Models: 10-100x simulations
  - Control Sim = 20
  - Best Binary Sim = 99
- Never ejected Binary

The background features a soft rainbow gradient from purple on the left to yellow on the right. Overlaid on this are faint, repeating floral and scrollwork patterns in a light grey or blue color. The overall texture is slightly grainy, resembling a watercolor or paper-like surface.

**Questions?**