Some aspects of chaotic diffusion of Trojan asteroids

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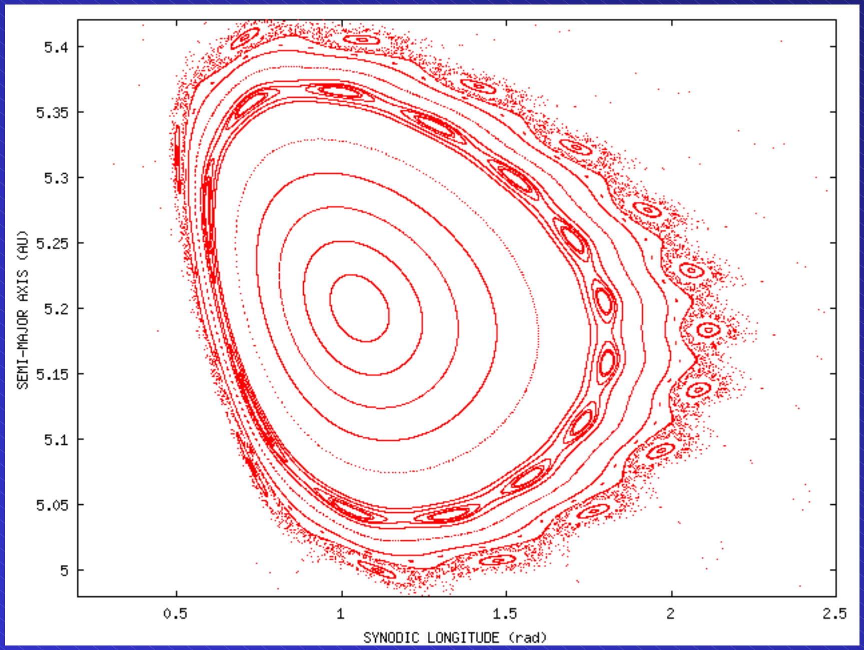
The phase space structure

Circular case: e'=0



Inner chain of islands: the 13:1 secondary resonance

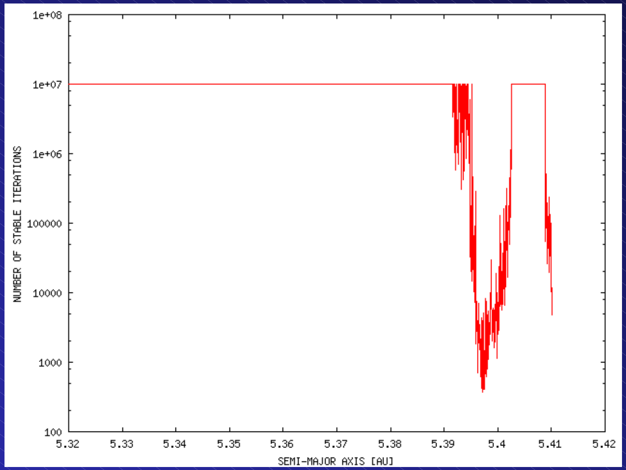
Outer chain of islands: the 14:1 secondary resonance

Boundary of the stability region

Elliptic case:

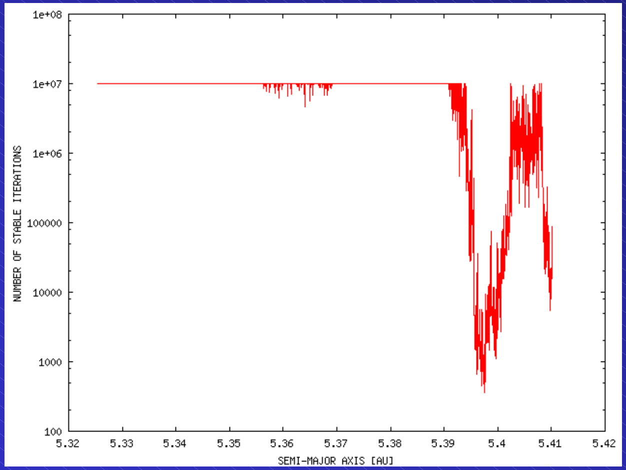
e'=0.048

e = 0.048



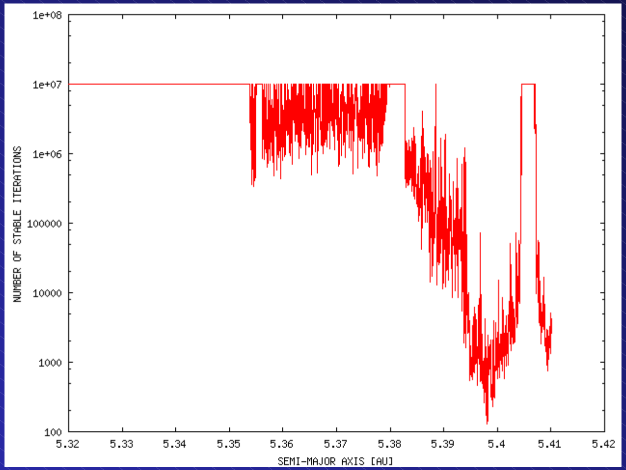
e', ϖ' secularly changing:

e = 0.048



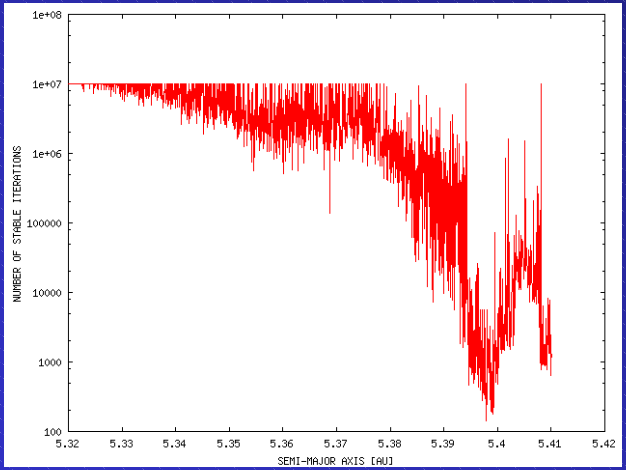
Boundary of the stability region

Elliptic case:
e’=0.048
e = 0.1



e’, ϖ’ secularly changing

e = 0.1

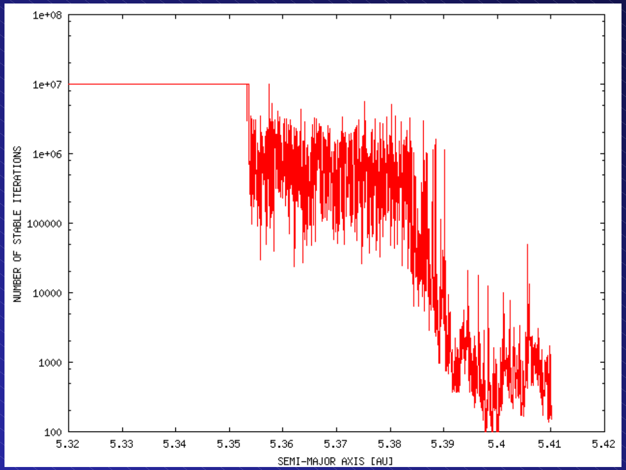


Boundary of the stability region

Elliptic case

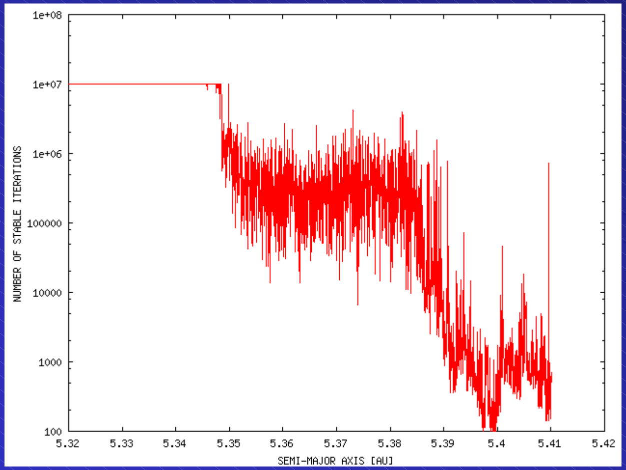
e’= 0.048

e = 0.15



e’, ϖ’ secularly changing

e = 0.15

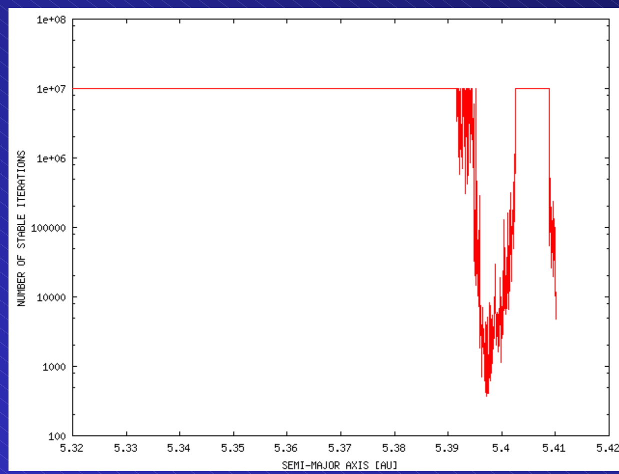


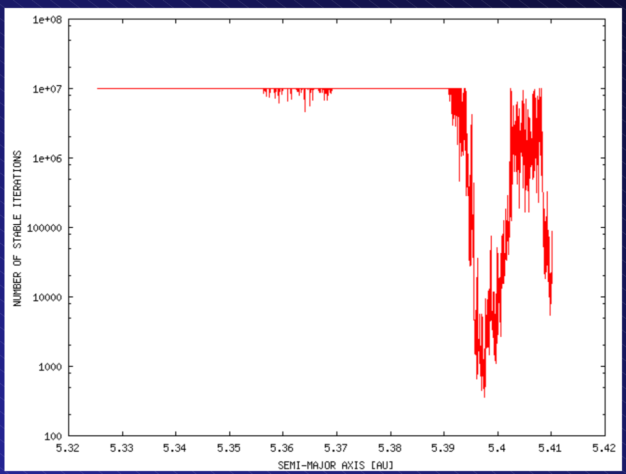
The role of the secondary resonances

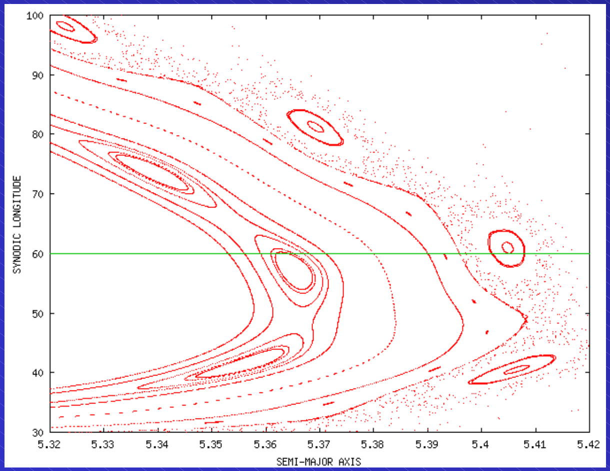
pure elliptic case

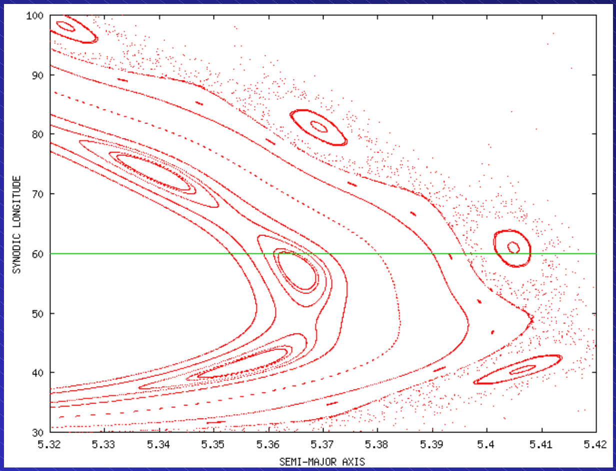
secular case

e = 0.048







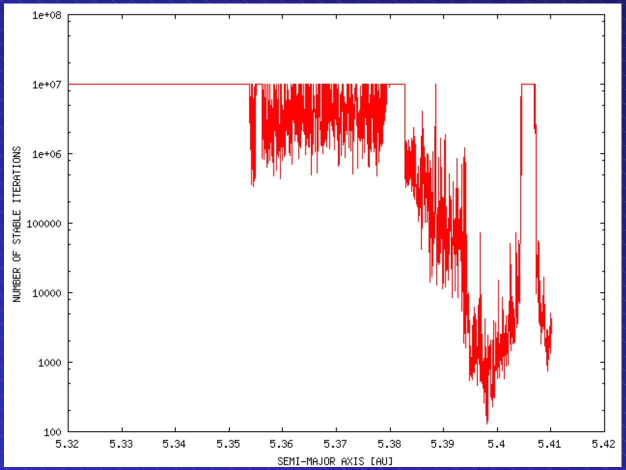


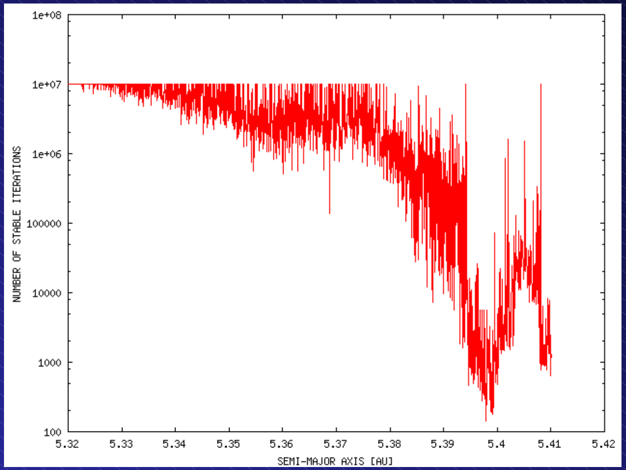
The role of the secondary resonances

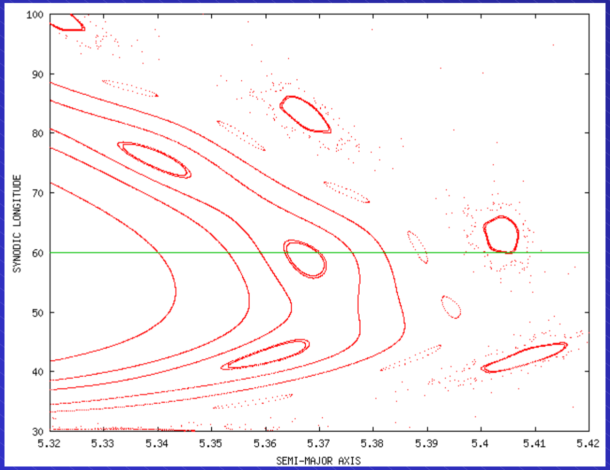
pure elliptic case

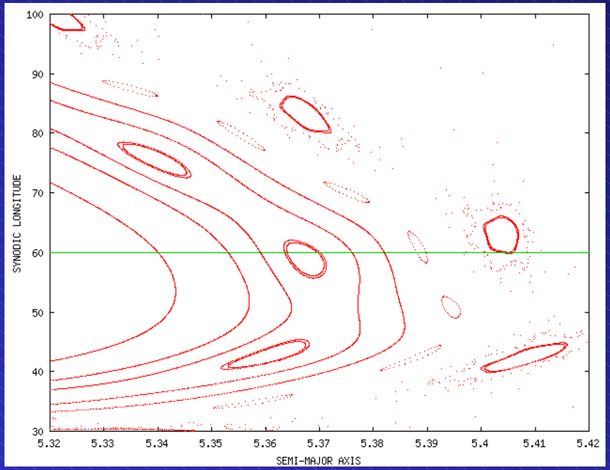
secular case

e = 0.1





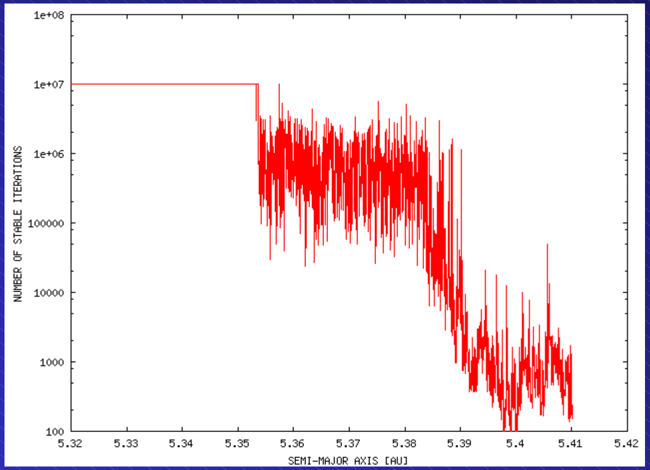


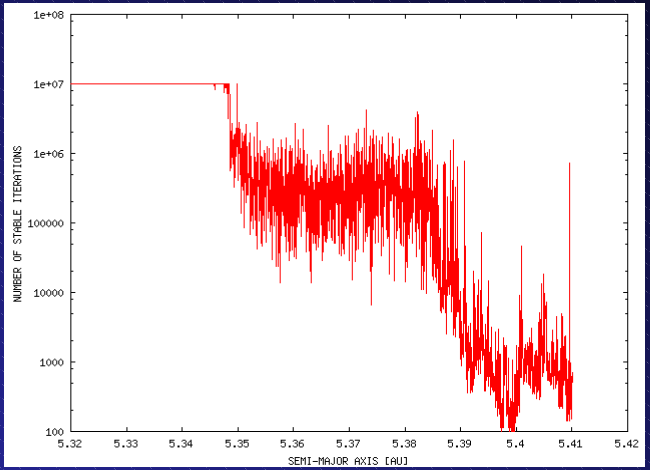


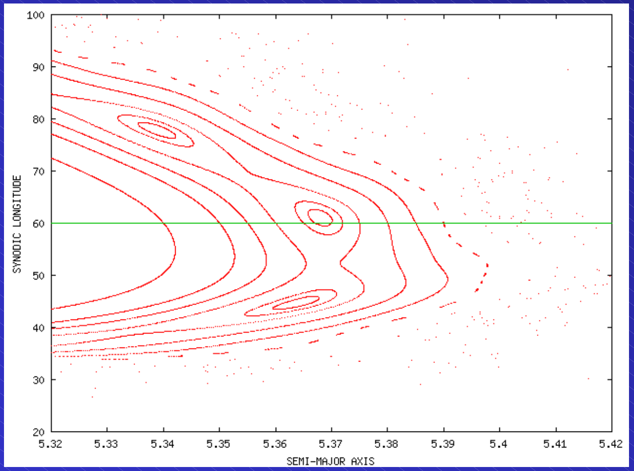
The role of the secondary resonances

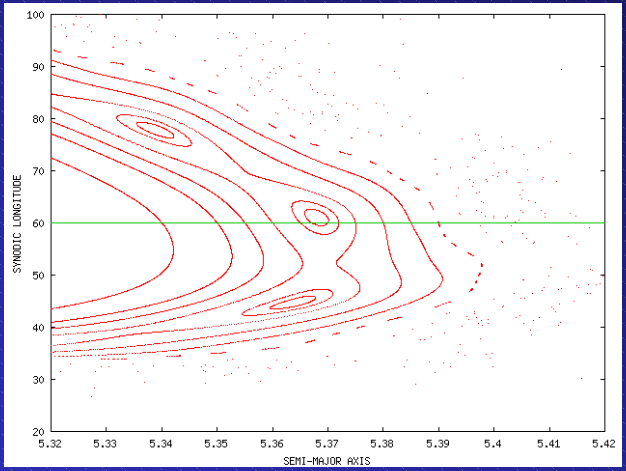
pure elliptic case | **secular case**

e = 0.15









Property of orbits

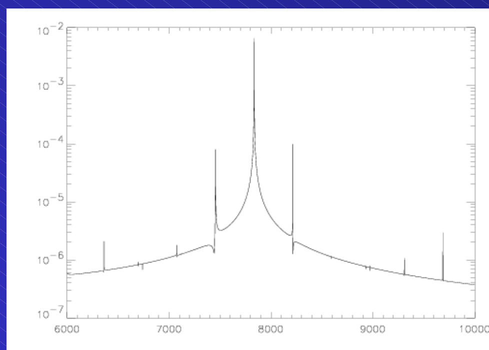
Observation: orbits in the vicinity of the secondary resonances are chaotic in the elliptic case $e \neq 0$
Proof: FFT power spectra

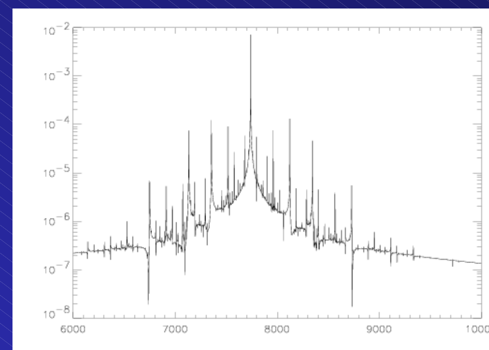
When *e* is small, orbits near these resonances are still stable (but chaotic), by switching on the planetary perturbations these regions become more unstable

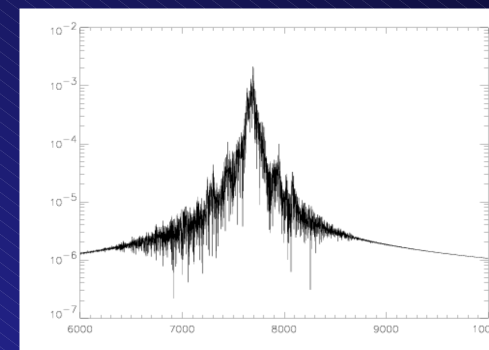
By increasing *e* these regions become unstable even in the elliptic case, the presence of secular perturbations do not influence very much the stability

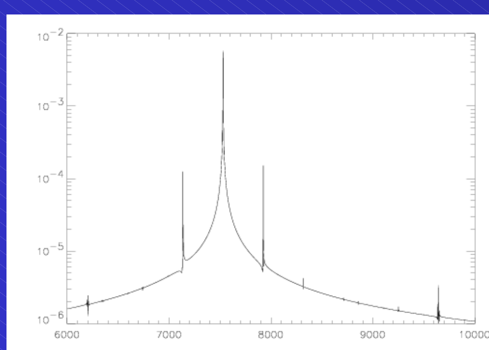
FFT Power Spectra

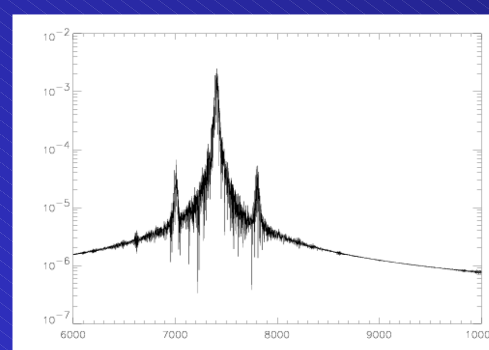
e = 0.048; a=5.346, 5.357, 5.367, 5.378, 5.388, 5.40 (AU)

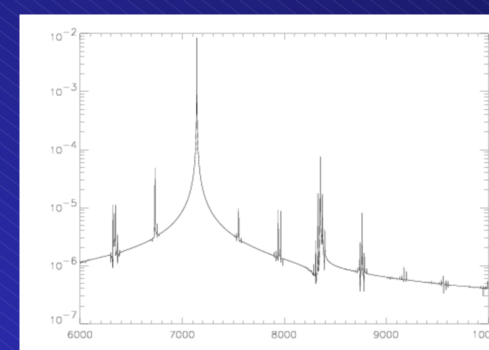












Conclusions:

The regions of the phase space, where <u>in the circular problem</u> (e'=0) the islands of secondary resonances take place, become chaotic by increasing e'.

For small e' these chaotic regions are stable, by switching on the secular perturbations these regions become unstable in a 10-100 million years timescale.

For larger e', these regions are unstable, by adding the secular perturbations, the stability region does not change essentially.

<u>The secondary resonances may play a not negligible role in the destabilization of Jupiter's Trojans</u>