3rd Austrian Hungarian Workshop on Trojans and related Topics

Stability of P-Type Orbits in Exoplanetary systems

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Stability of P-Type Orbits in Exoplanetary systems

- Planets around binaries
- The calculations of planetary orbits
  - Modell
  - Initial conditions
- The results
  - Dependence from the eccentricity
  - Dependence from the inclination

Planets around binaries

- Possible planetary orbits in binaries
- Are there any planets found in binary systems

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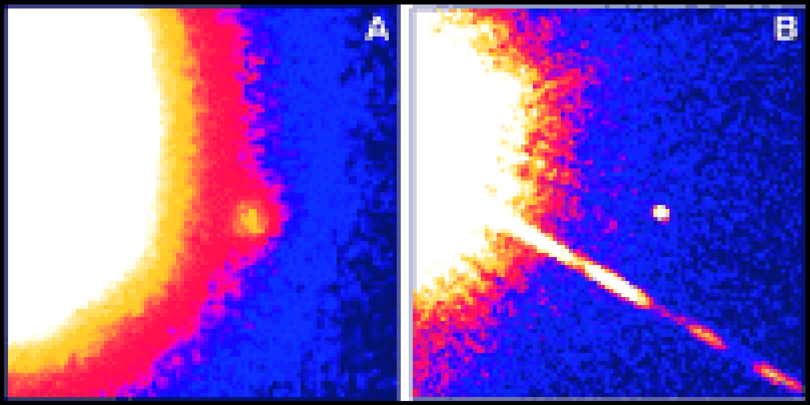


The calculations of planetary orbits: Modell

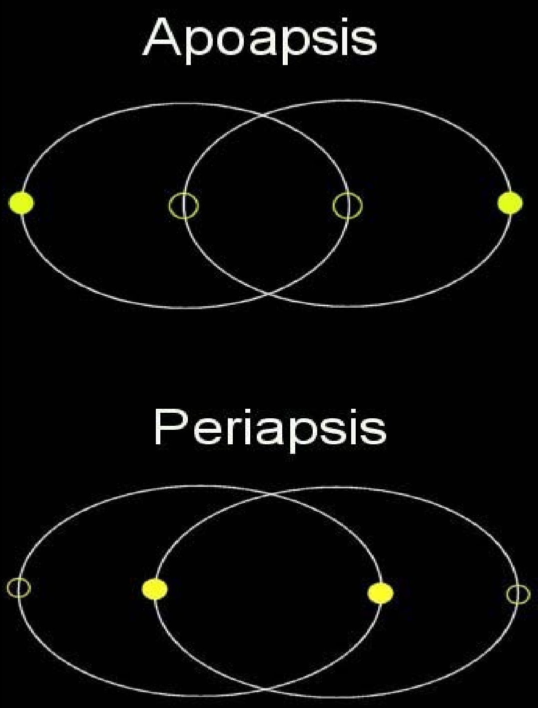
- Description of calculation
- Integration of the orbit

Description of calculation

- The restricted three body problem
  - Two stars m_1, m_2 and a third body $m_3=0$
- The stars:
  - Mass ratio: $m_1=m_2$ $\mu=0.5$
  - Distance between the stars is one
- The planets:
  - Move in the gravitational field of the primaries
  - Follow the equations of motion of the restricted three body problem

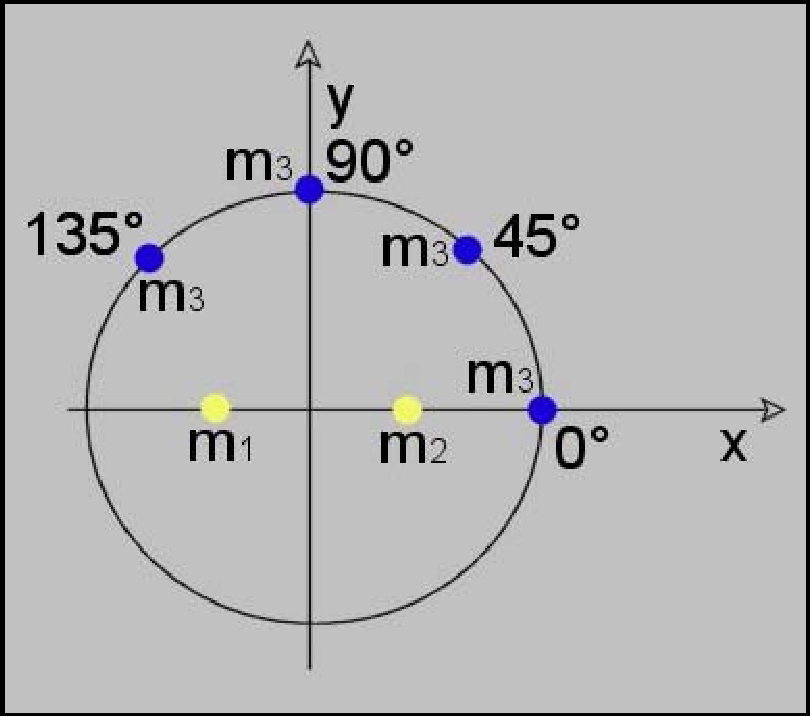
Initial Conditions:
The stars

- Different eccentricities
  - e = 0 – 0.5
  - Step = 0.05
- Two initial positions:
  - Apoapsis
  - Periapsis



Initial Conditions: The planets

- The planets start on circular orbits
- Different inclinations
  - $0° < i < 50°$
  - Step: 2.5°
- 4 initial positions
- Different distances from the barycentre



Integration of the orbit

- Each orbit was integrated until:
  - the planet escaped
  - the integration time limit (50000 periods of the primaries) was reached

The results

Some examples:

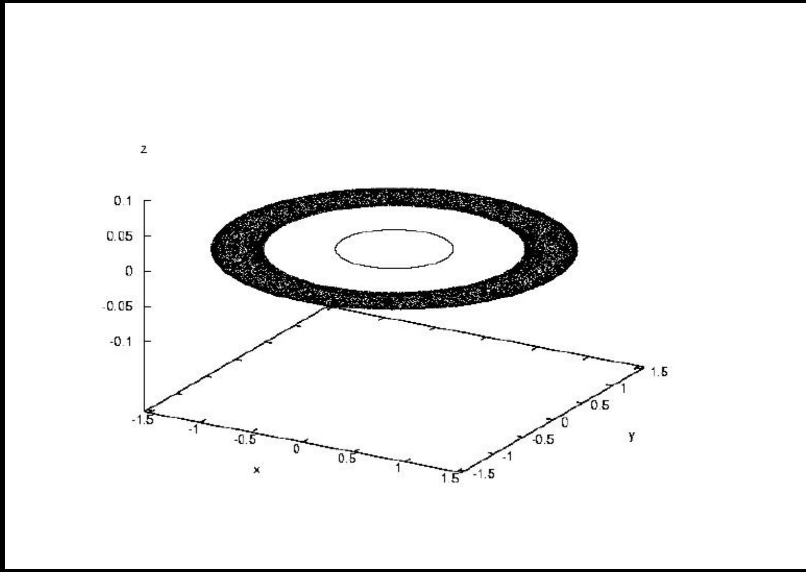
– Planetary orbits with inclination:

» i = 0°

» i = 10°

» i = 30°

» i = 50°



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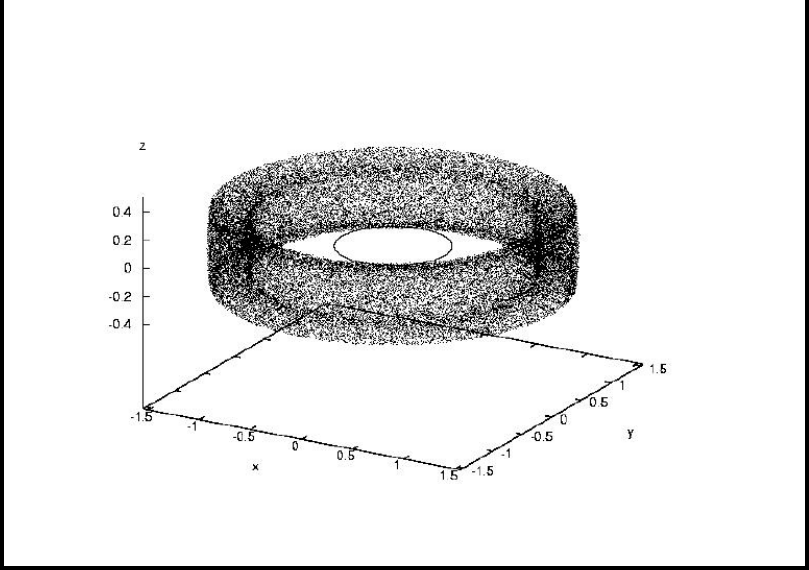

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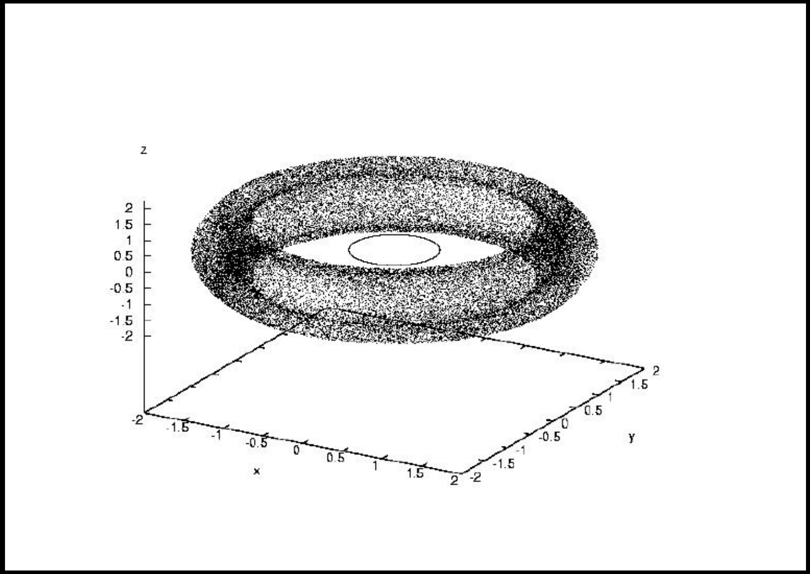

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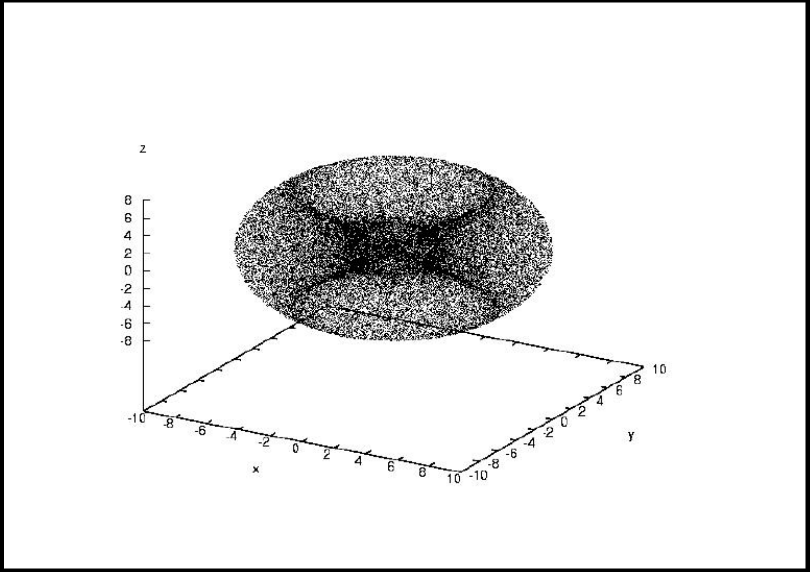
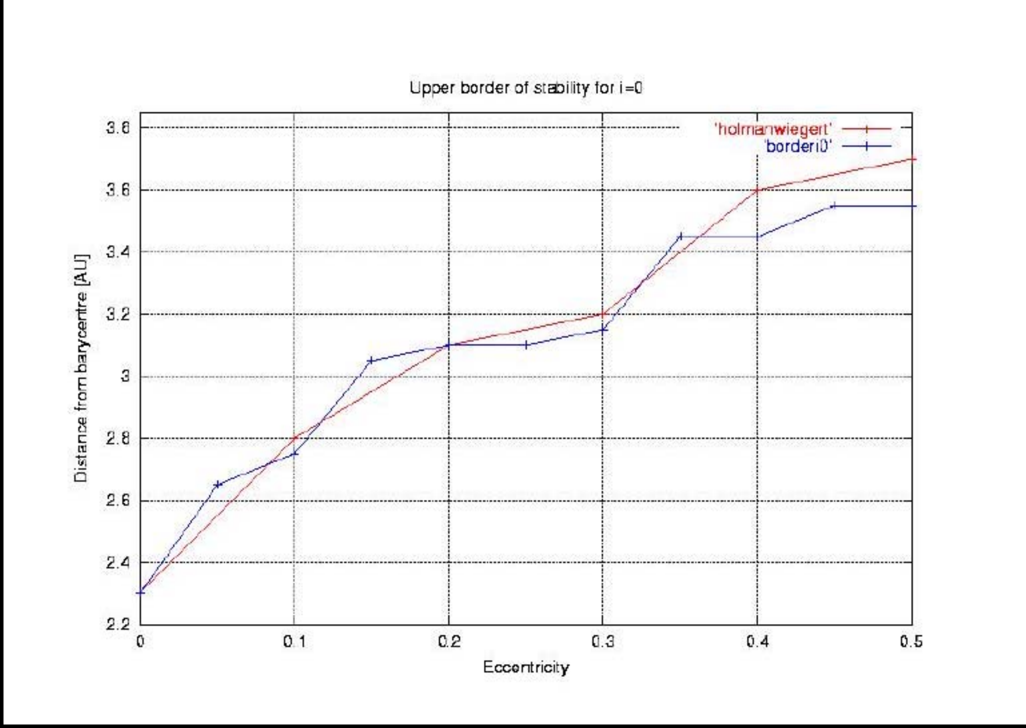


The results

- Border of stability
  - Absolut upper border
    - Over this border all orbits were stable
  - Absolut lower border
    - Under this border all orbits were unstable
  - Between those borders: chaotic region
- Dependence from the eccentricity
- Dependence from the inclination

Dependence from the eccentricity

- Comparison of the border of stability for i=0 with Holman-Wiegert
- The border of stability for different eccentricities and inclinations



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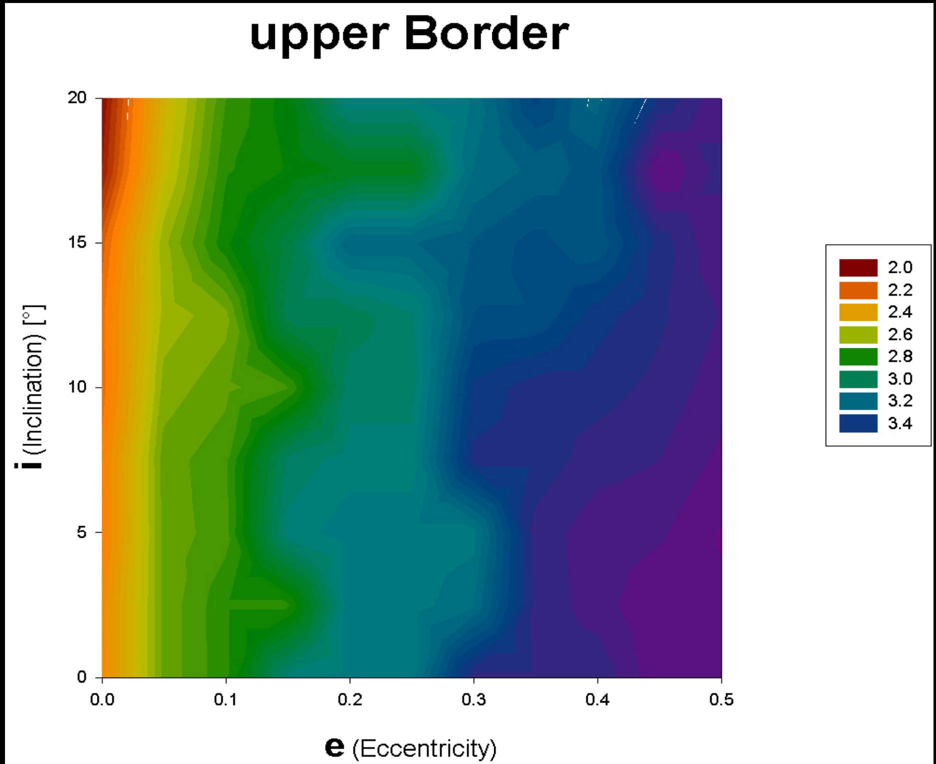
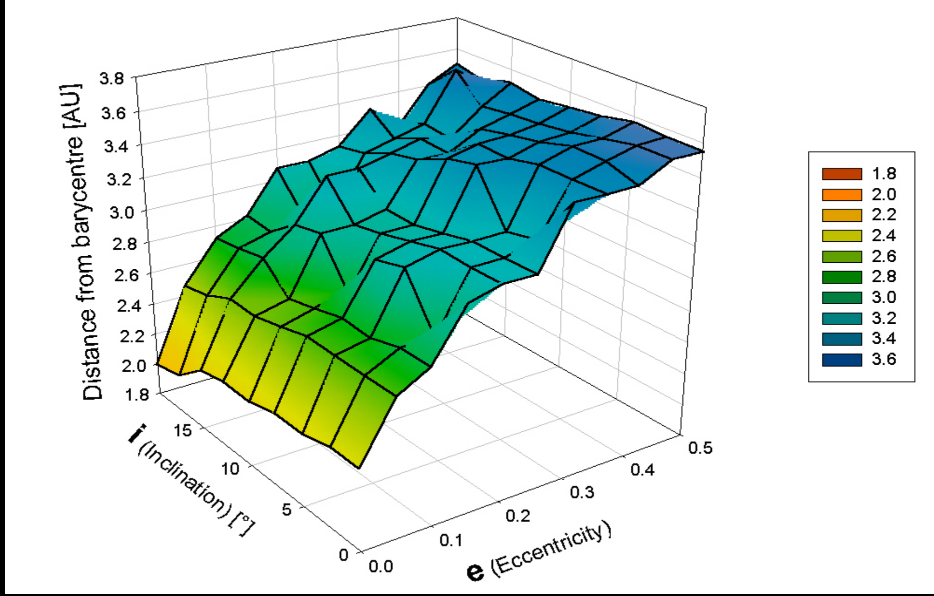
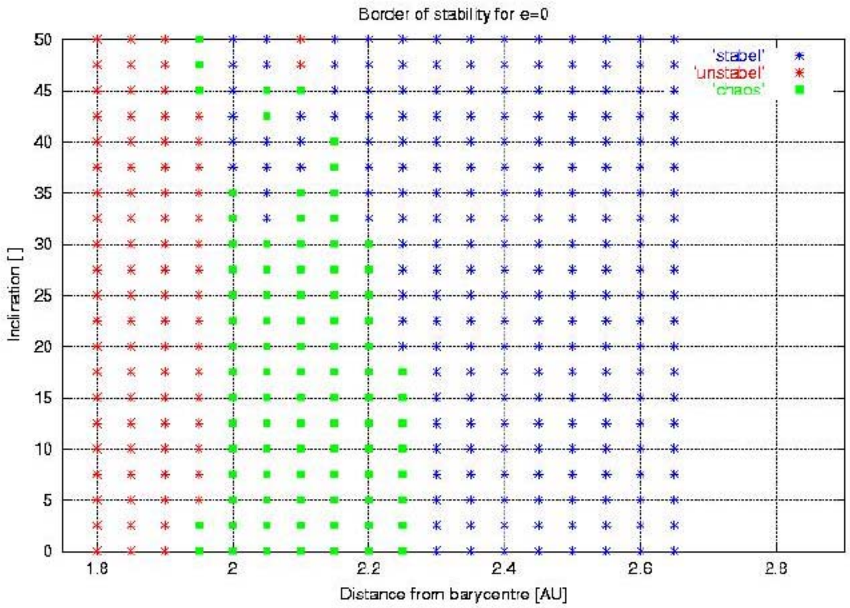
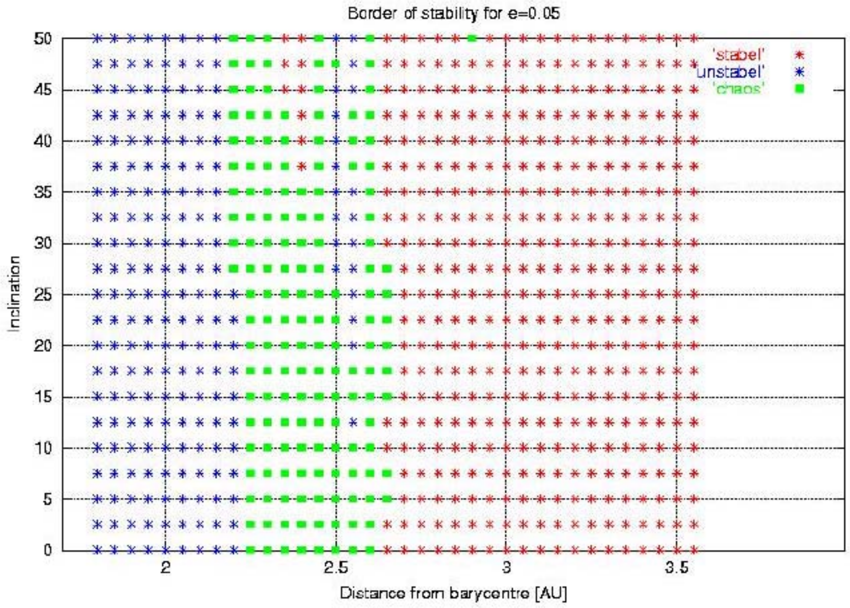




Dependence from the inclination

- For e=0 and 0.05
  - Stabel, unstabel and chaotic region
  - Upper und lower border of stability
  - Escape times:
    - For e=0
    - For e=0.05





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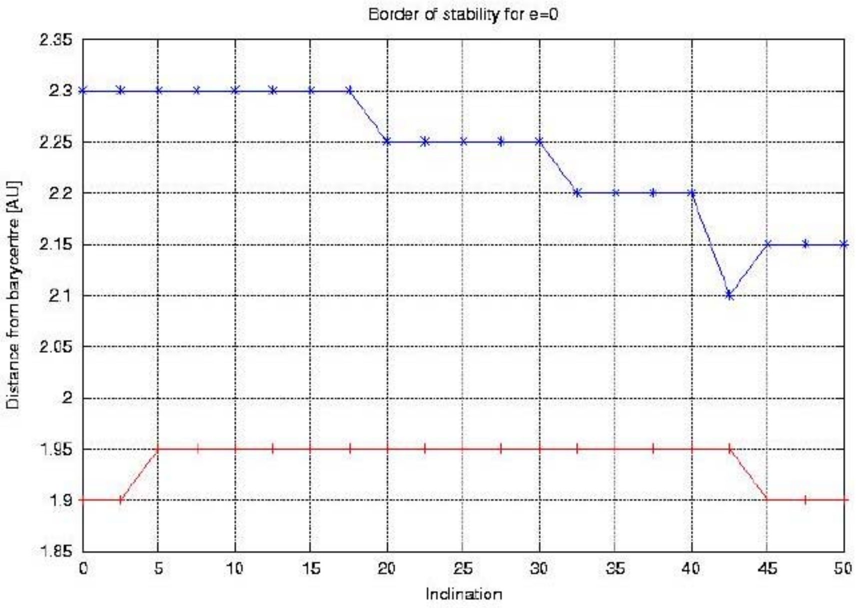

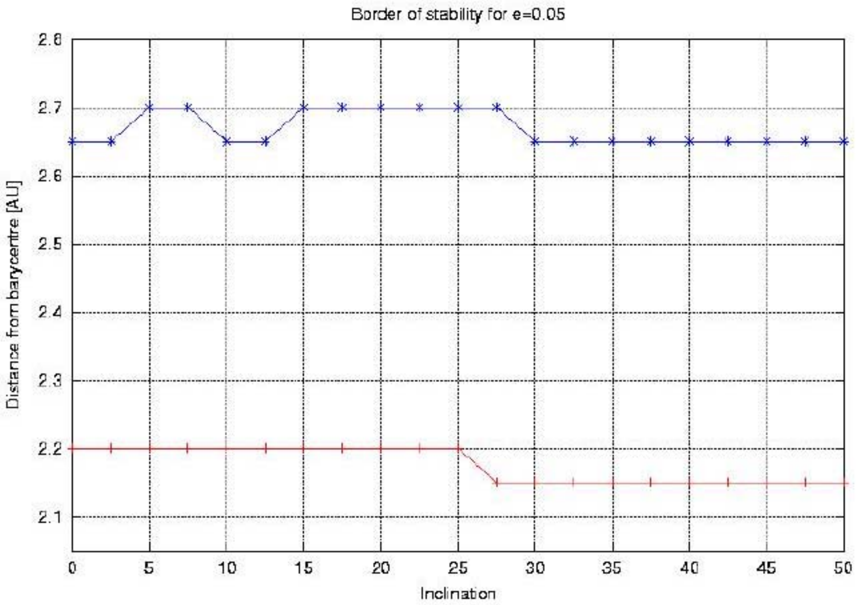

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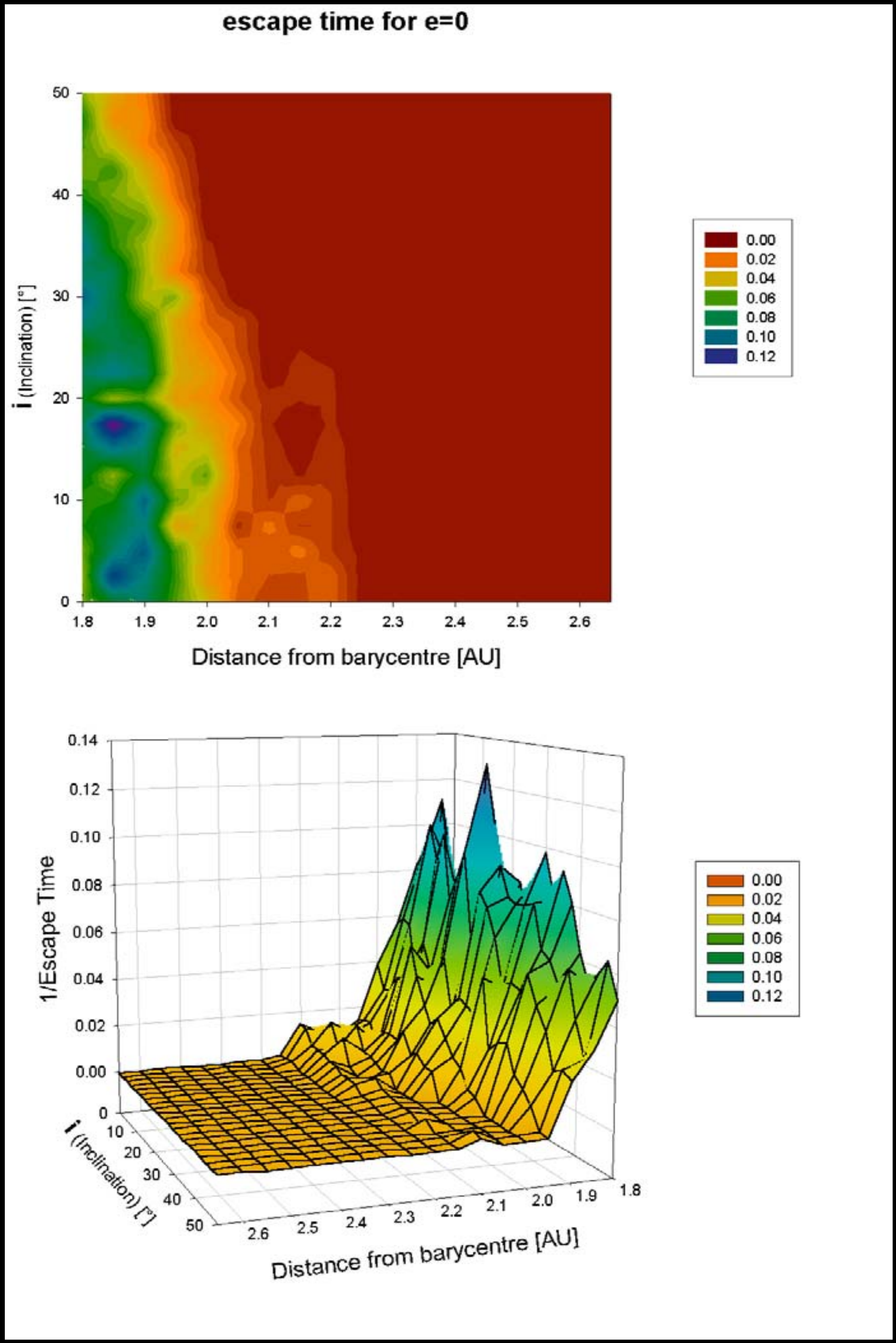

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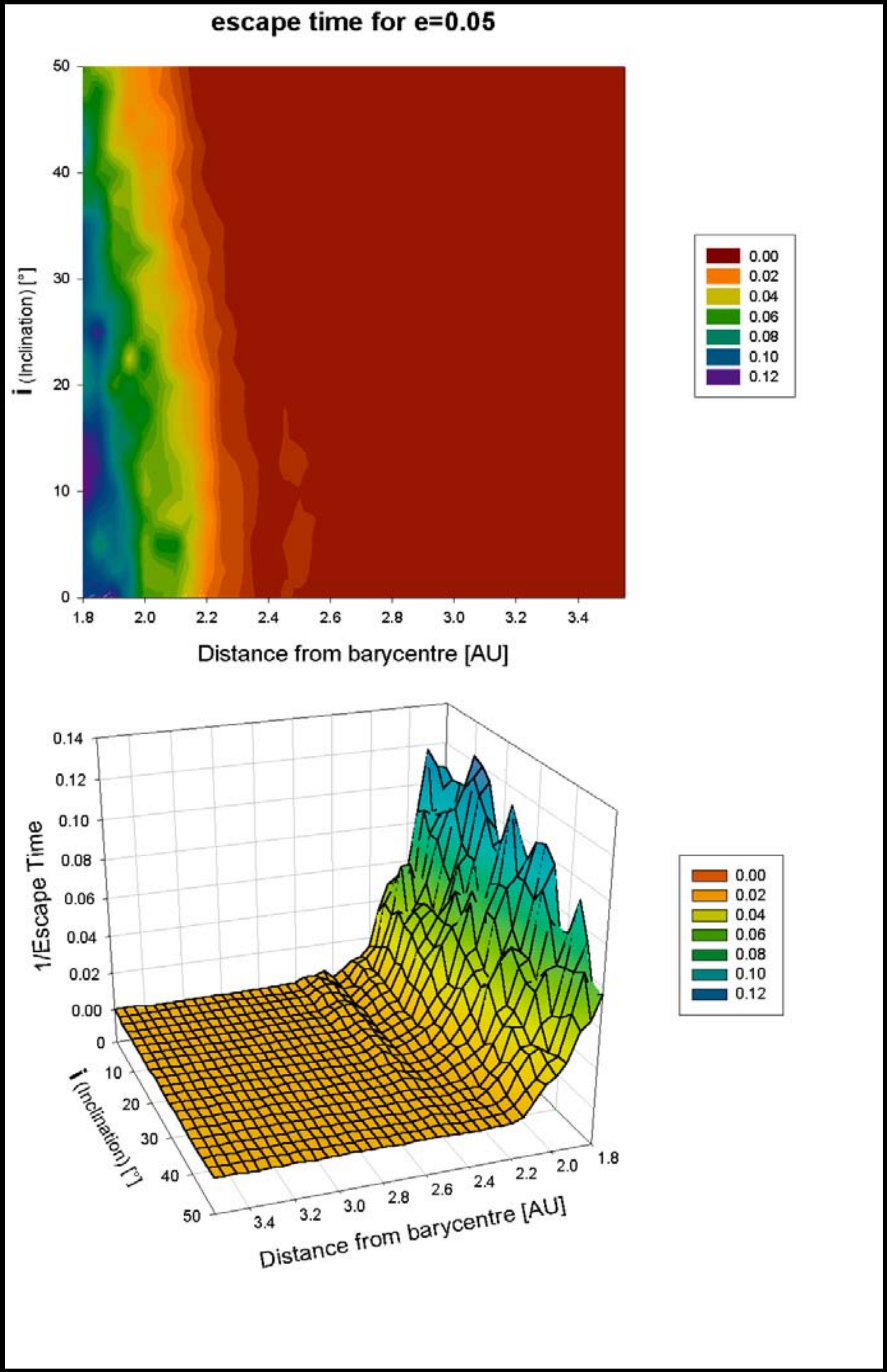

Conclusions

- Lower and upper border decrease slightly with the inclination
- Increase from the border of stability with e independent from the inclination
- Calculations for more values of the eccentricity and the inclination will be done