XVIII^èmes Rencontres de Blois
Planetary Science: challenges and discoveries

New perspectives on the origin of Saturn irregular satellite system

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Questions

The questions we are trying to answer are:

- Is the present day structure of the irregular satellites of Saturn a faithful representation of the post-capture one?
- Is collisional capture a viable mechanism to create a system of irregular satellites?
- Is there any dynamical signature of the original nature of the satellites?

Dynamical modeling

Evaluation of the dynamical secular evolution of the satellites

Evaluation of the existence of collisional families

Determination of the plausible origins of the captured bodies

Evaluation of the impulse needed to change the orbit from heliocentric to planetocentric

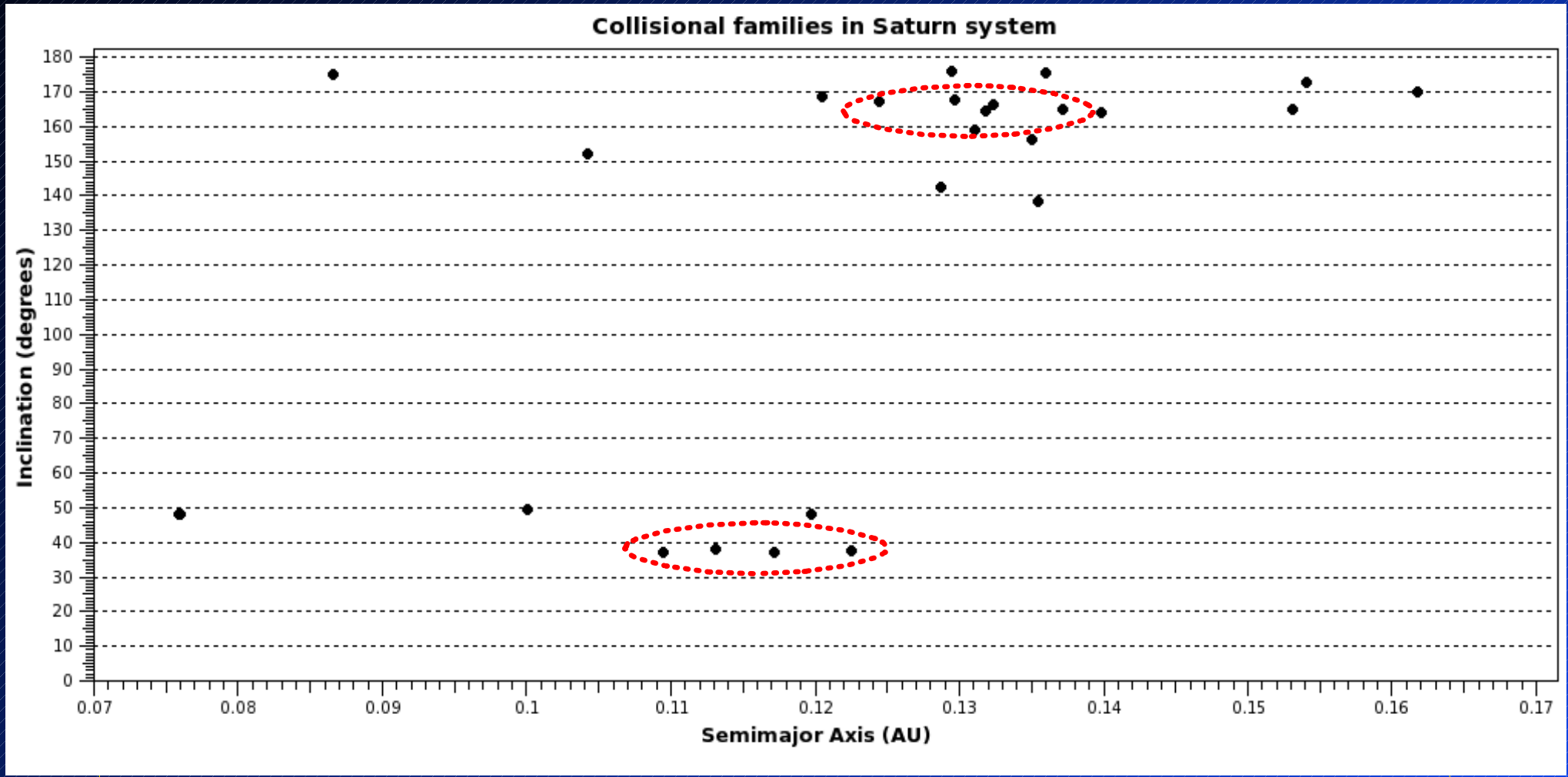
Mean orbital elements *(1)*

Dynamical model: Sun + Jupiter, Saturn, Neptune, Uranus + Titan, Iapetus

Mean orbital elements *(2)*

Dynamical model: Sun + Jupiter, Saturn, Neptune, Uranus + Titan, Iapetus

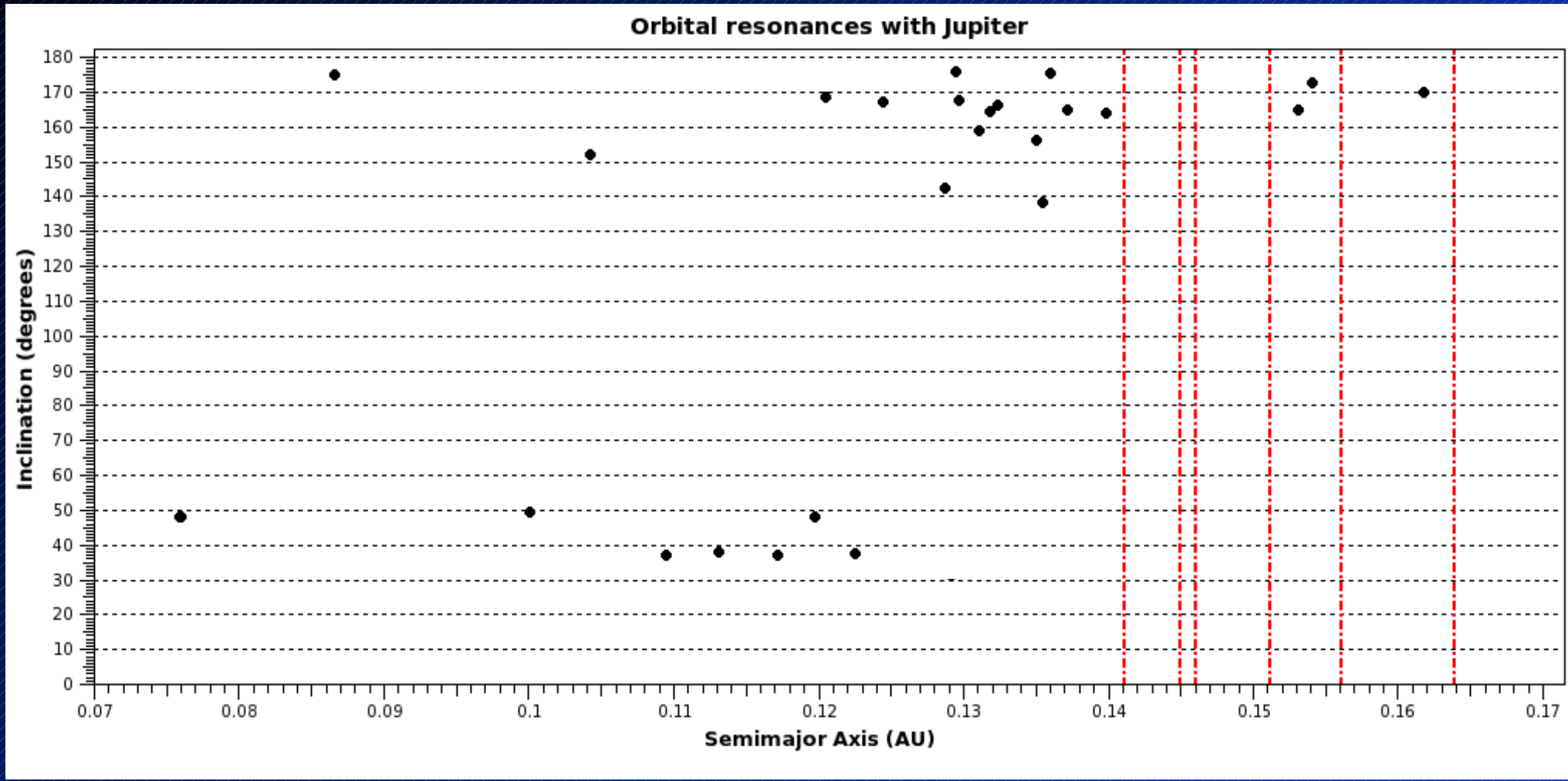
Collisional families



Orbital intersections

Black error bars: oscillations due to the **mean eccentricities** and **inclinations**
Red error bars: oscillations due to the **mean eccentricity** when **ignoring** the effects of **Titan and Iapetus**

Orbital resonances



Red lines: orbital resonances with **Jupiter**

Primordial orbits

Green dots: computed **pre-capture orbits**
Red dots: the **Saturn crossers** (Morbidelli et al.)
Black dots: the **Centaurs** which cross the orbit of Saturn

Conclusions

- First results indicate that the system of irregular satellites of Saturn is dynamically evolved and not primordial
- Our results suggest that the dynamical features of irregular satellites may preserve some signature of their origin
- We need to integrate dynamical and physical modeling in order to solve the problem of the origin of these bodies

Merci !