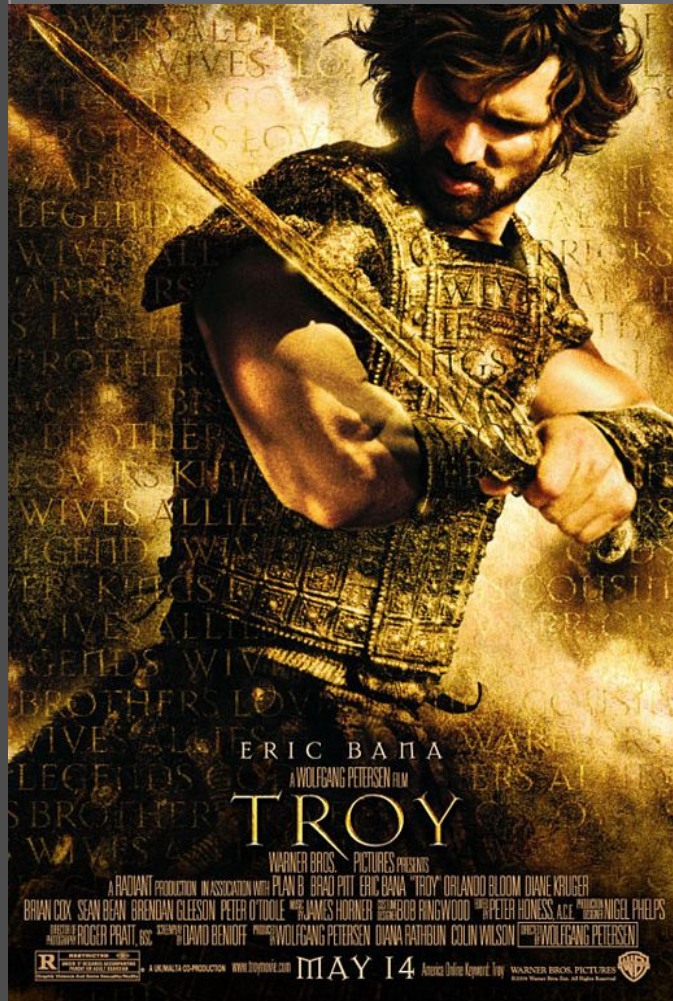




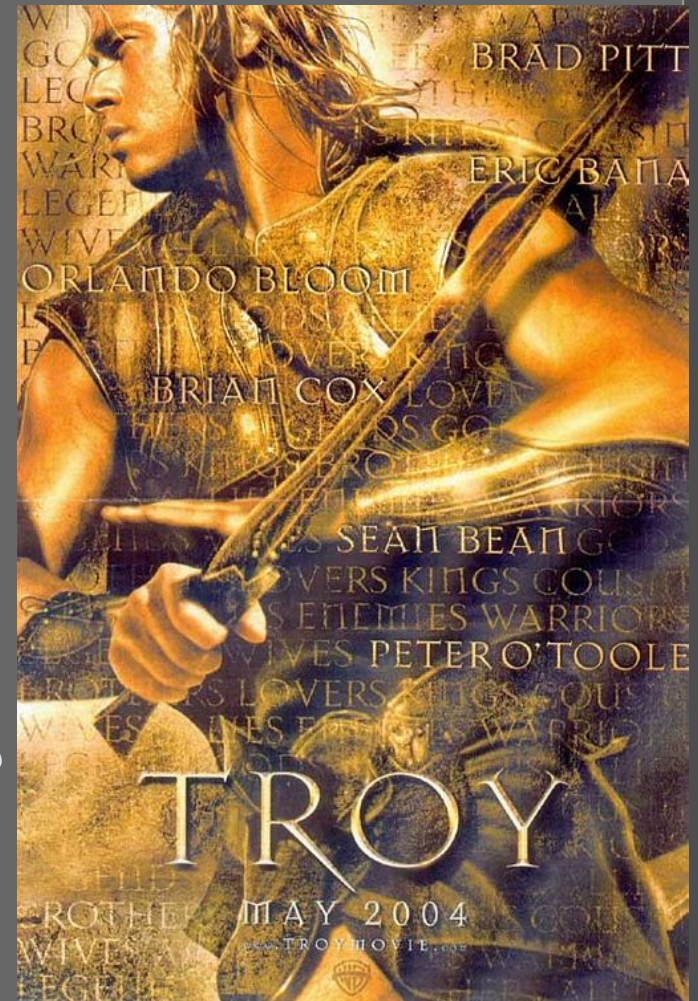
Stability of Jupiter Trojans and the difference between L4 and L5



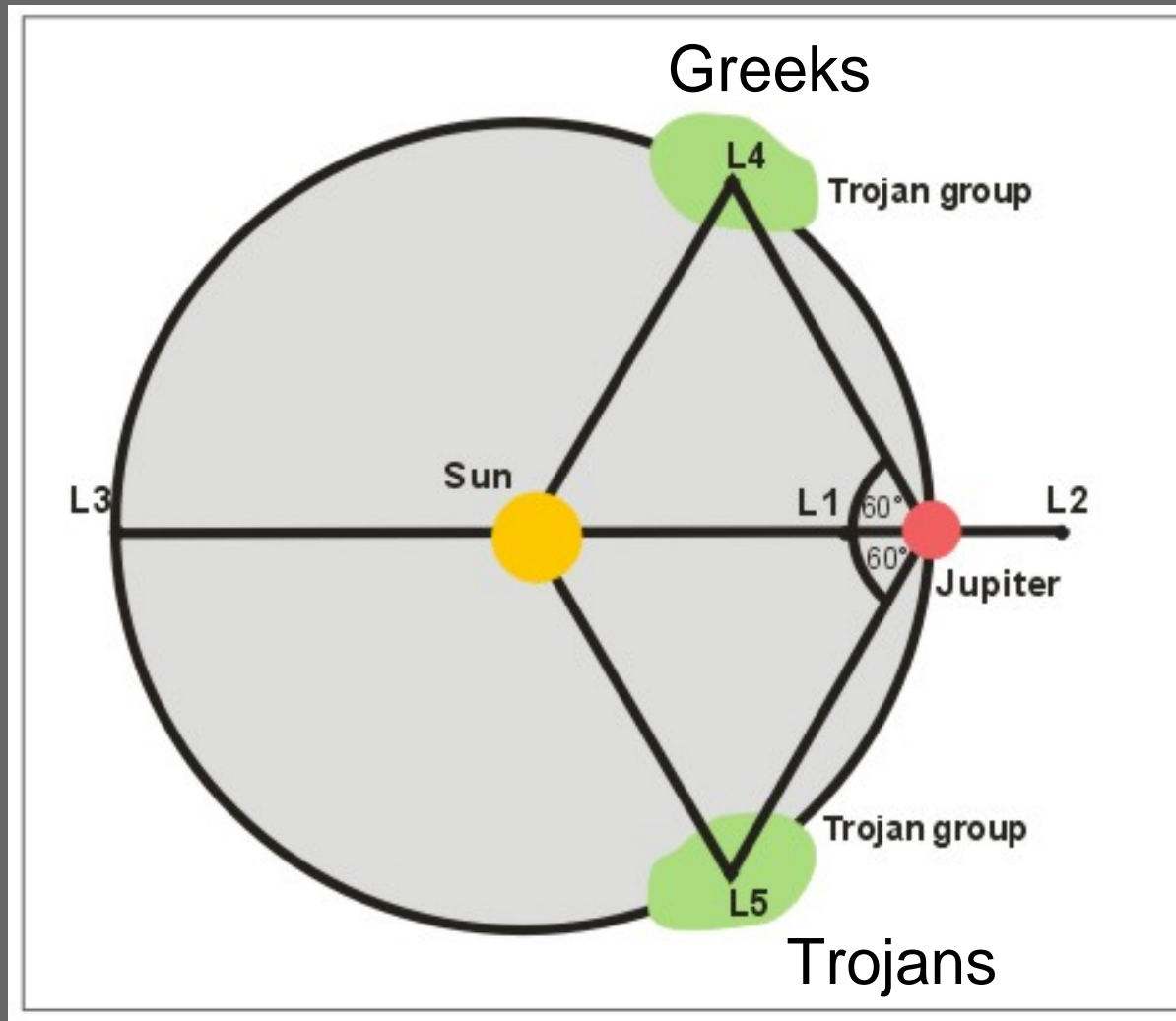
Greeks

VS.

Trojans



Introduction



Introduction

2 Goals:

- Determine Stability Regions around Lagrange Points
- Examine the Trojan Asymmetry

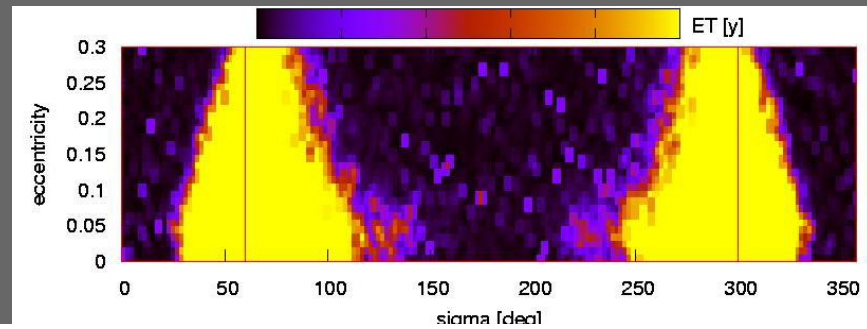
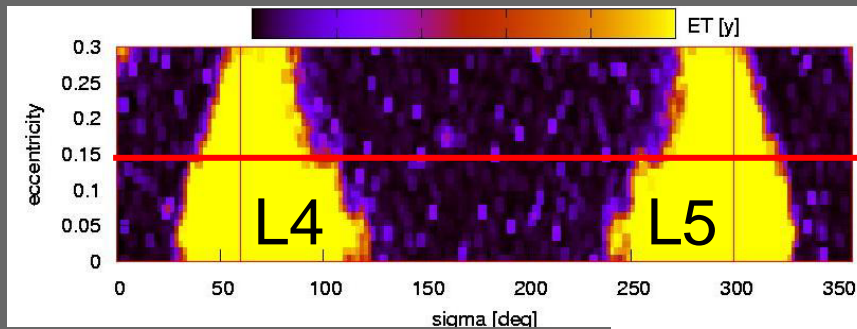
Setup

$$\sigma = (\omega + \Omega + M) - (\omega + \Omega + M)_{\text{JUP}}$$

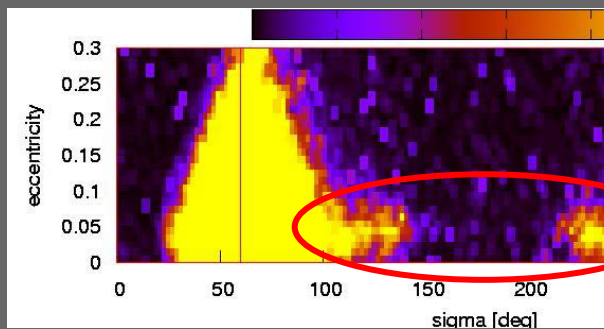
- 3 different models (~80000 test-asteroids)
- $(\sigma - e)$ plane :: $(\sigma - i)$ plane :: $(e - i)$ plane
- $(e - i)$: asteroids placed in the direct vicinity of the Lagrange points
- $(\sigma - e)$, $(\sigma - i)$: asteroids placed around the *whole* orbit of Jupiter
- investigation of escape time and $\Delta\sigma$ (libration width)

Stability regions: σ - e

Freistetter 2006, A&A



$i_{INI}=0^\circ$



$i_{INI}=25^\circ$

| i_{INI} | total | $e \leq 0.15$ | $e > 0.15$ |
|-----------|-------|---------------|------------|
| 0 | 33.42 | 43.66 | 22.52 |
| 5 | 33.85 | 44.60 | 20.98 |
| 10 | 34.55 | 45.13 | 23.30 |
| 15 | 34.66 | 43.75 | 23.40 |
| 20 | 34.55 | 44.38 | 22.57 |
| 25 | 32.62 | 45.15 | 18.09 |
| 30 | 30.90 | 44.93 | 14.93 |

Stability Regions: e - i

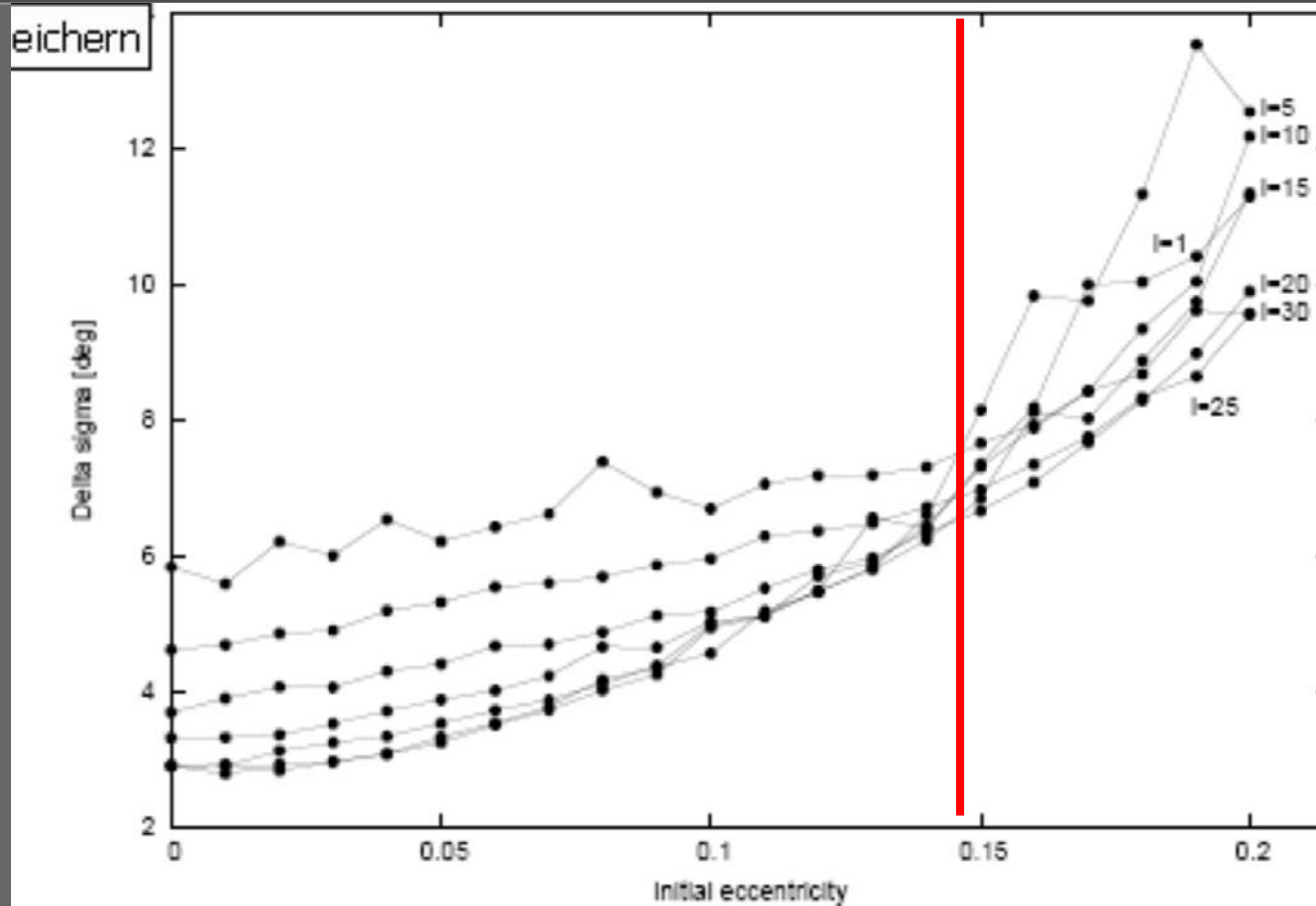
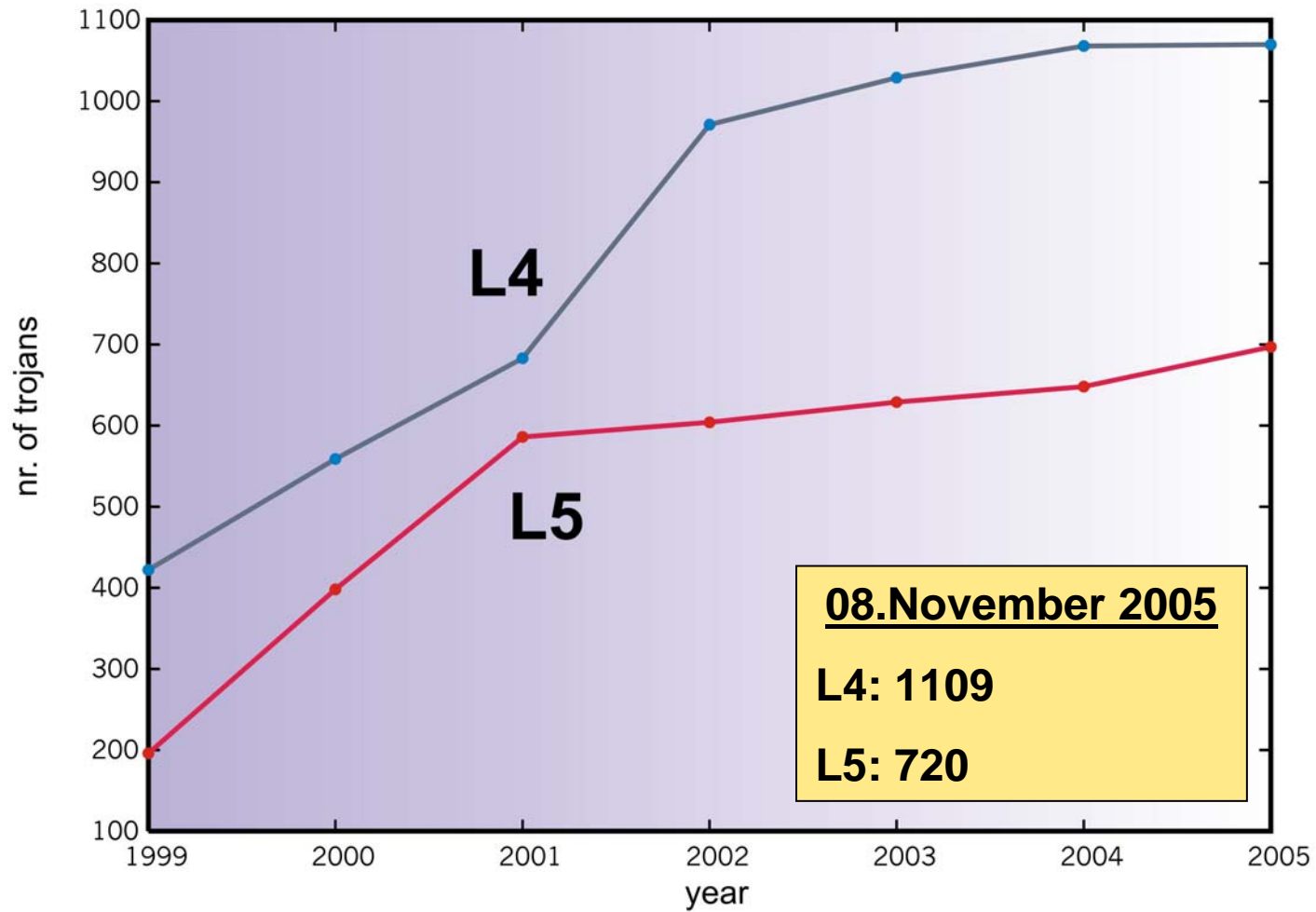


Fig. 3. Dependence of $\Delta\sigma$ on the eccentricity for L_4 (left) and

The Trojan Asymmetry



The Problem

1. Observational Reasons

Shoemaker et al. 1989

Fleming & Hamilton, 2000

Kuchner et al. 2000

2. Different Formation Processes

Peale 1993

Marzari & Scholl 1998

Beaugé & Roig 2001

3. Singular Event

Morbidelli et. al. 2005

4. Dynamical Reasons

Barber 1986

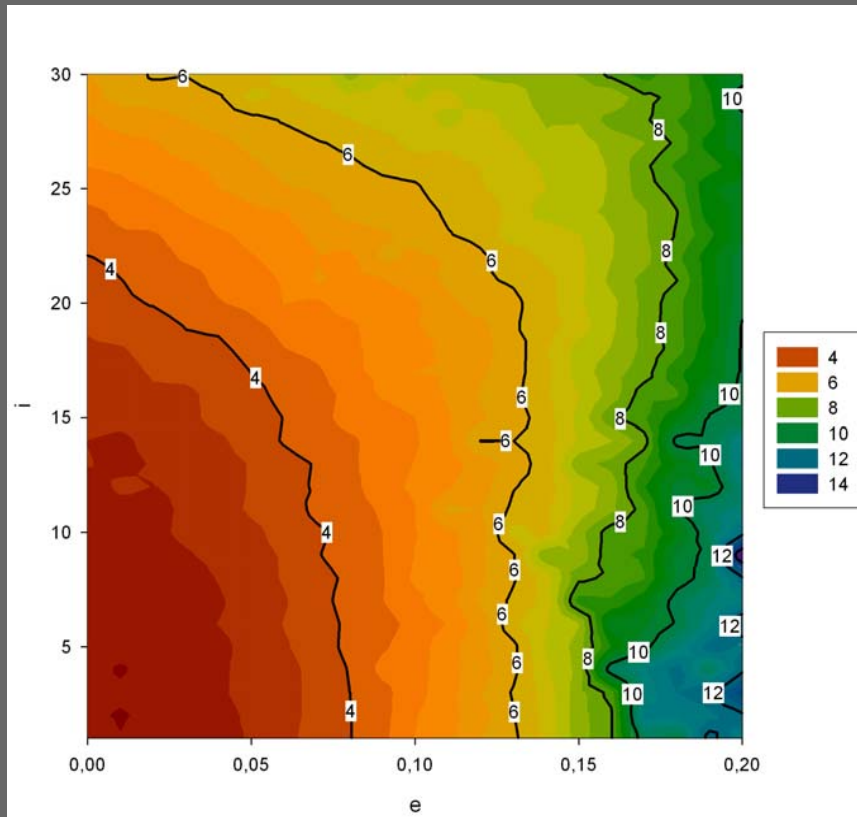
Pál & Süli 2004

Schwarz et al. 2004

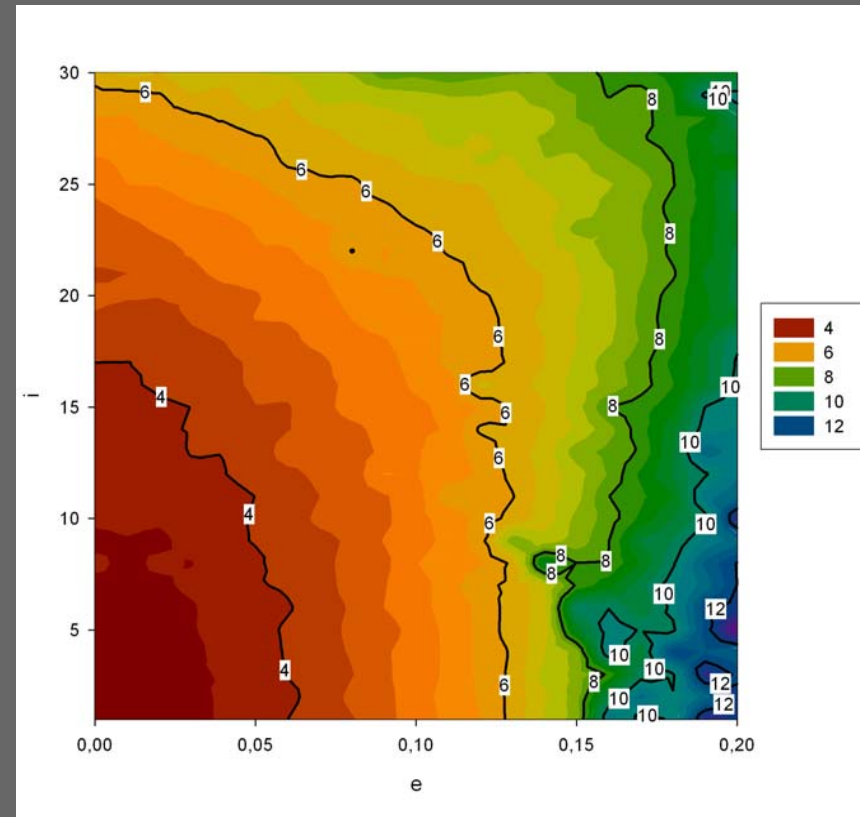
Dvorak & Schwarz 2005

Difference between L4 and L5

L4

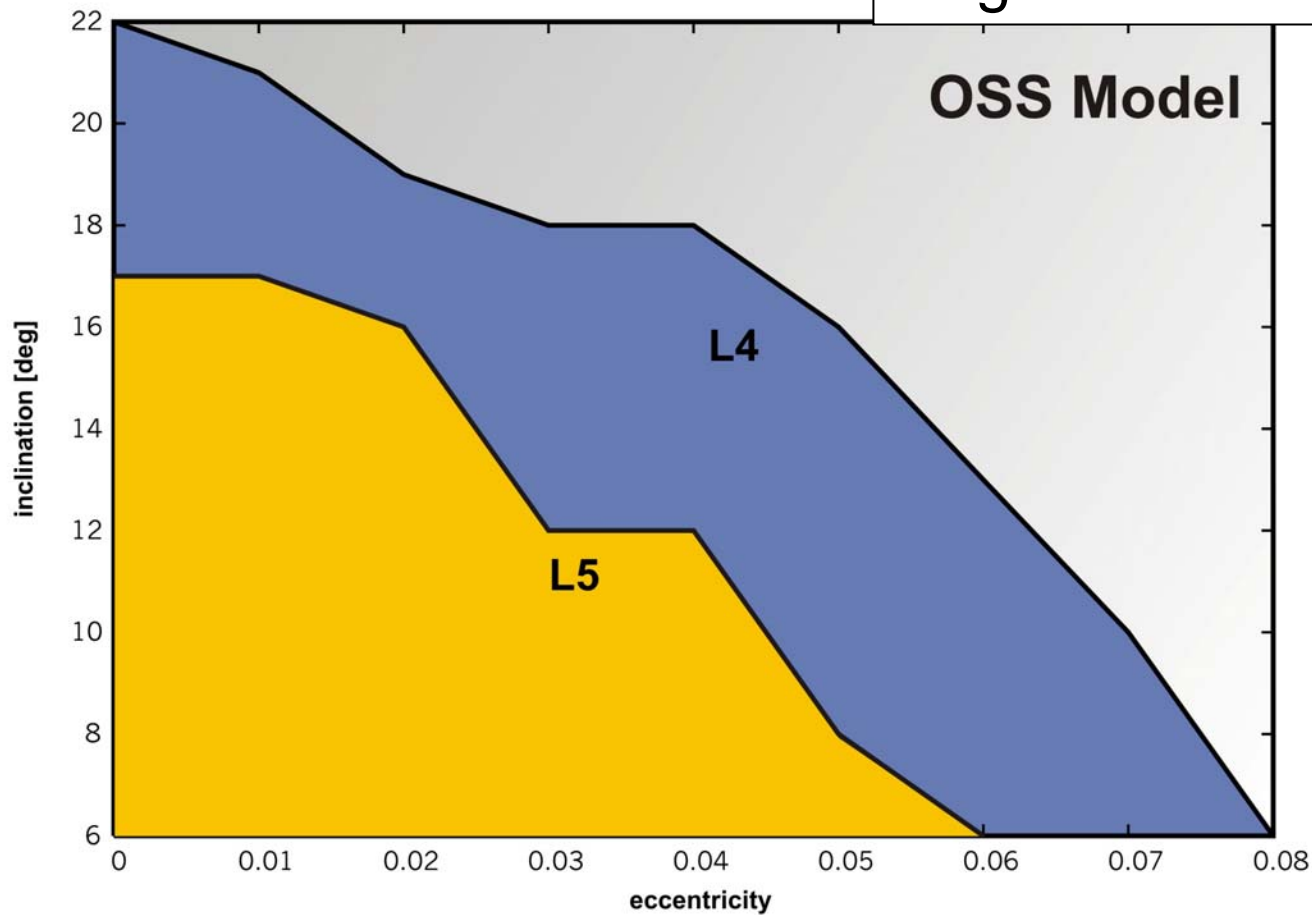


L5



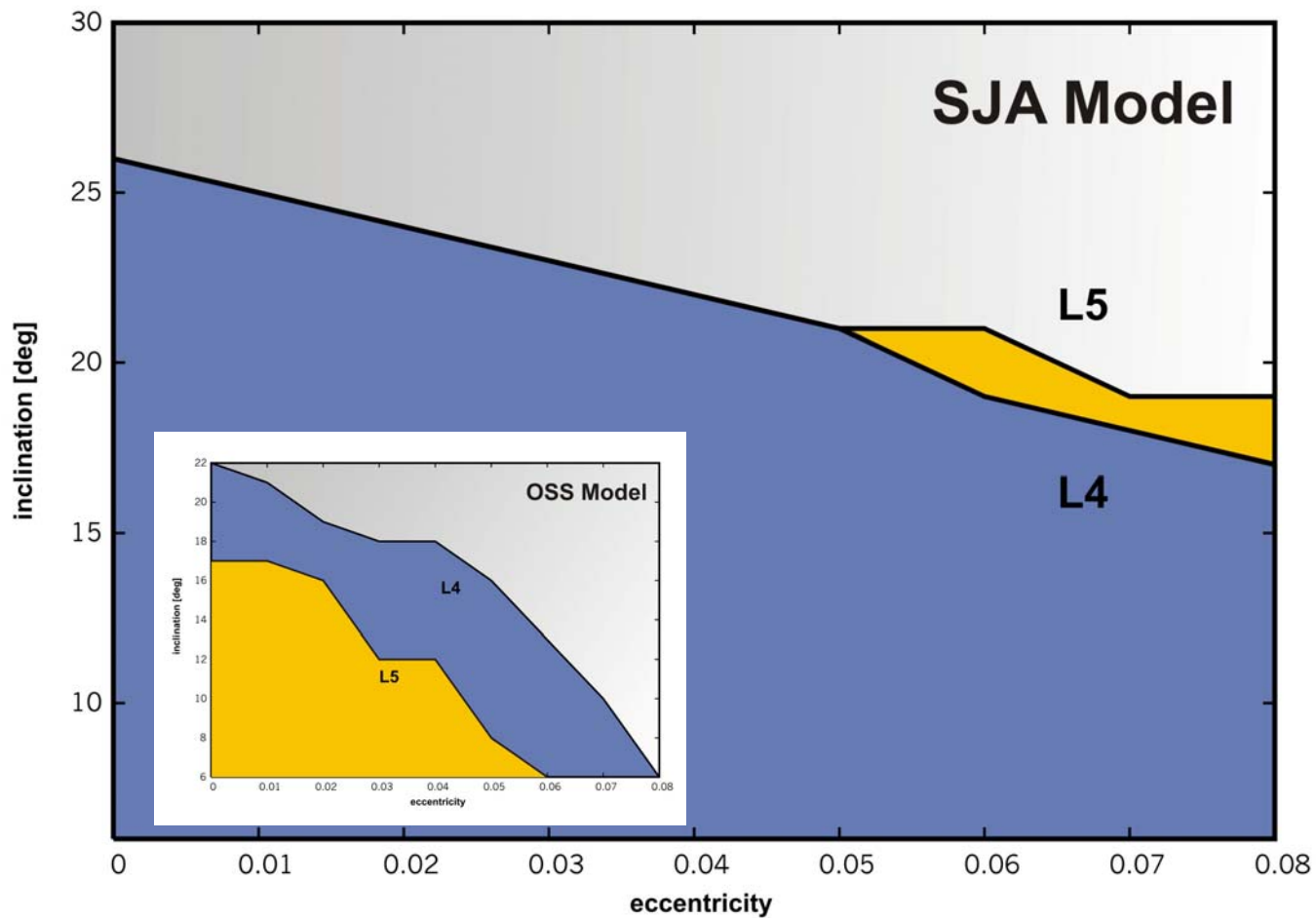
Difference between L4 and L5

Region of Minimum Libration



Libration width smaller than 4°

Difference between L4 and L5



Conclusions

- the initial eccentricity of $e=0.15$ plays an important role
- it influences the shape and size of the stability regions...

Conclusions

- We found a dynamical difference between L4 and L5.
- This difference is due to the influence of Saturn!
- Only the actual orbital elements were used (no chaos indicators!)
- The effect is distinctive!

Open Questions

- Is this effect the real reason for the difference in the populations?
 - more integrations for longer time scales and different initial distributions of asteroids are needed...
- What is the real reason of this effect?
 - mass, eccentricity, inclination,...
 - analysis of the mean-motion and secular resonances are needed...
- What is happening at $e=0.15$
- What is the reason for the strange shapes?

The story goes on...

... and the Greeks are still fighting the Trojans.

