CELMEC IX

Astronomical Institute of the Czech Academy of Sciences

Photo: MoMet team

What chaos maps teach us about the Taurids meteoroid stream

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Melaine Saillenfest – Jérémie Vaubaillon – Marc Fouchard

Previous works

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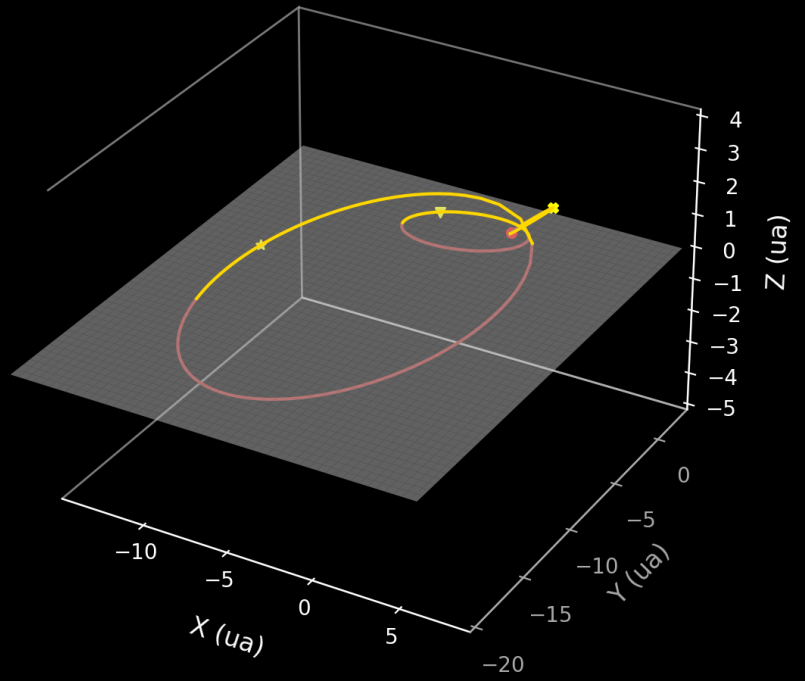
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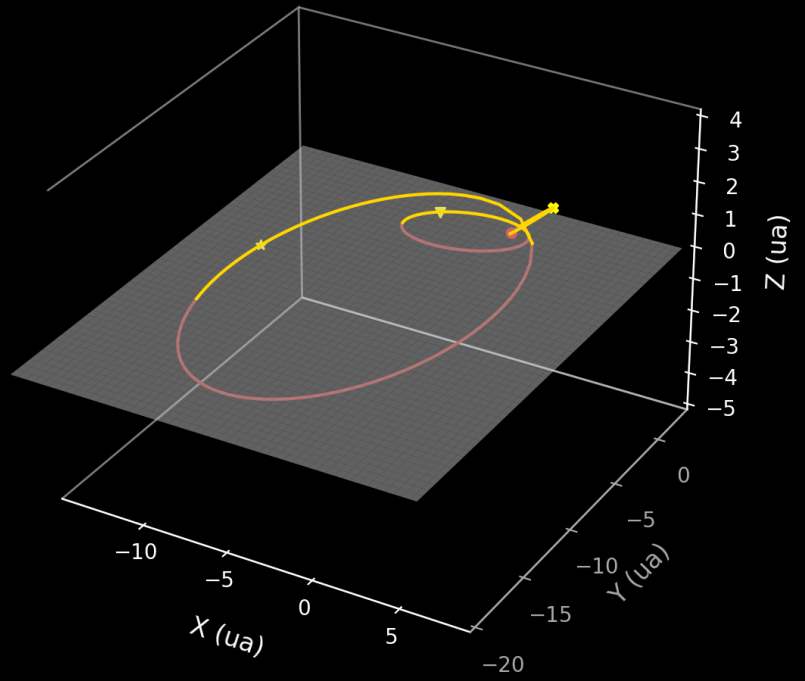
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Do all stream follow this pattern ?



Why the Taurids?

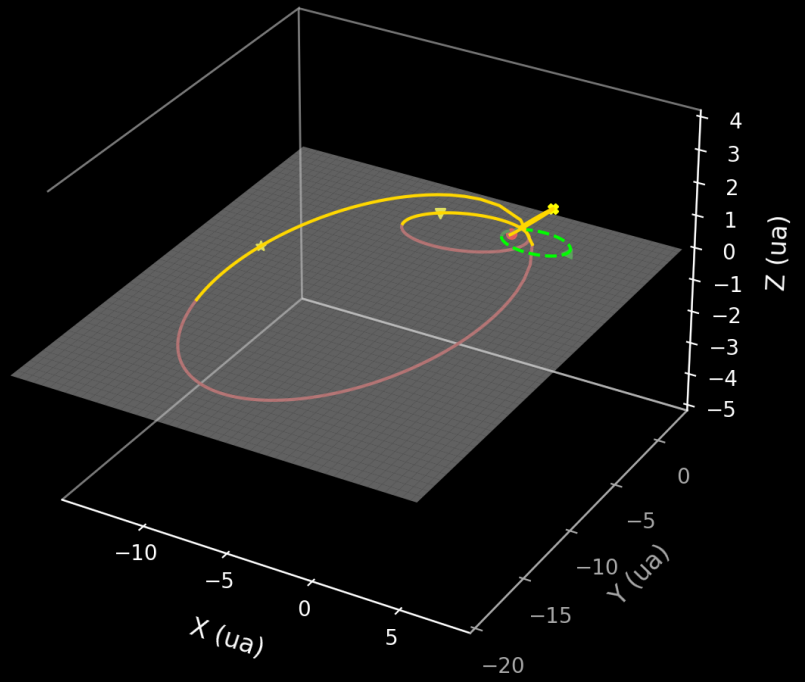
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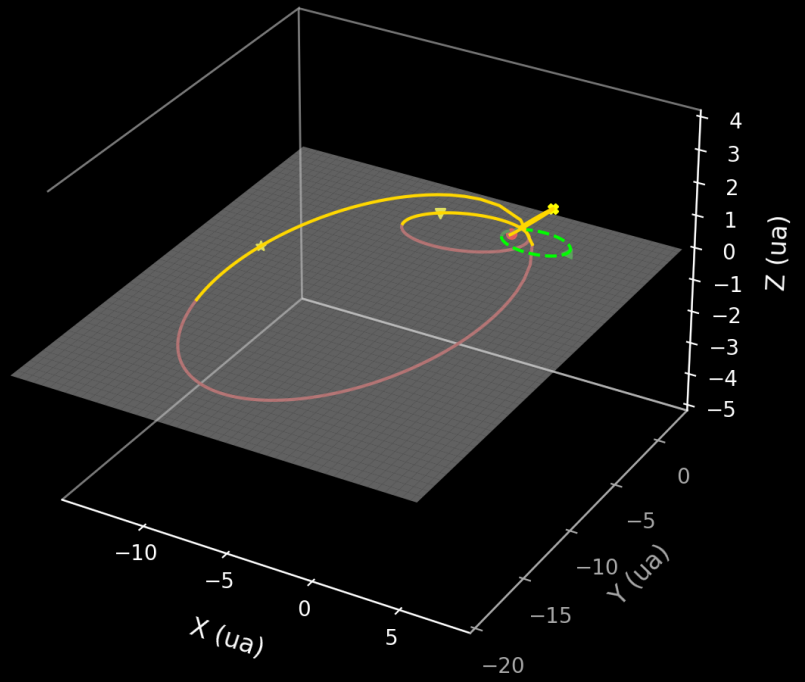


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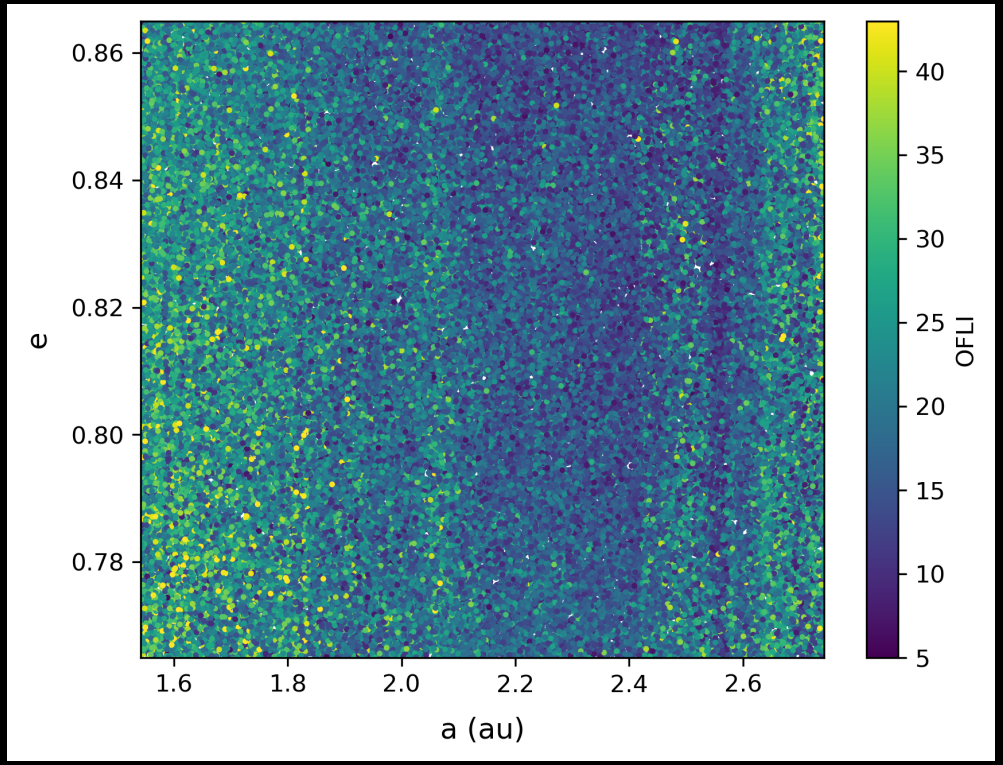
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Branch studied : Northern Taurids (NTA)

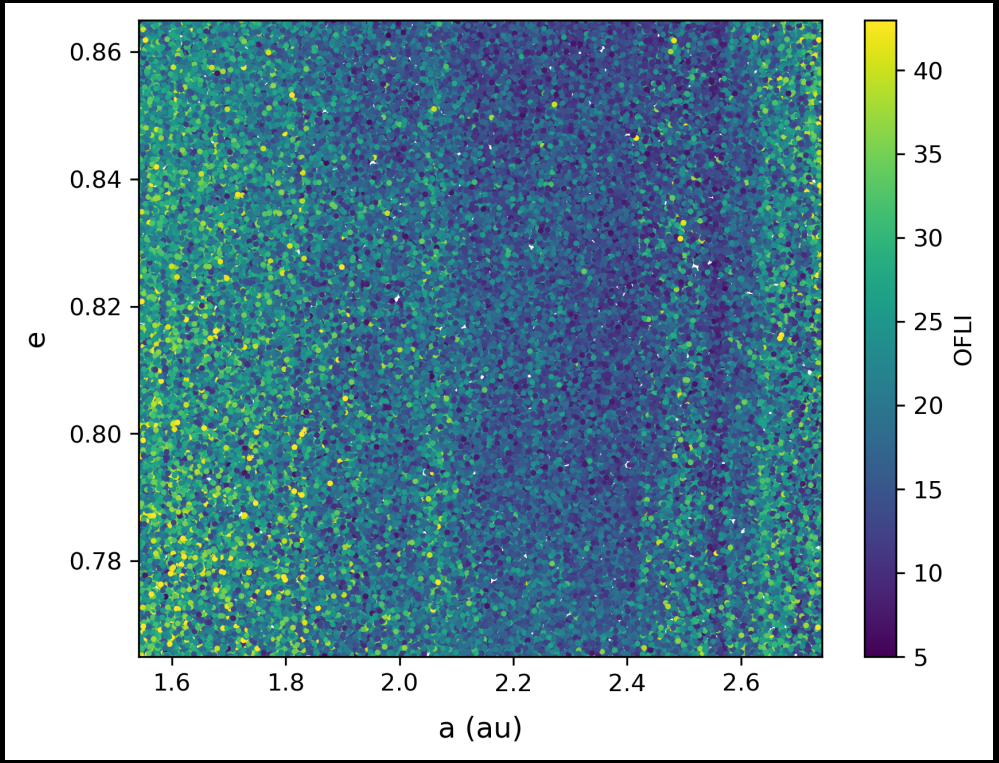


The surprise of the first map

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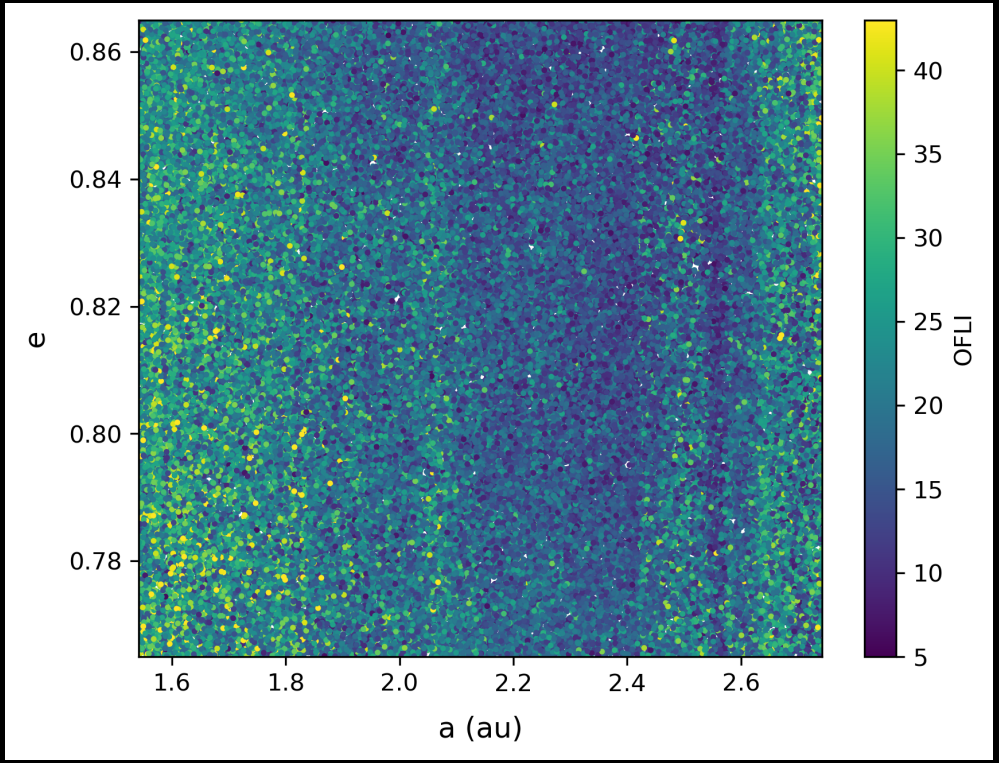


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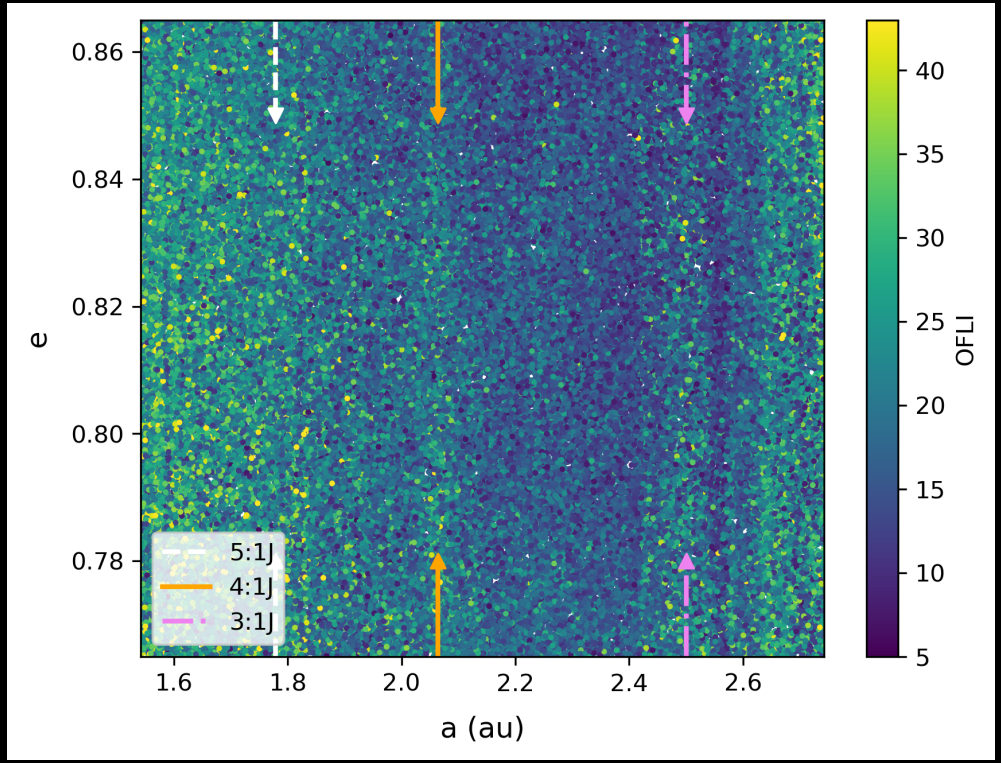


No MMR fit with the lines of regularity : different mechanism !

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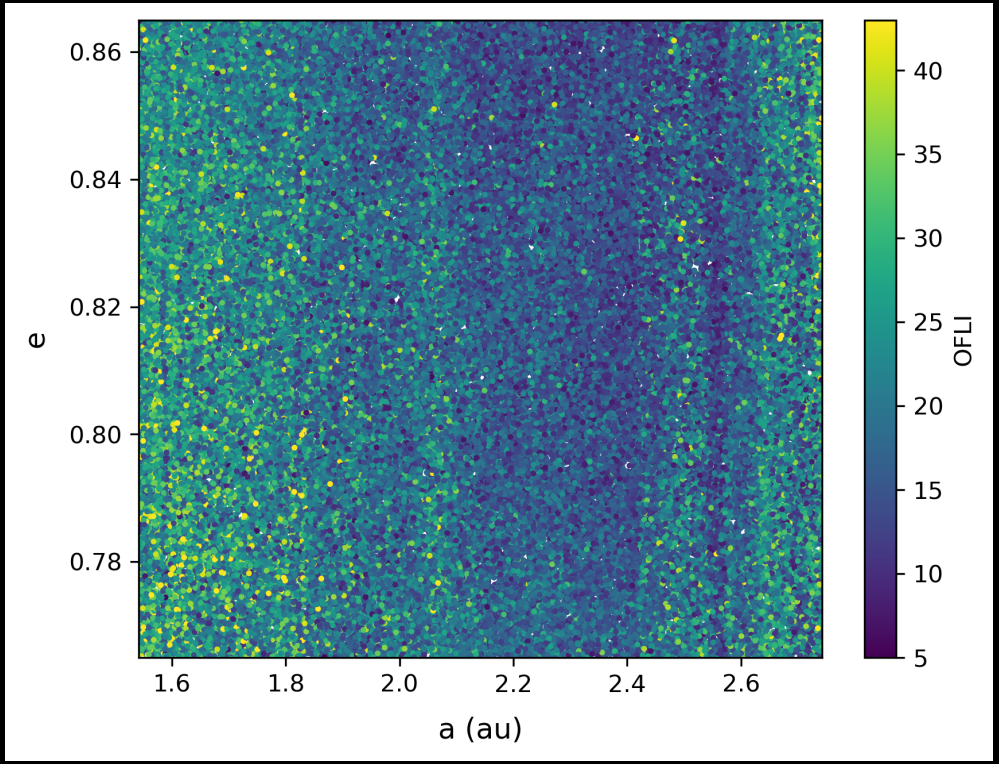
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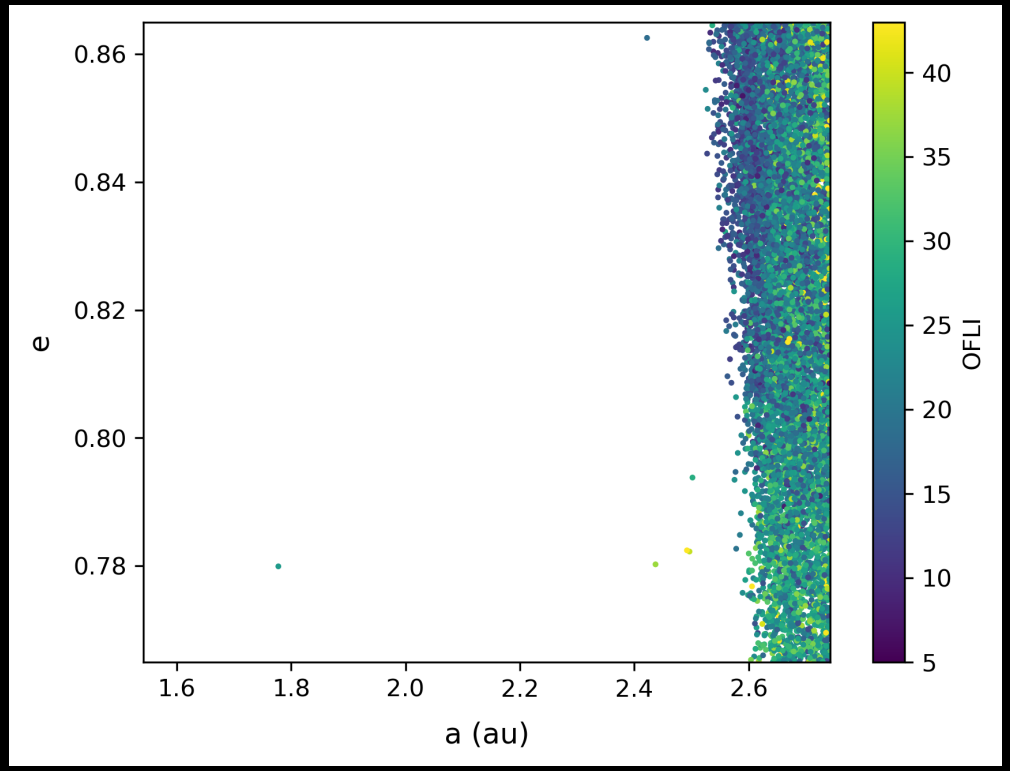
Instead : MMR with Jupiter fit with chaotic lines ! => Why ?

Close encounters

Close encounters

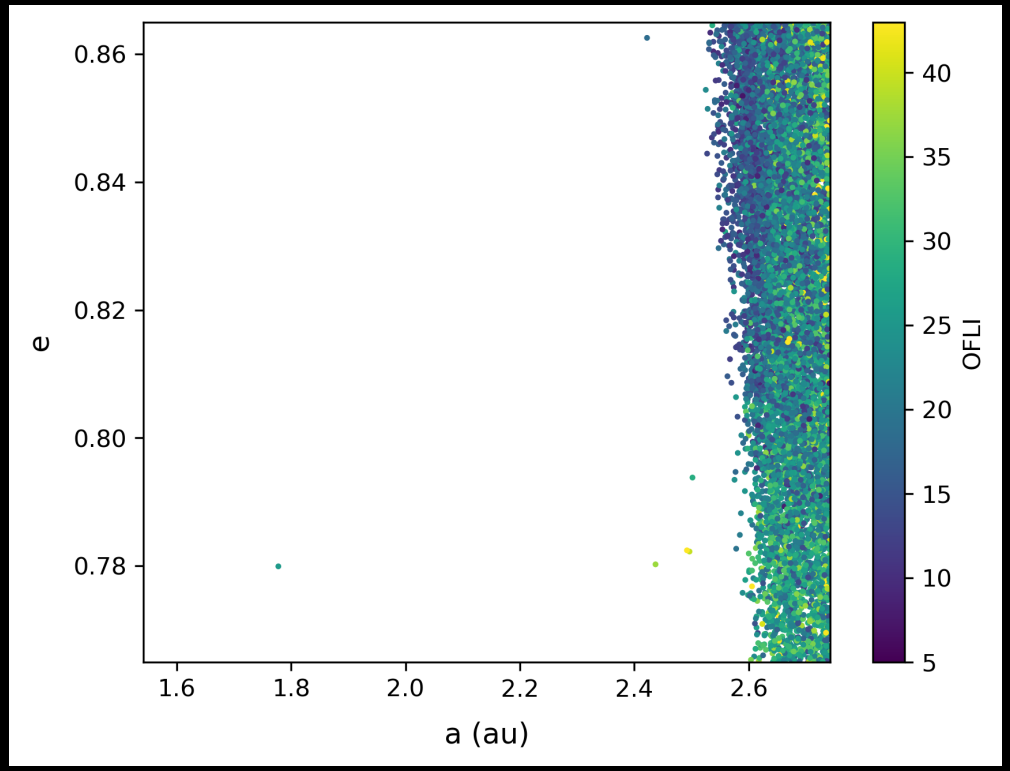


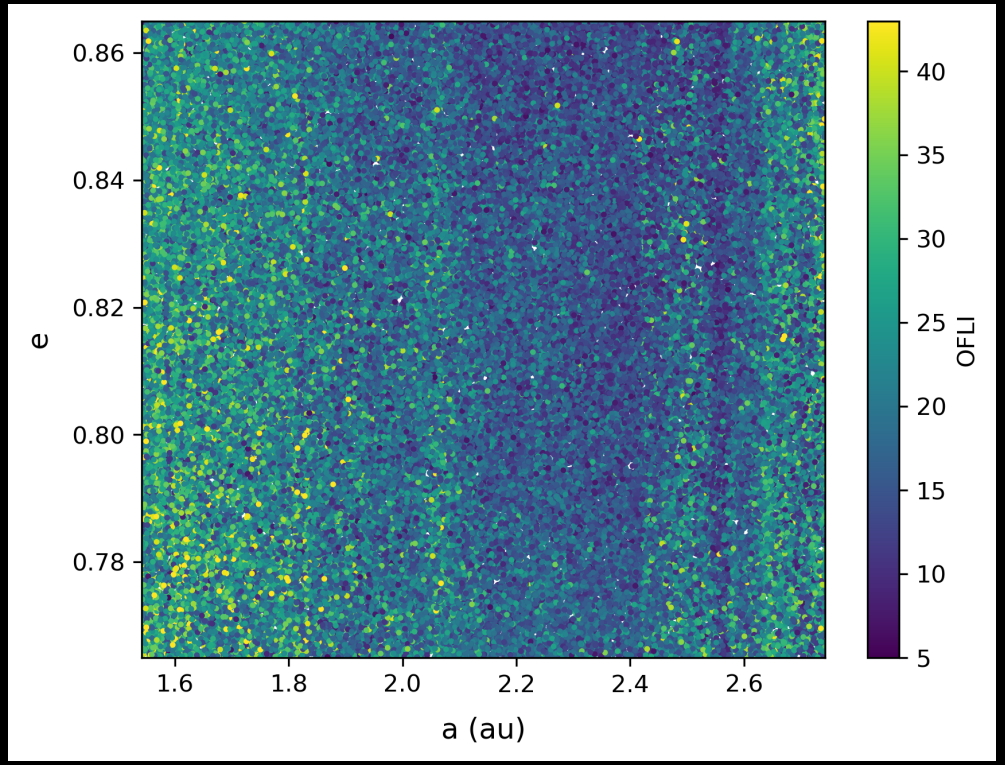
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Encounters with Jupiter

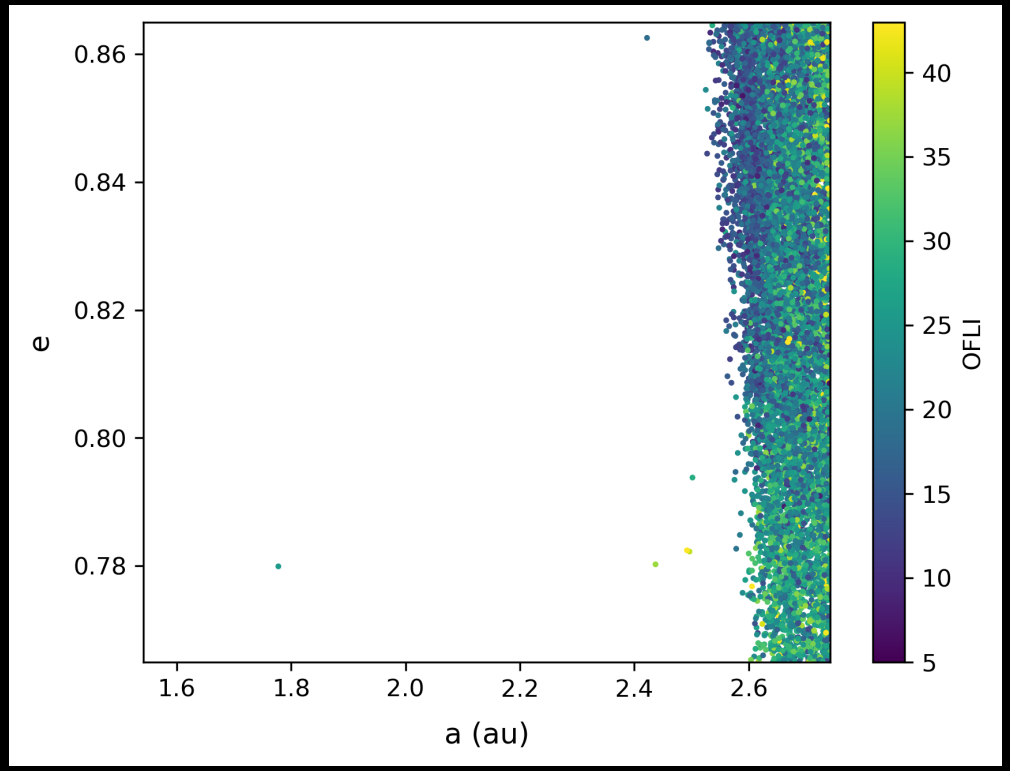
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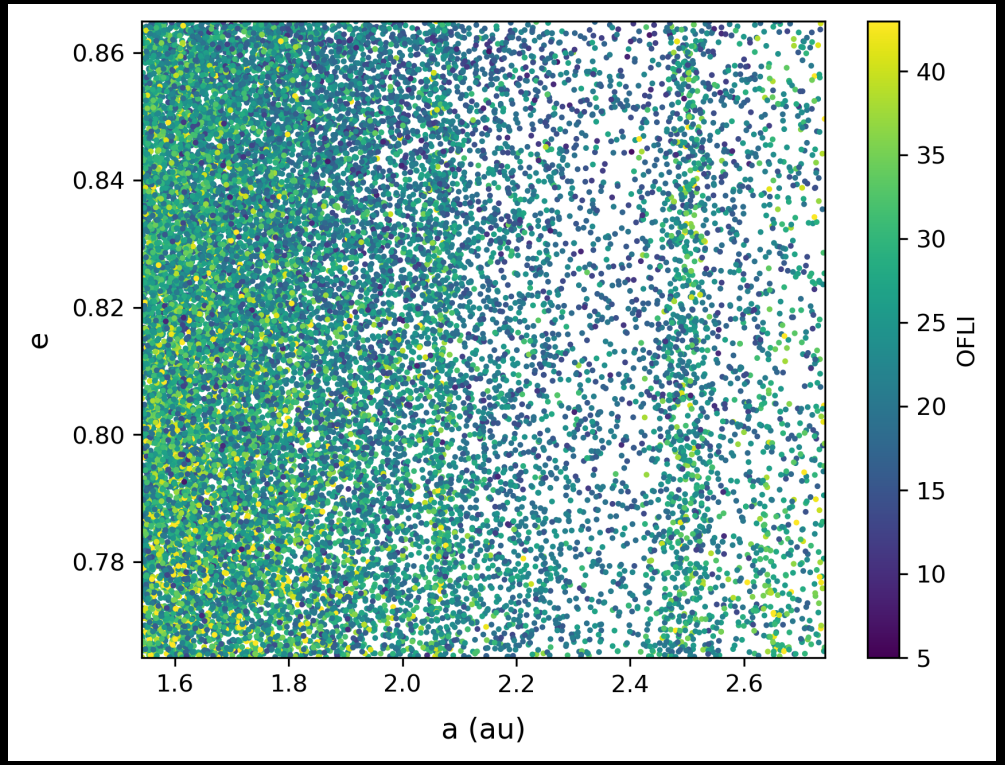


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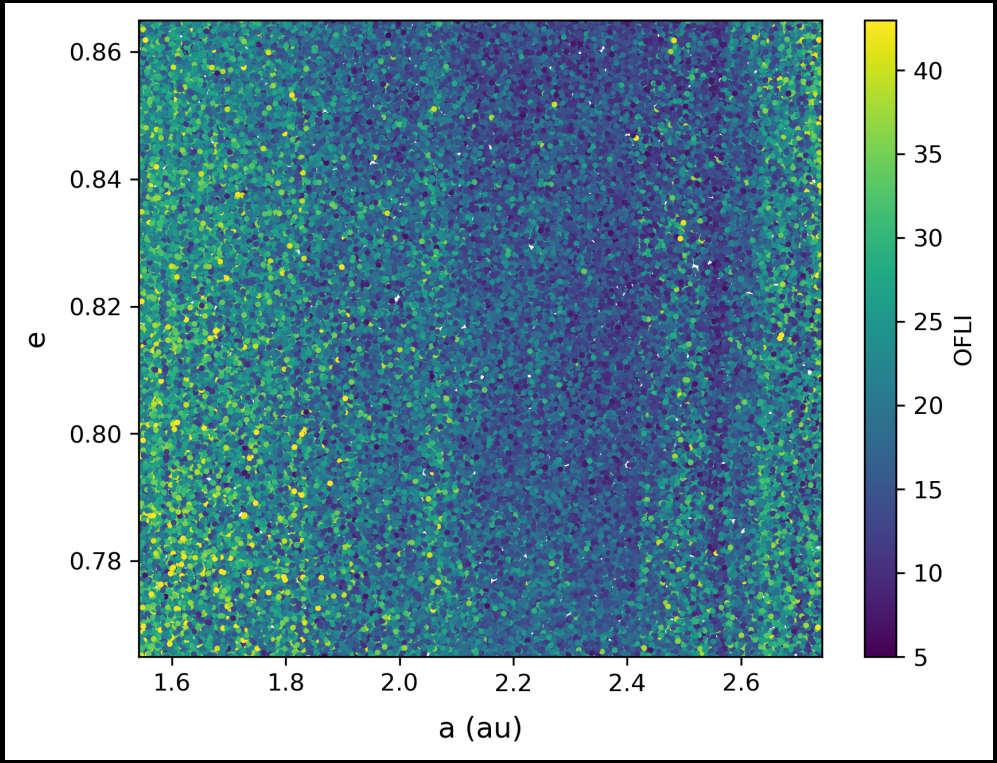


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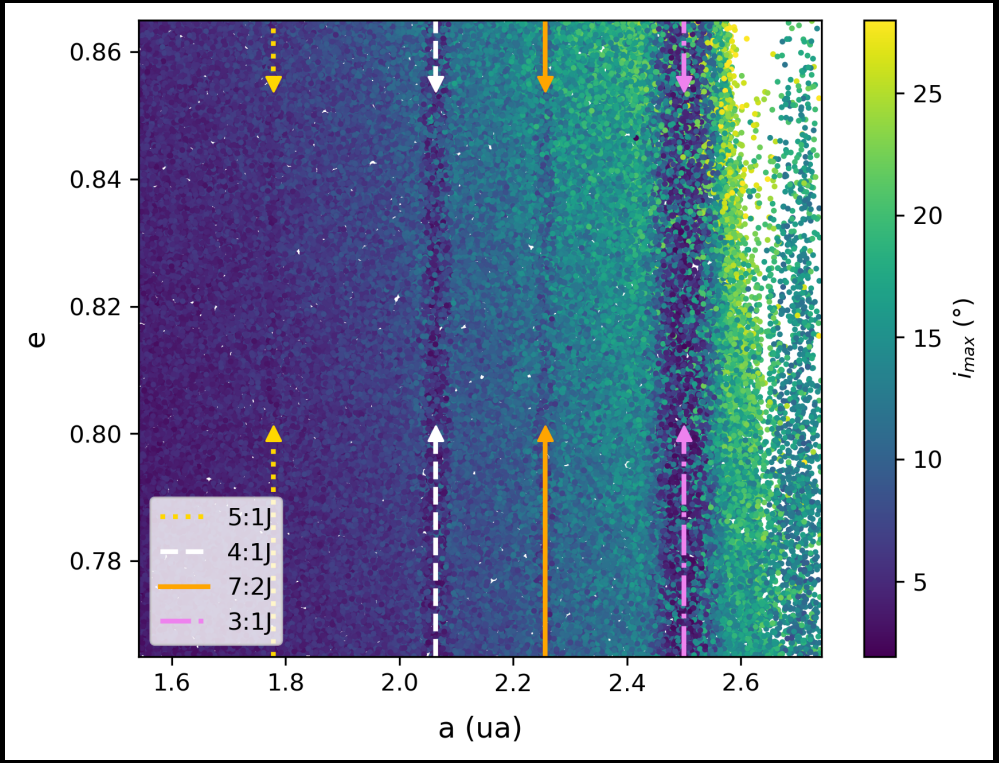


Encounters with Venus/Earth/Mars

Effect of vonZeipel-Lidov-Kozai?

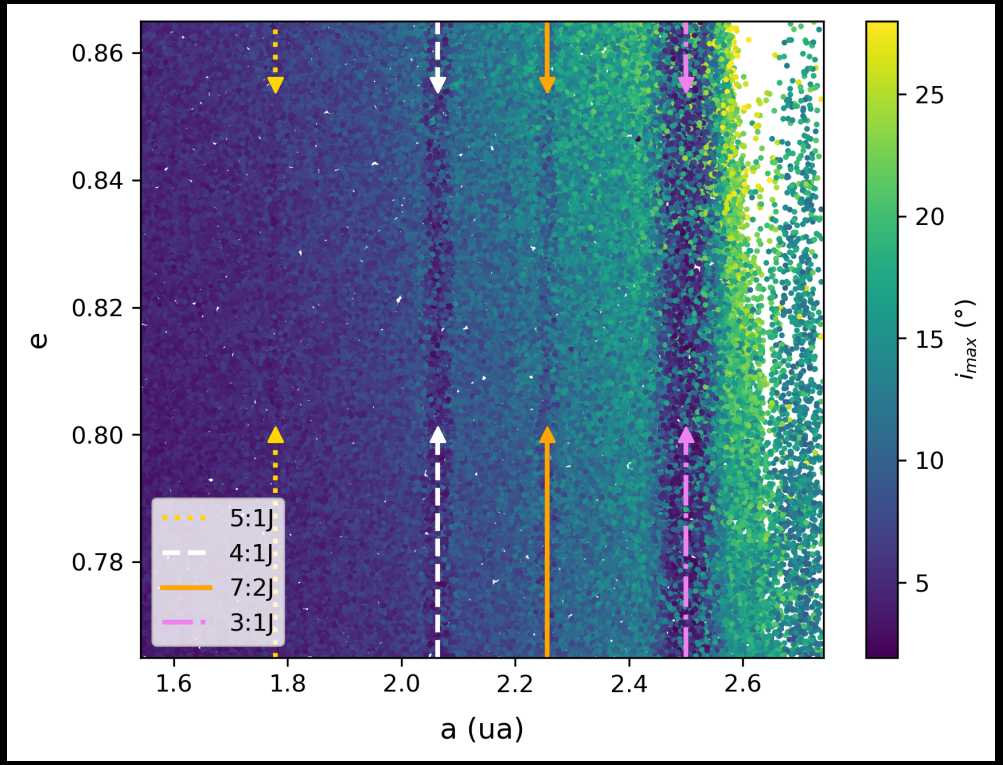


Effect of vonZeipel-Lidov-Kozai?



MMR : small max inclination but higher everywhere else

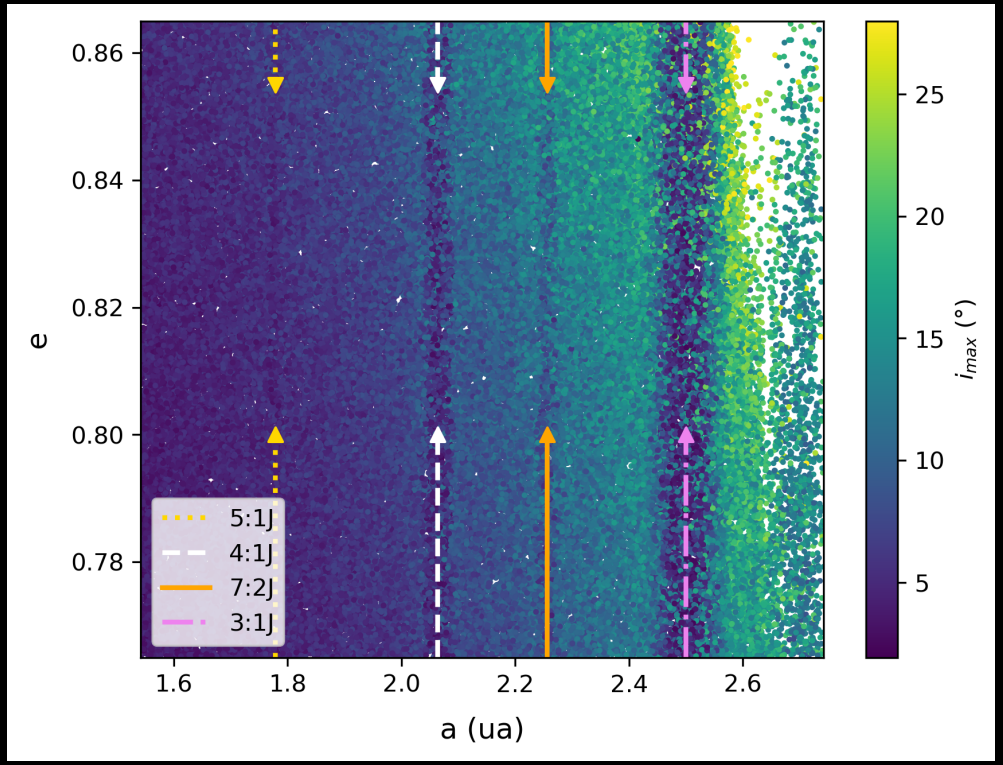
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$H' = \sqrt{1 - e^2}\cos i$ should be constant
[Thomas & Morbidelli, 1996]

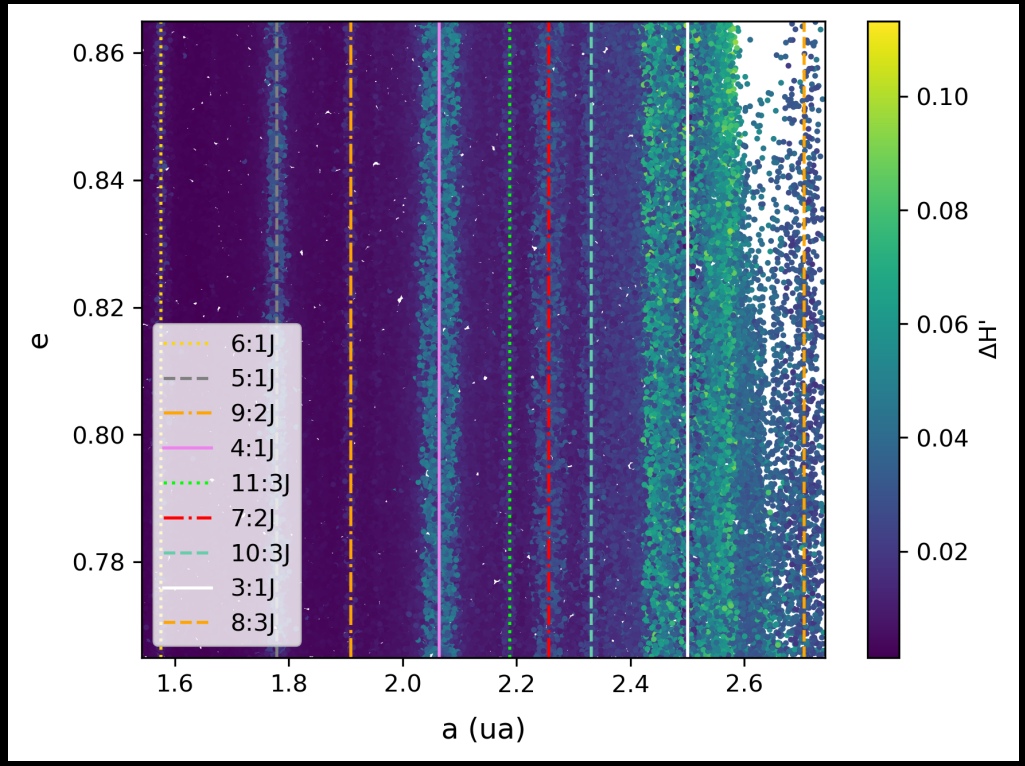
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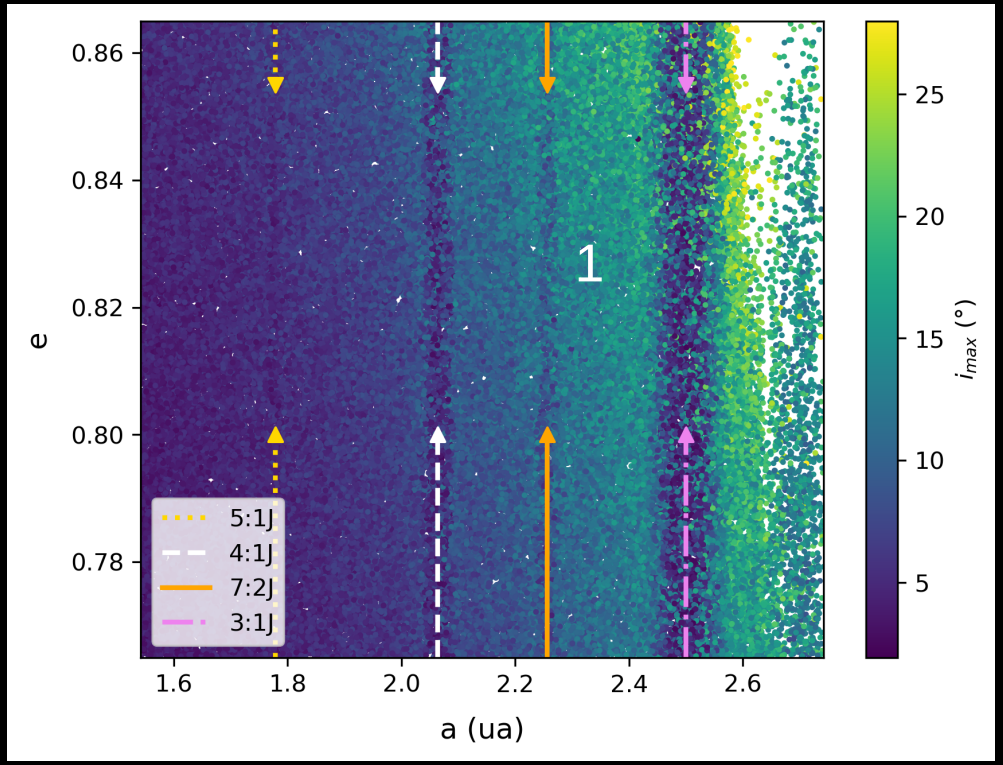


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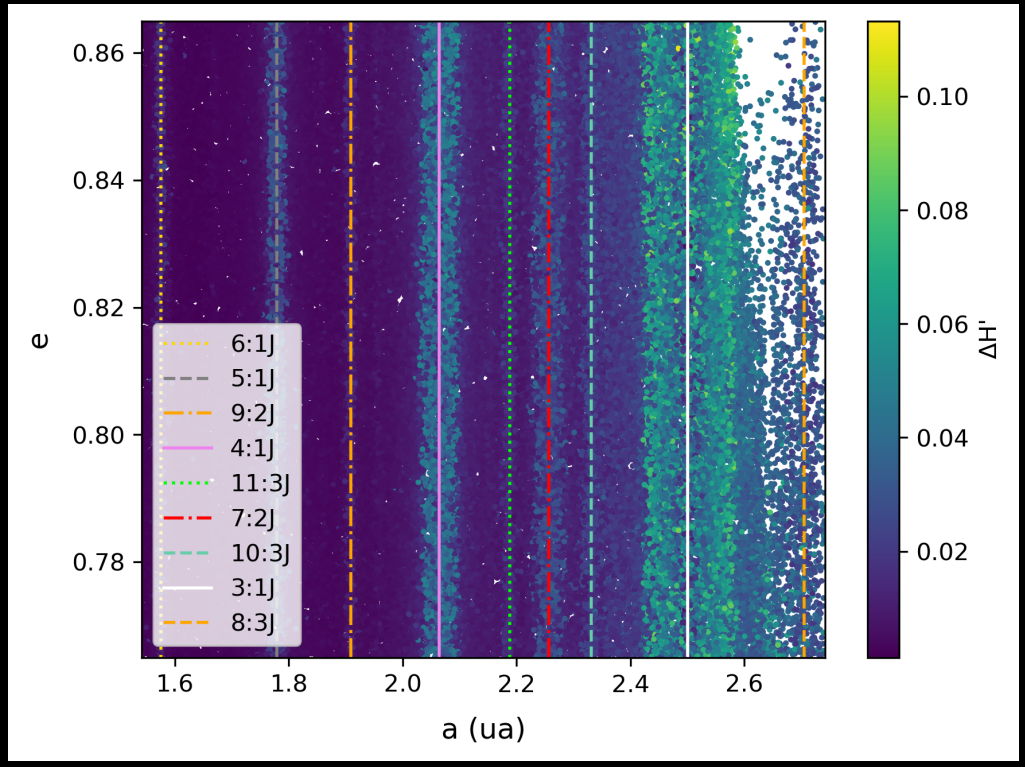


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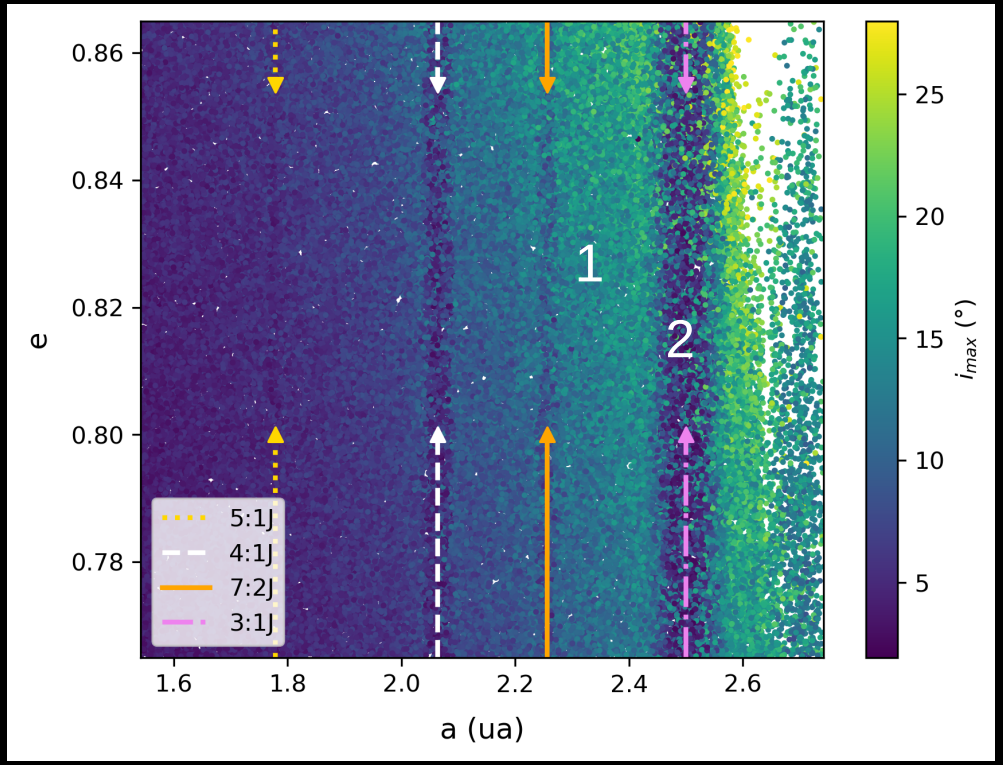


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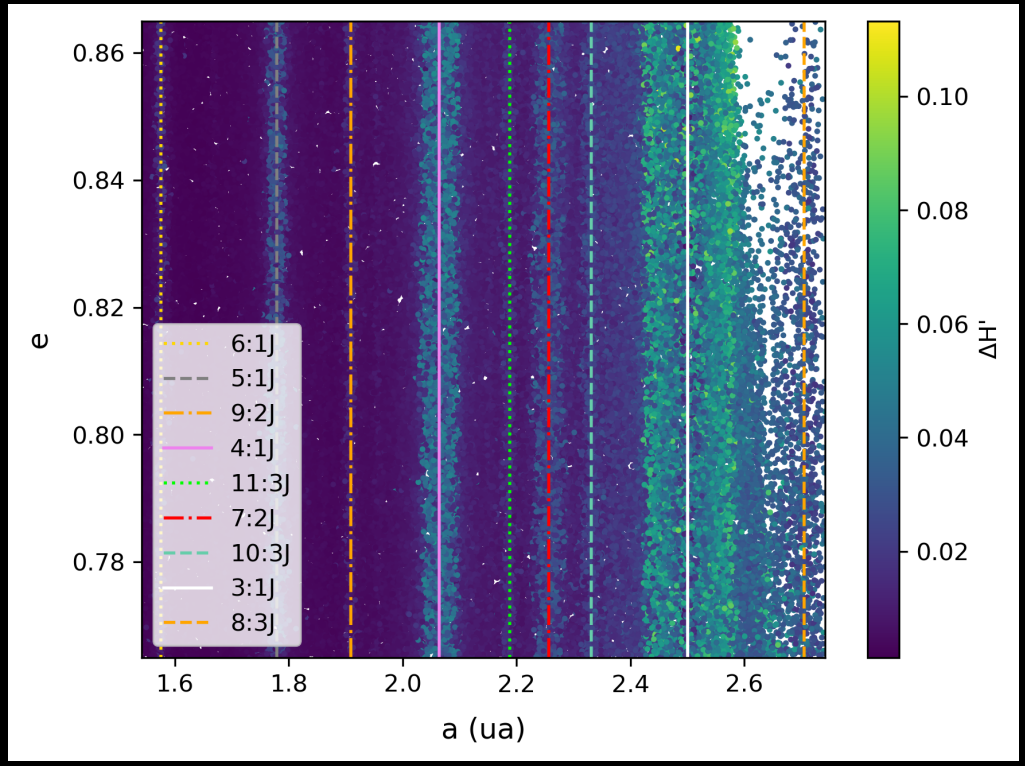


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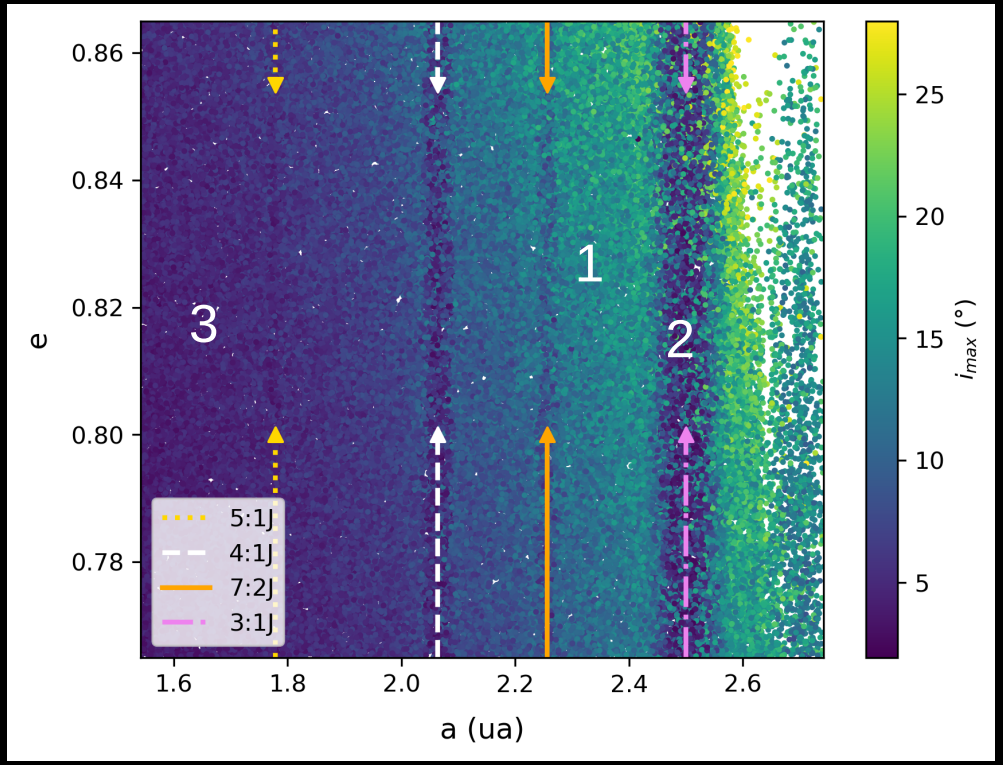


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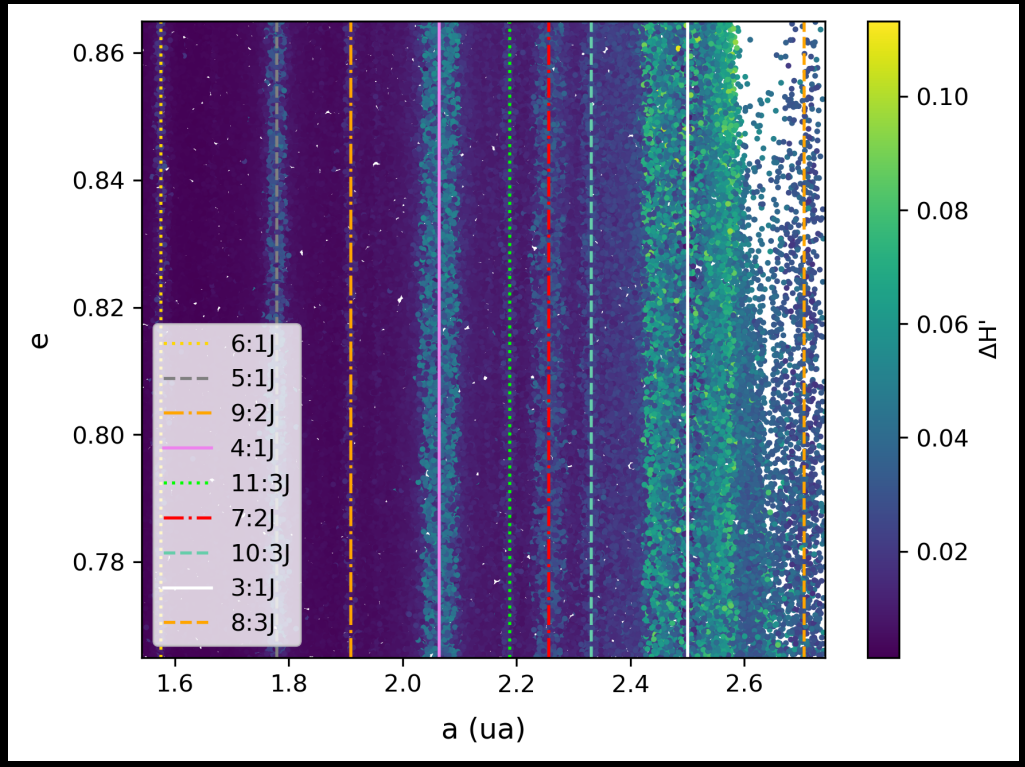


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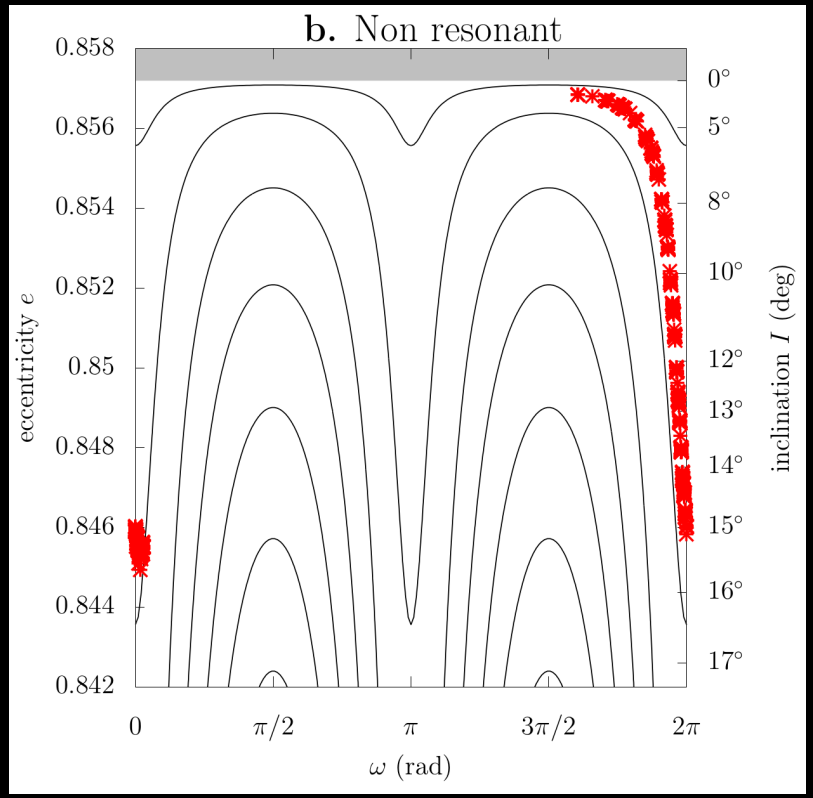


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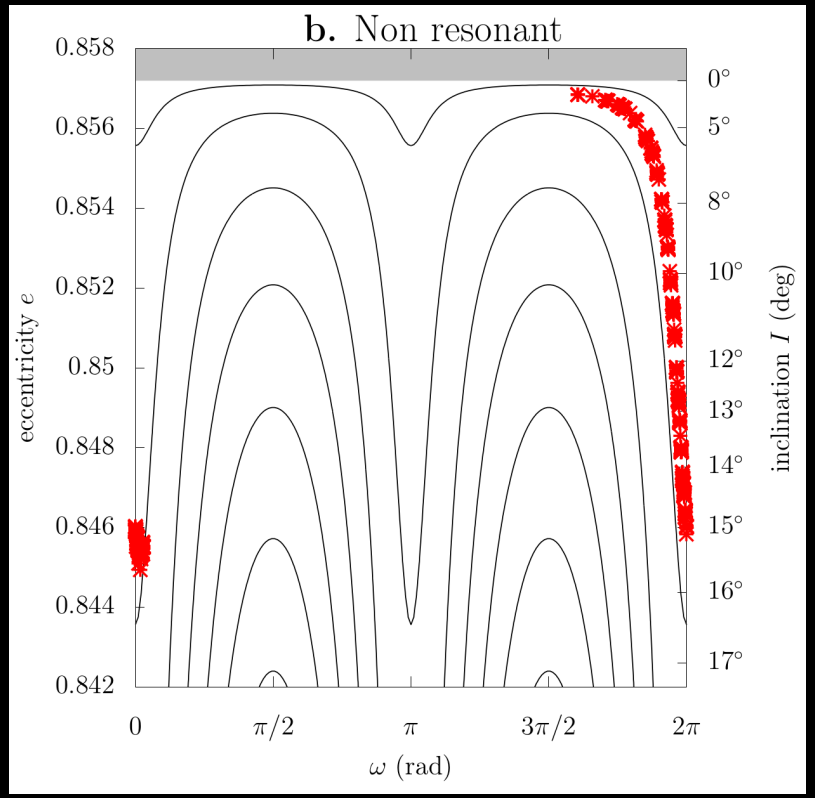


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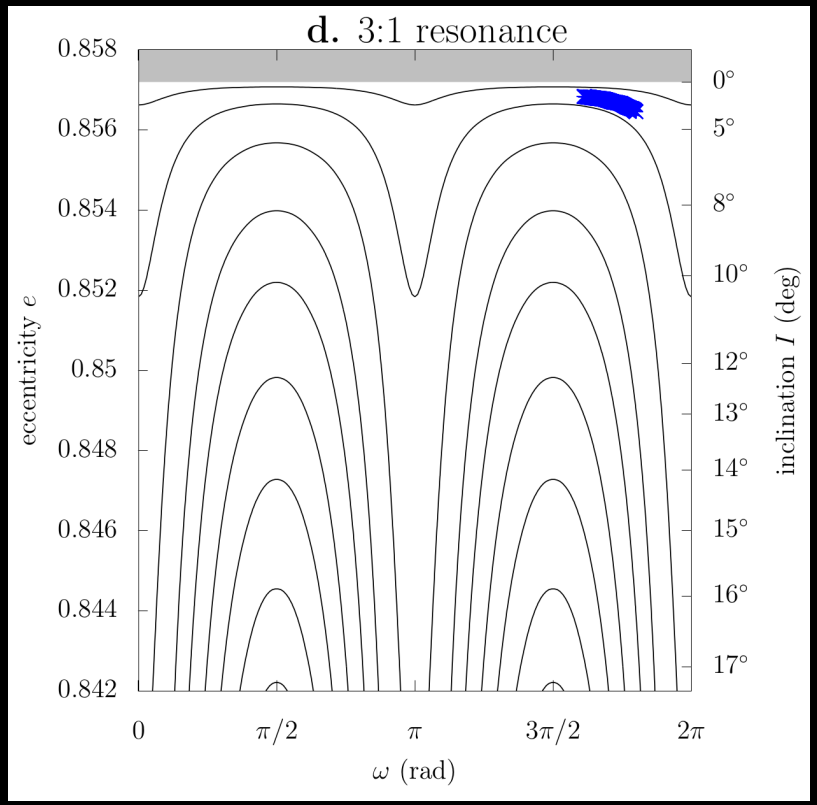


1

Effect of vonZeipel-Lidov-Kozai

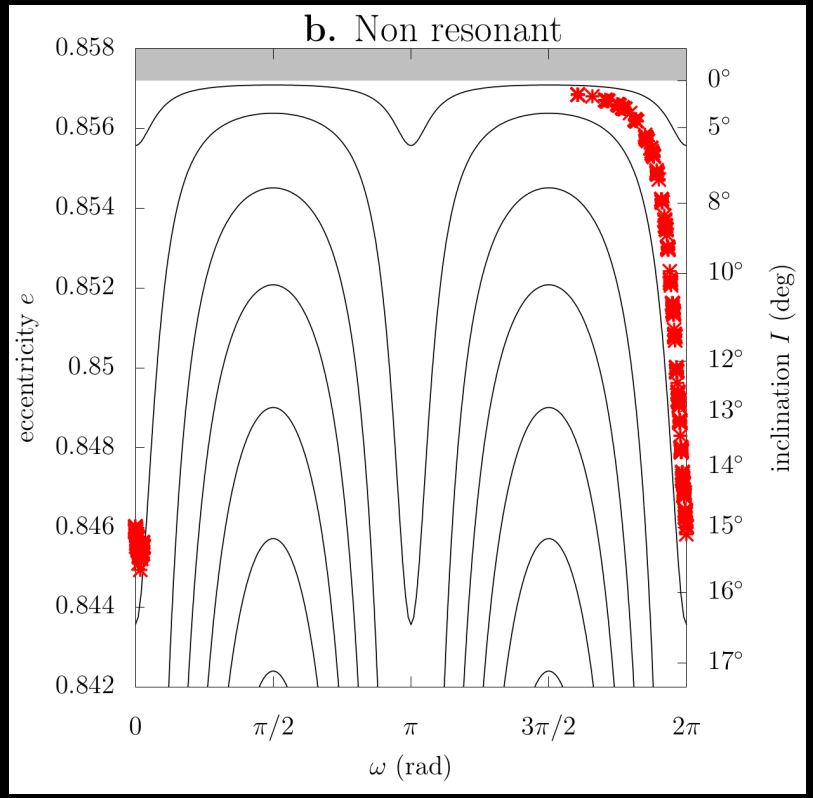


1

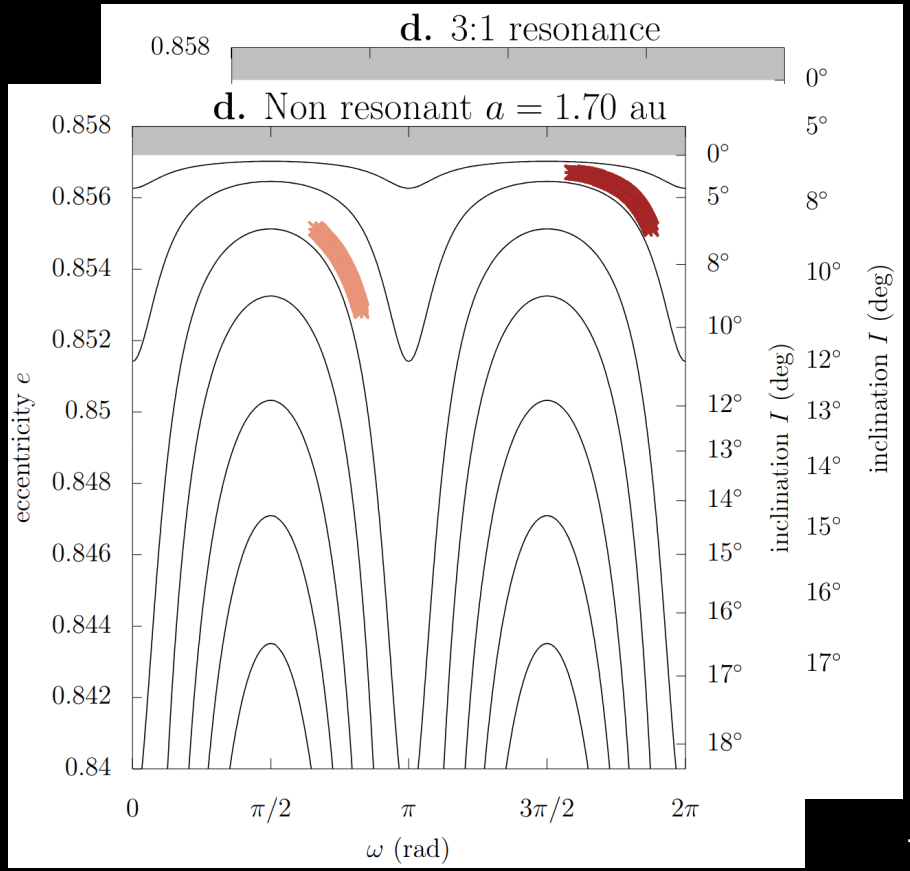


2

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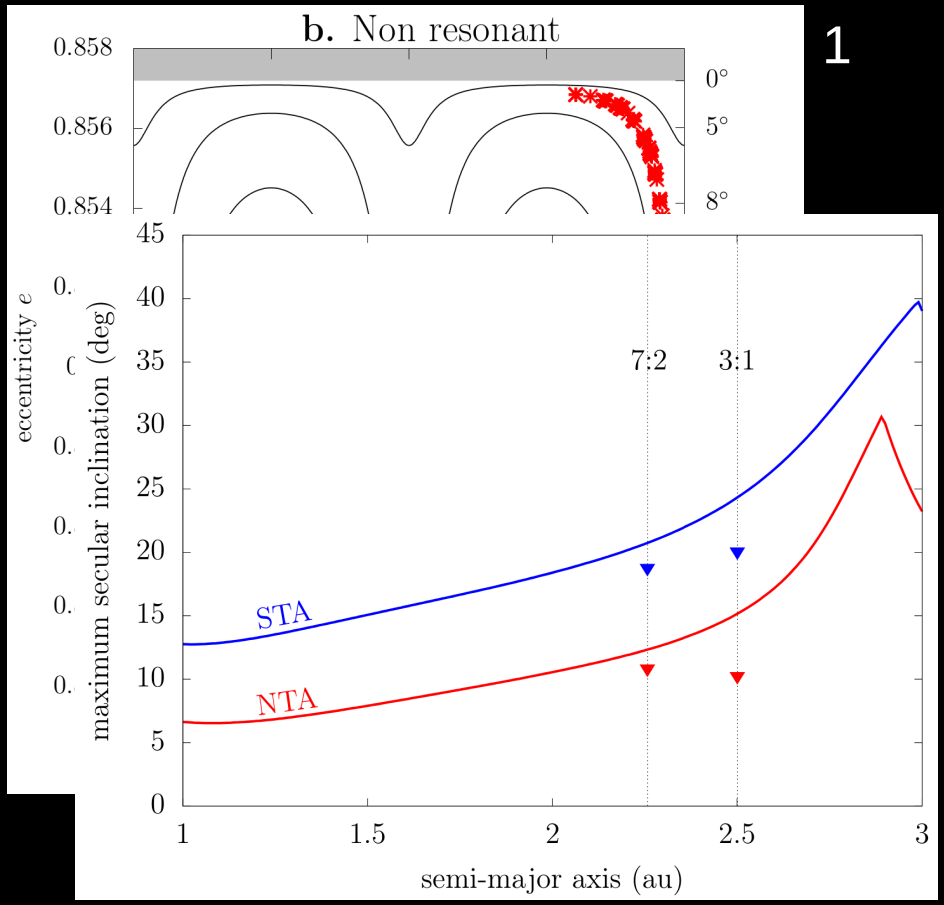
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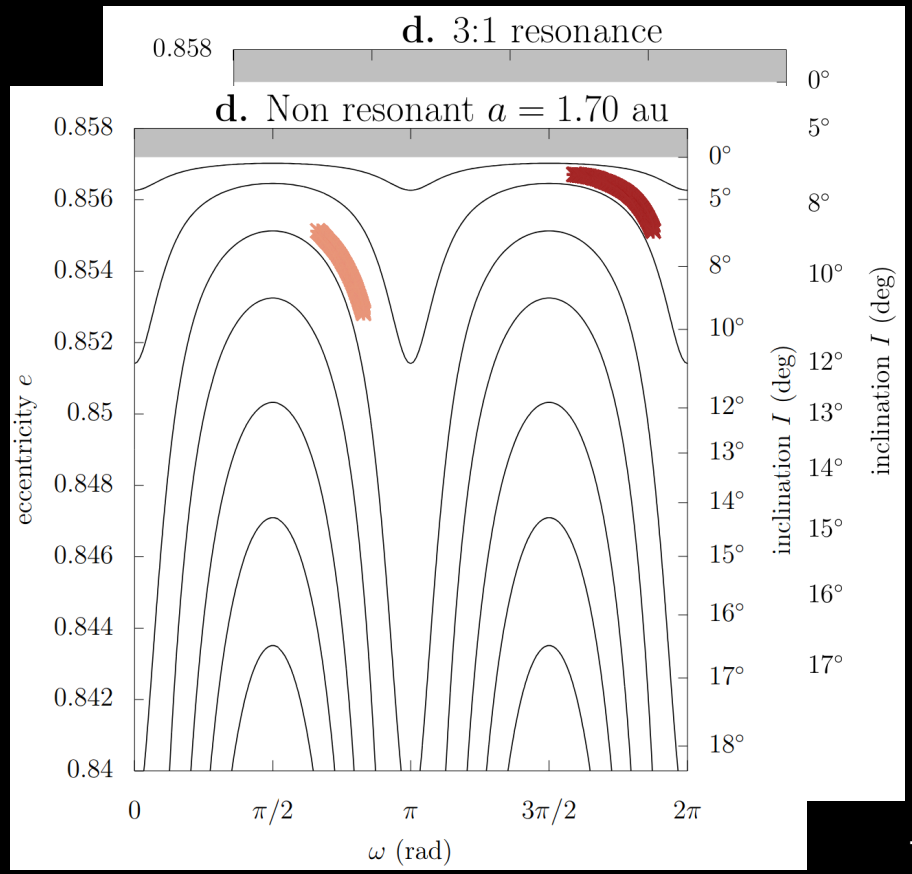
2

3

Effect of vonZeipel-Lidov-Kozai



1



2

3

7

VonZeipel-Lidov-Kozai and NGFs

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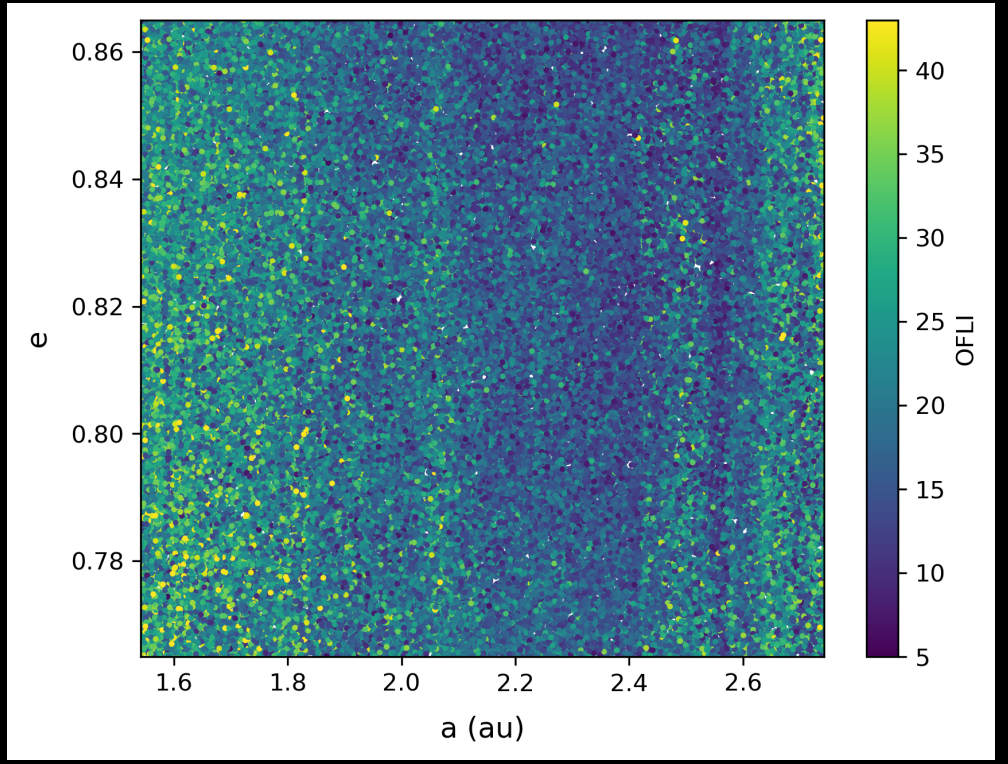
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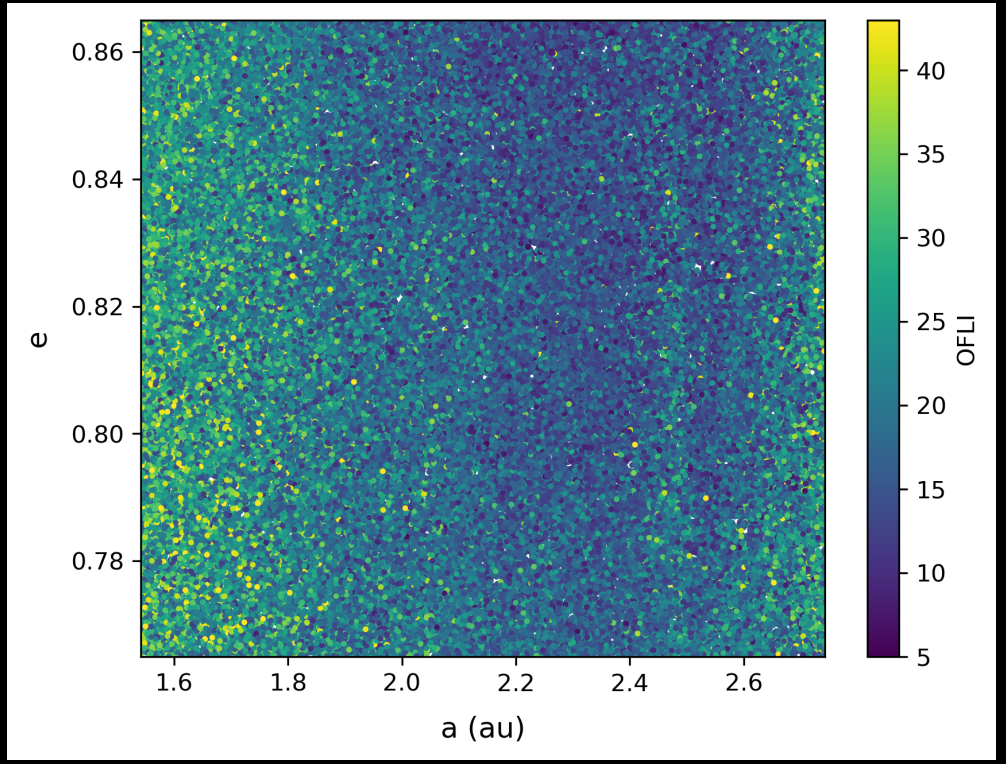
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Similar picture but Poyting-Robertson destroys the minor MMR

Conclusion

- Taurids : different dynamical mechanisms compared to other meteoroid streams => maybe why difficult to find its supposed parent body...
- Because initially low inclination and high eccentricity : vonZeipel-Lidov-Kozai brings particles at higher inclination => regular orbits. Except if MMR.



- NGF make particles drift out of the MMR

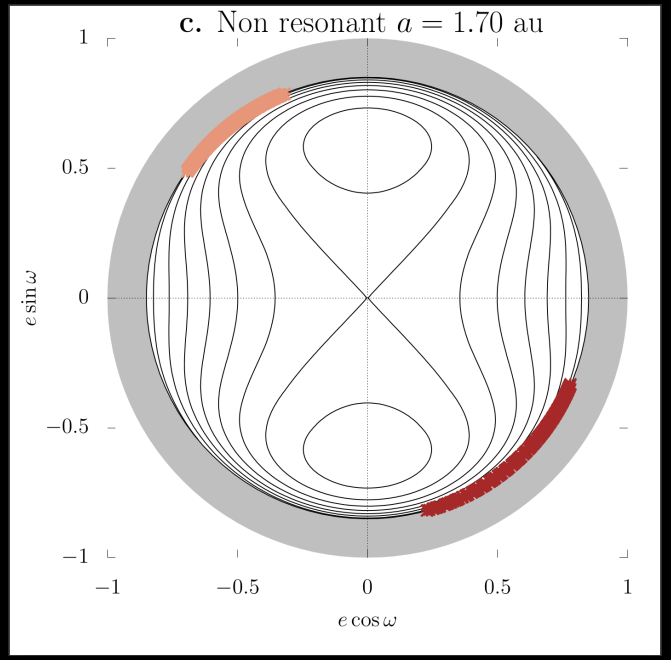
Future : Work on gravitational focusing and creation of an artificial meteor shower database

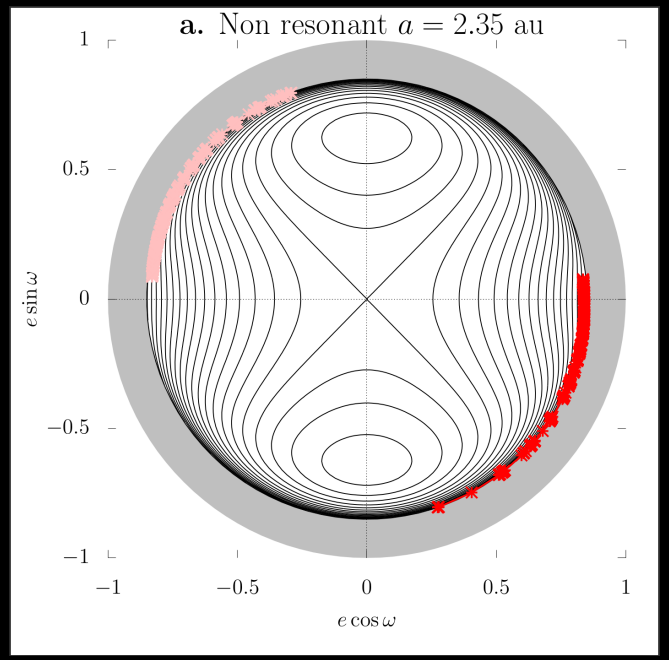
Thank you for listening !

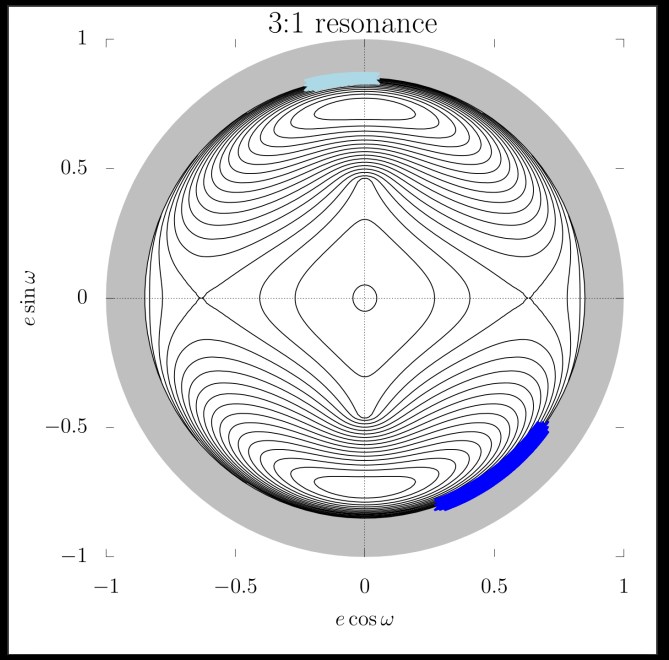
Questions ? Remarks ?



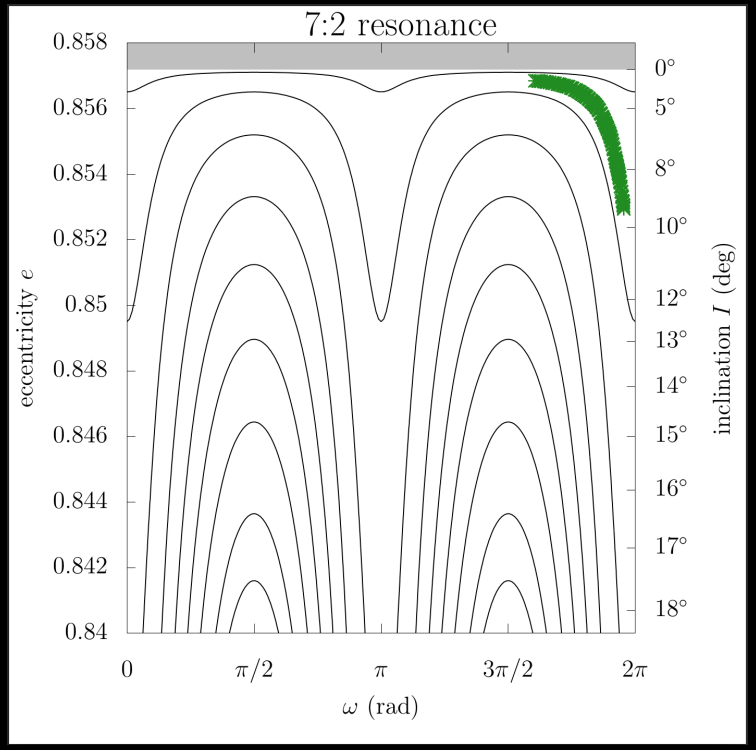
Phase portrait

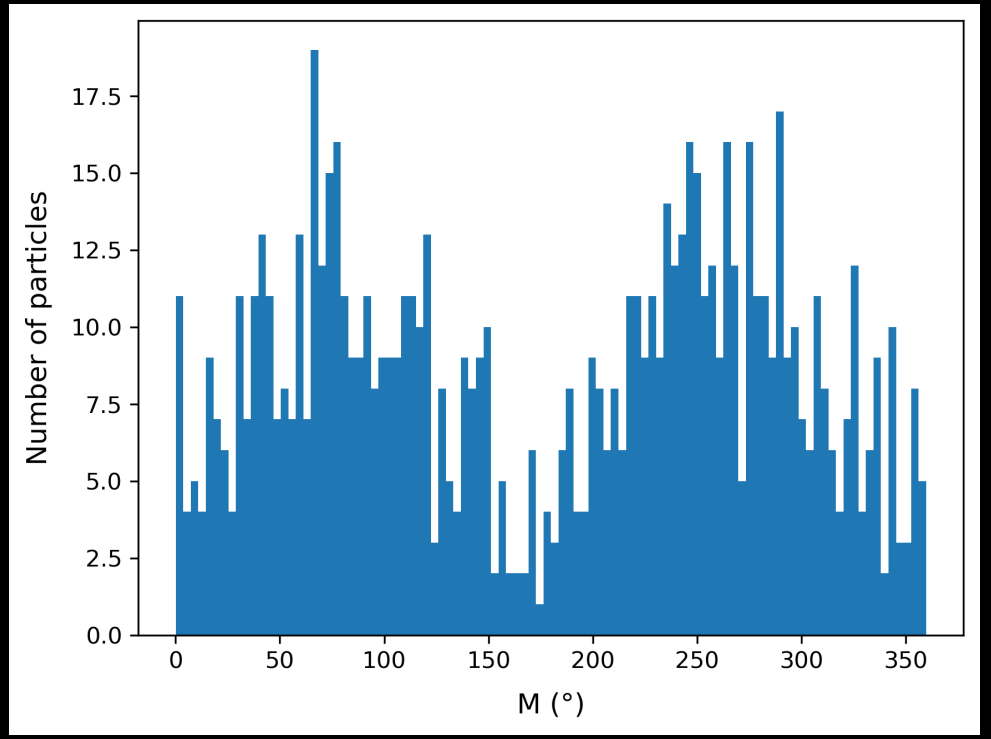






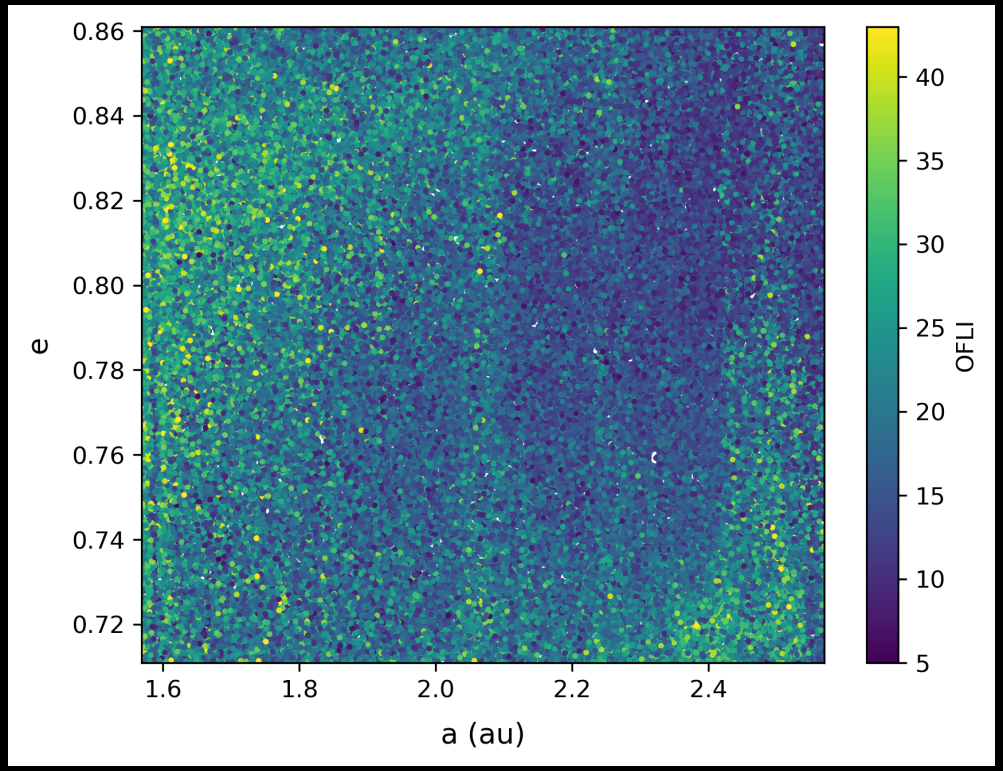
MMR 7:2 Jupiter

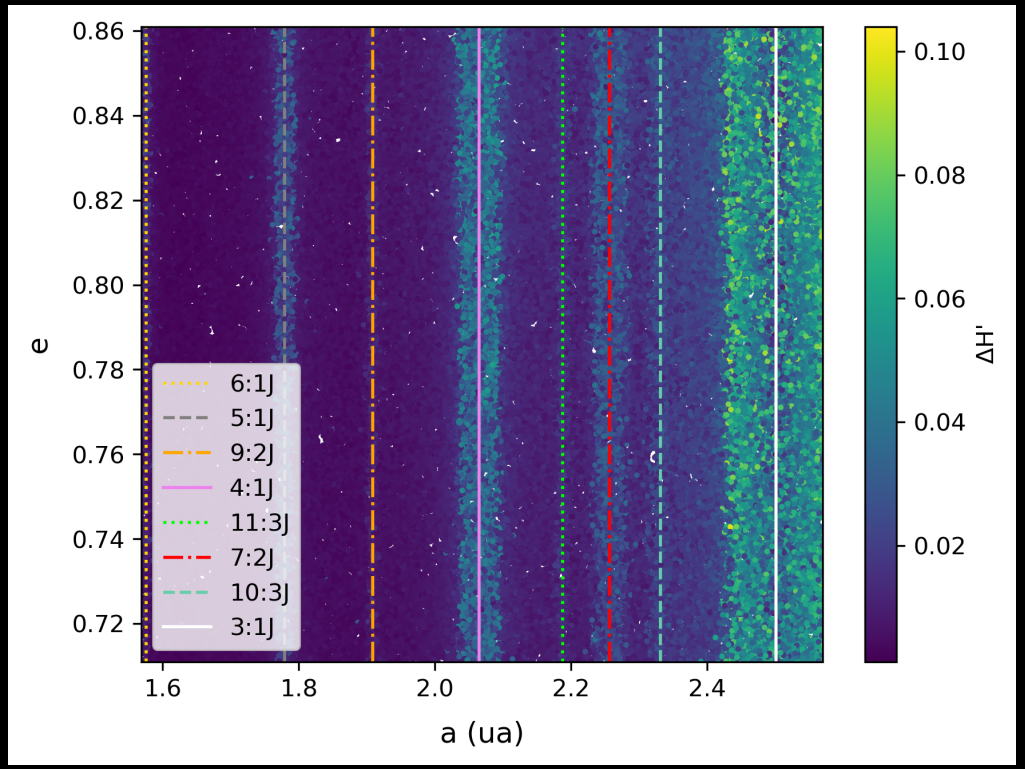




Asher & Izumi, 1998 : concentration of particles for specific values of M => swarm of meteors detected on Earth

STA


0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
e
1.6
1.8
2.0
2.2
2.4
a (au)
40
35
30
25
20
15
10
5
OFLI


0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
e
6:1J
5:1J
9:2J
4:1J
11:3J
7:2J
10:3J
3:1J
1.6
1.8
2.0
2.2
2.4
a (ua)
0.10
0.08
0.06
0.04
0.02
ΔH'