Low-Energy Dynamics for the Iapetus Colour

Martín Leiva

Area: Planetary Systems

Sub-Area: Celestial Mechanics

Observatorio Astronómico de Córdoba, U.N.C.

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Carlos Briozzo

FaMAF, U.N.C.

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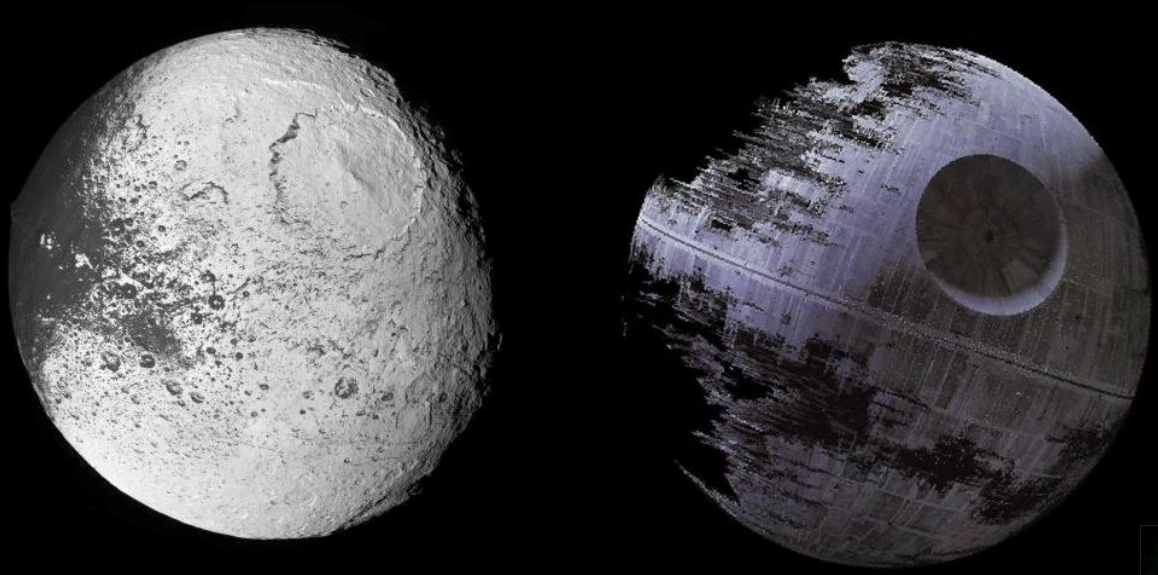
- **What is Iapetus?...**

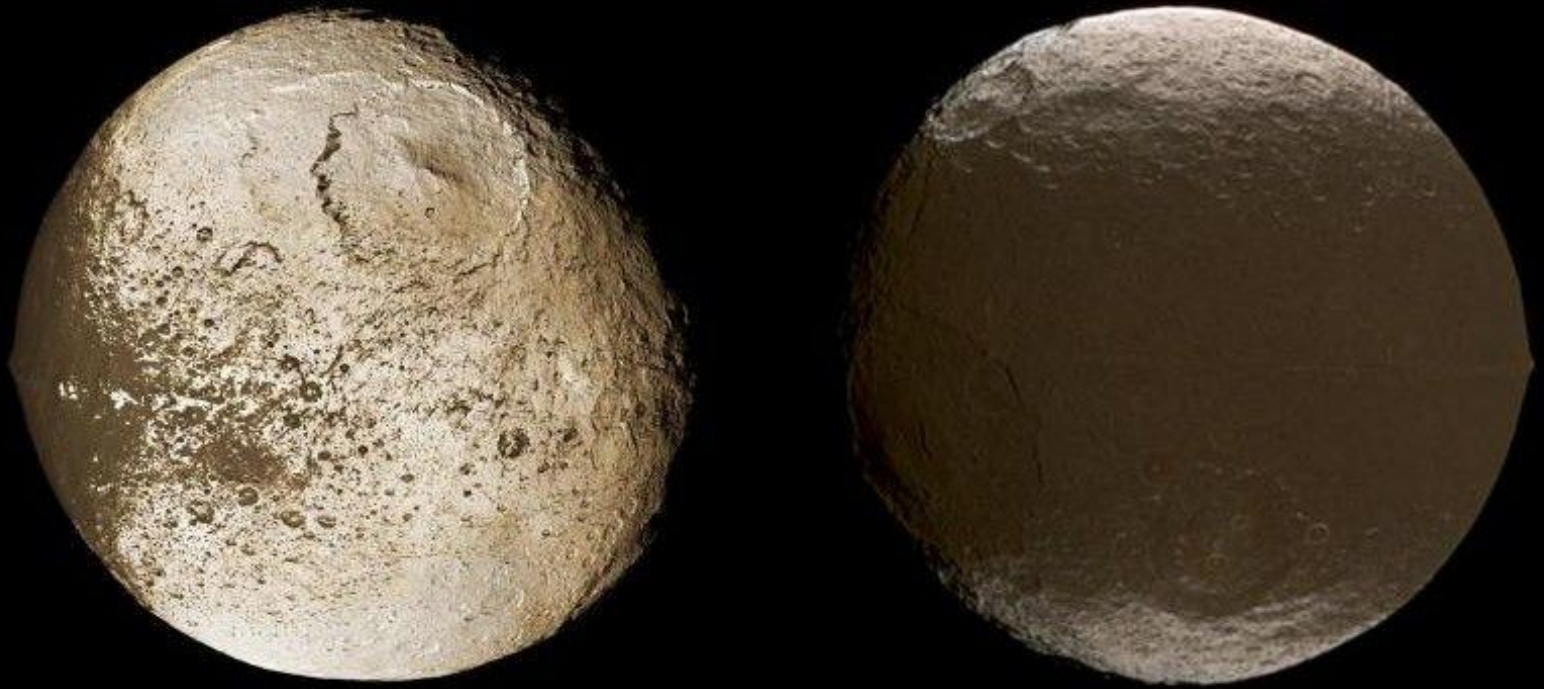
Is it a Natural or Artificial Satellite?



George Lucas et al. 1977

- **What is Iapetus?...**

Cassini (1671)



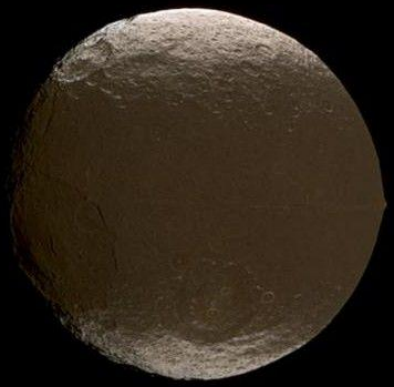
Voyager II - CASSINI

- What is Iapetus?...

alb. ~0.5

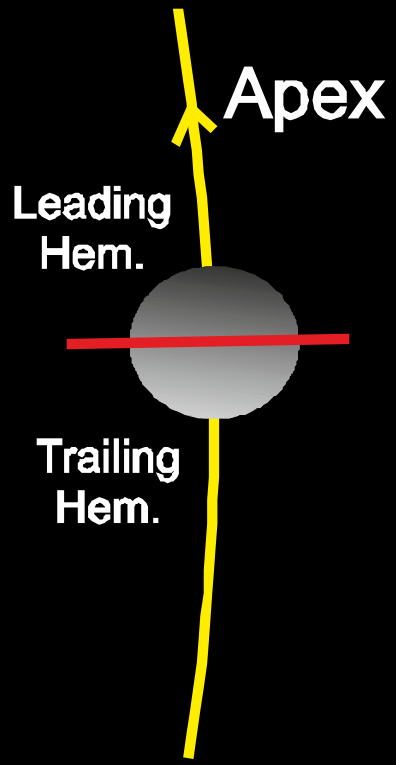
Trailing Hemisphere

alb. ~0.04



Leading Hemisphere

Res. 1:1



a ~ 0.024 AU

e ~0.028

$i_{E\text{-}Sat}$~16°

T~79.3 days

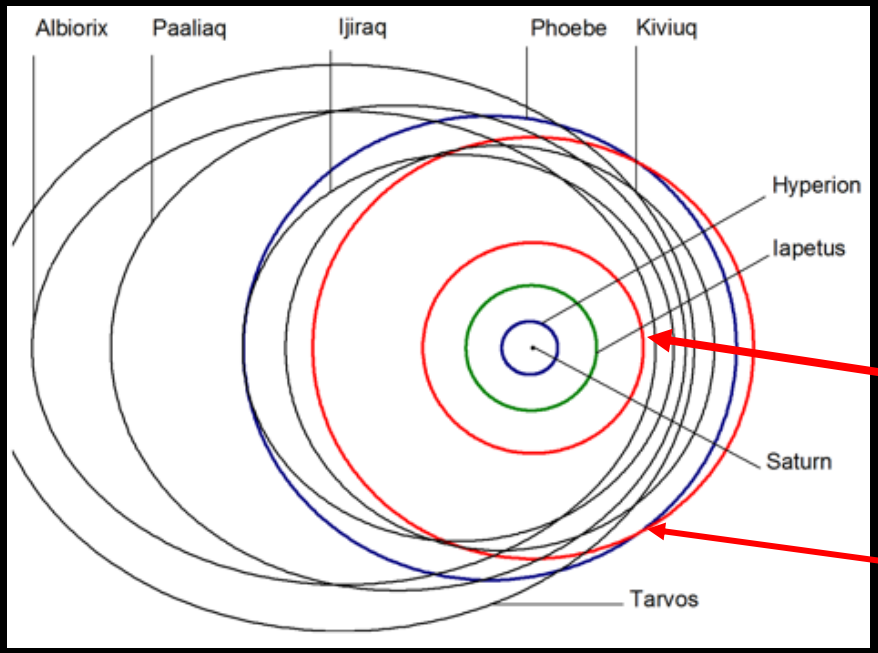
R~730 km

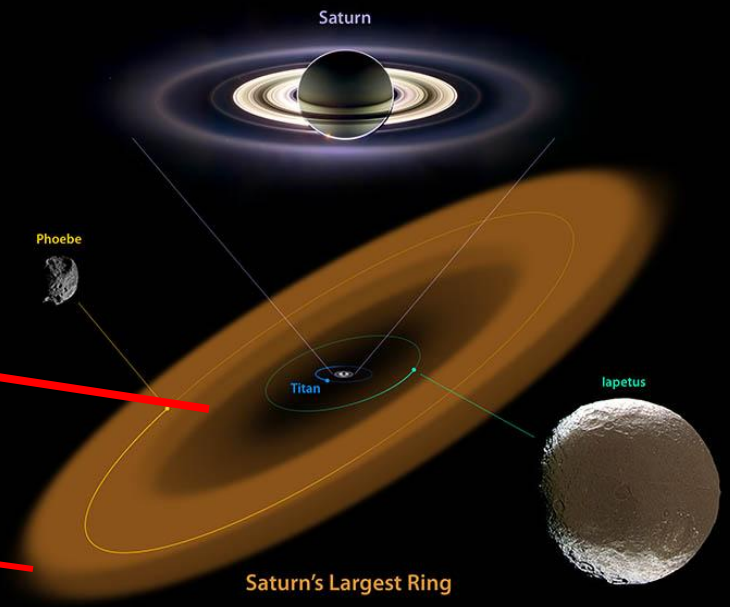
m~1.88x10^{21} Kg

- **What can we find there?...**

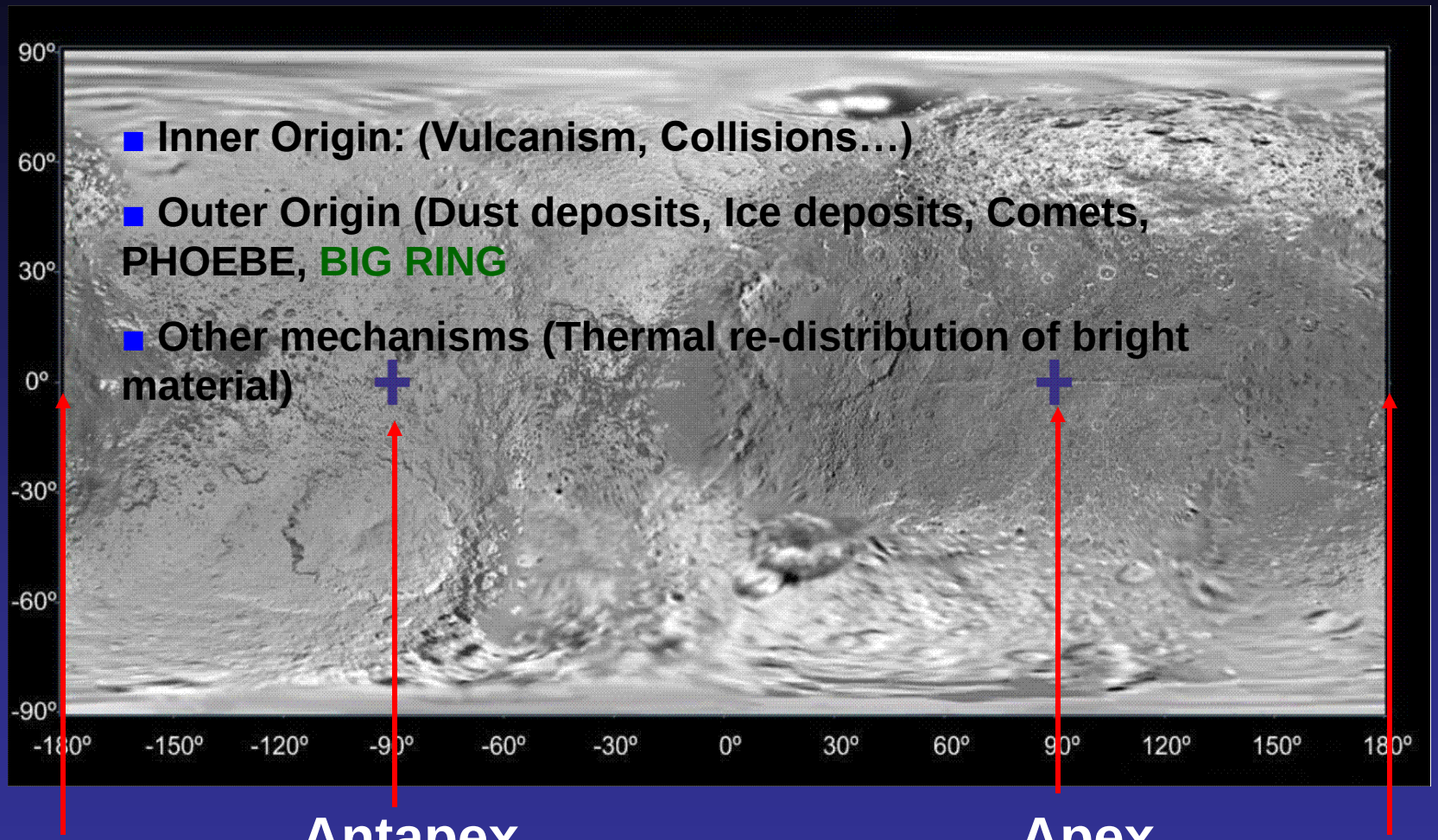
Outer satellites

Spitzer Telescope (2009)

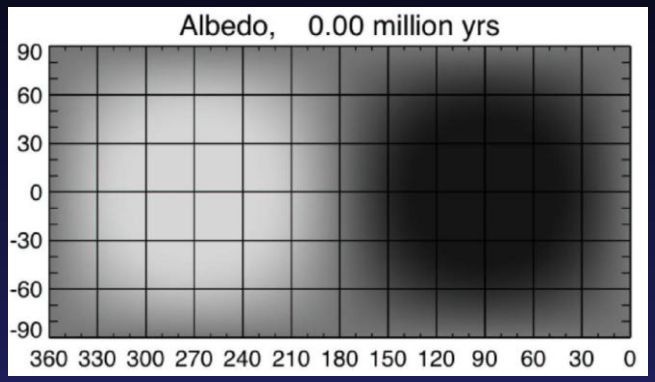


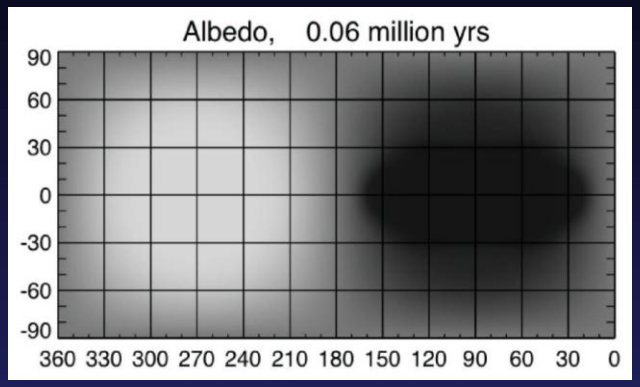


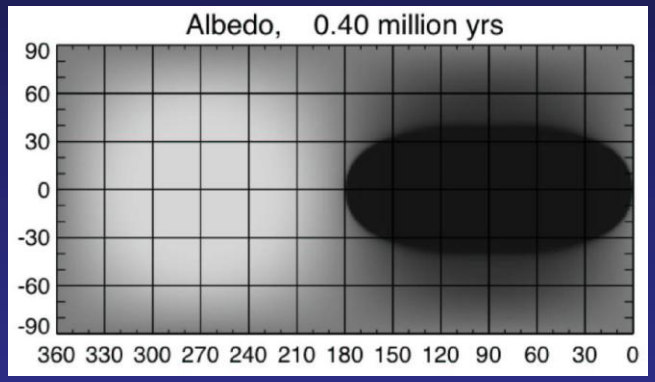
Iapetus Surface (2011)

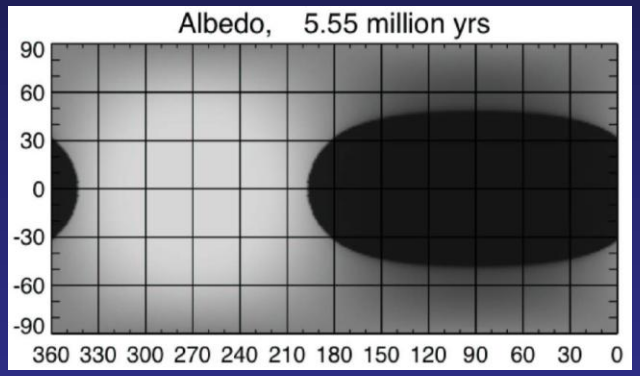


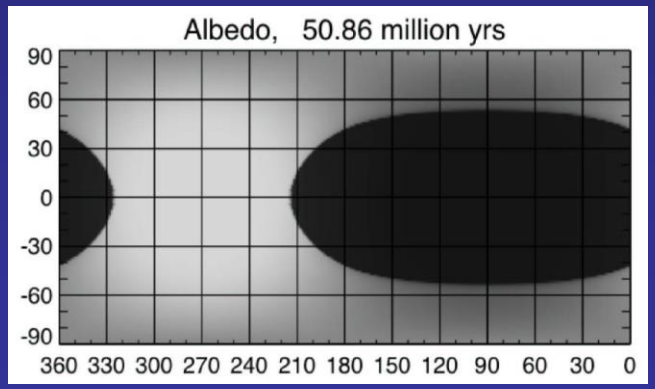
Frost Migration Model (Spencer et al. 2005)

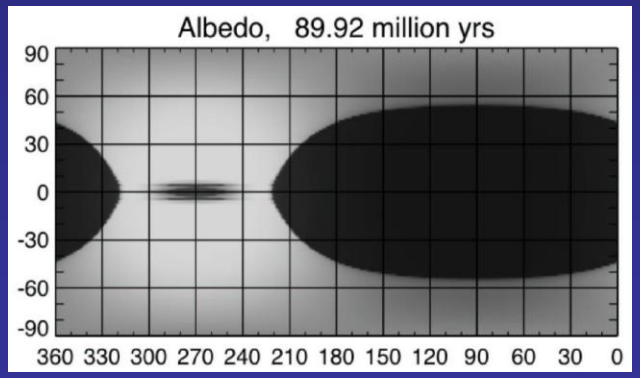






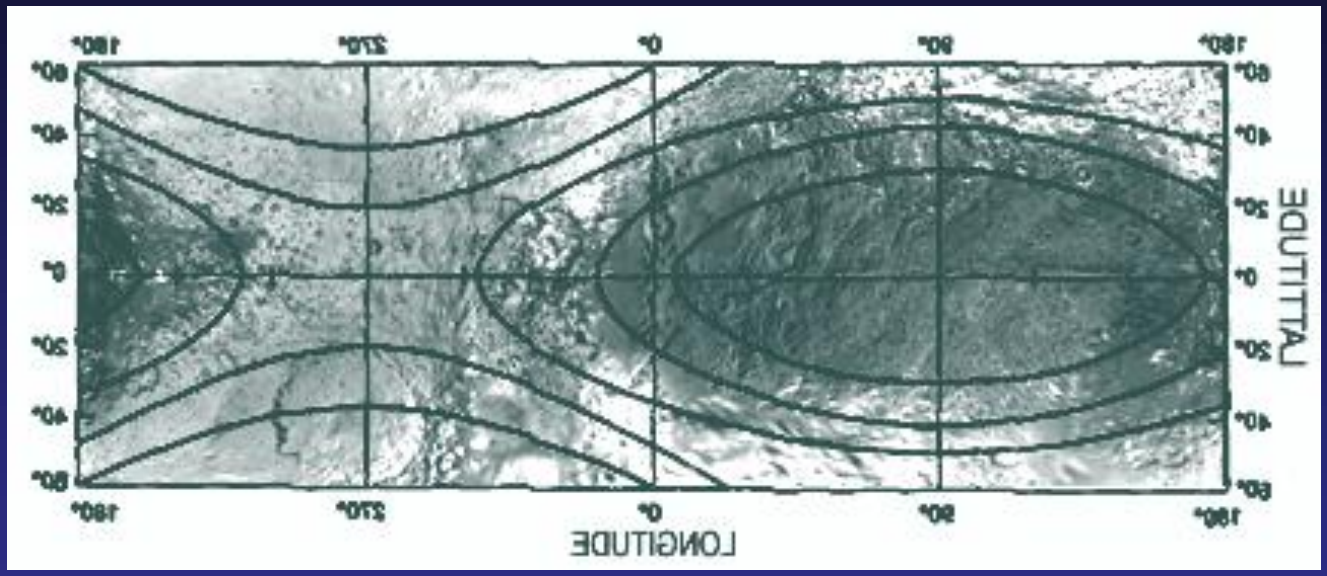






- **Dynamical Models for the Dust**

Cook & Franklin (1970)

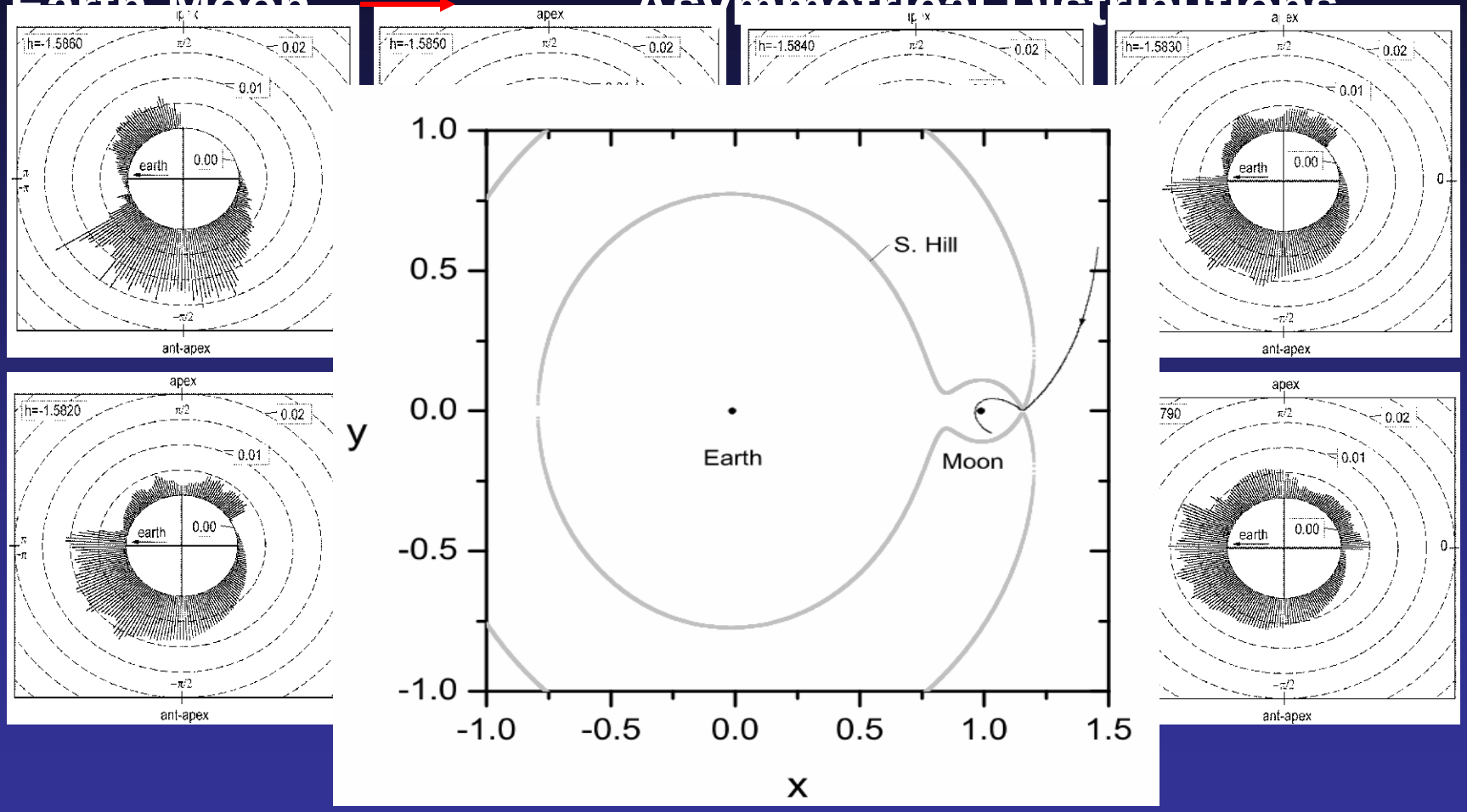


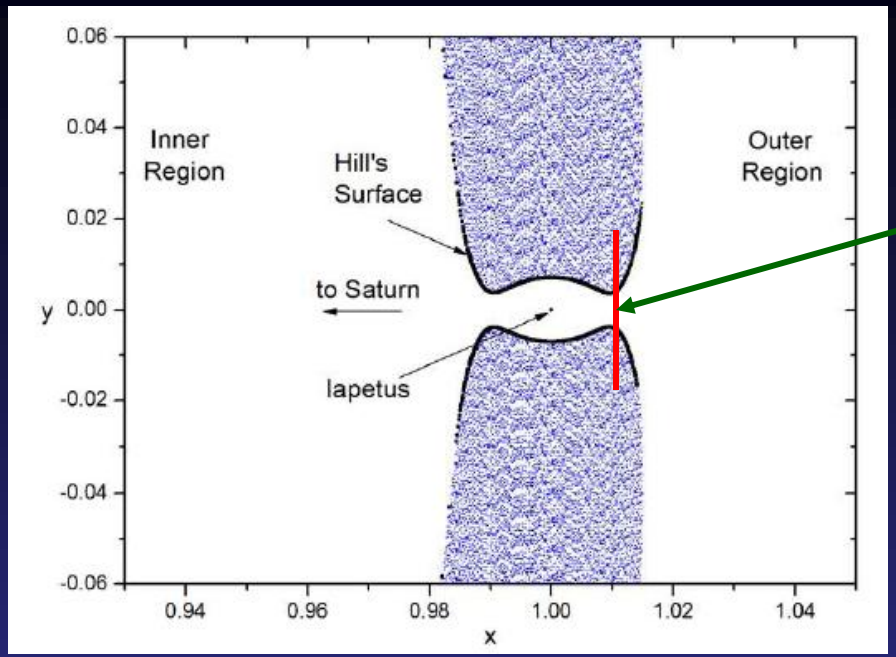
Dispersion of particles (high energy)

- **Our Model… RTBP**

  Low energy trajectories

Earth-Moon → **Asymmetrical Distributions**



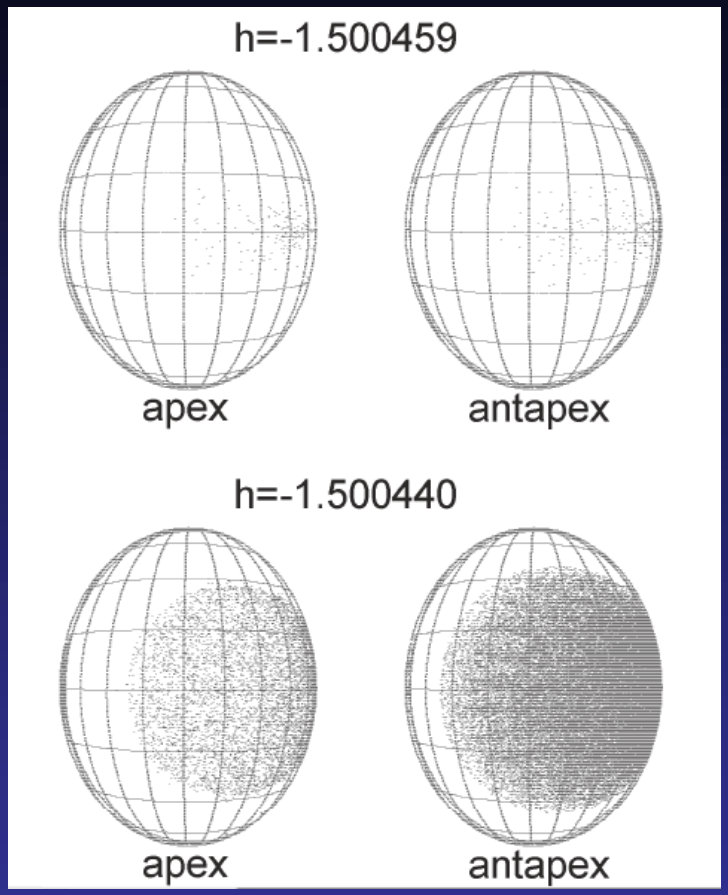


$$
\begin{aligned}
y_i &= -|y_M| + i\Delta \le |y_M| \qquad i = 0, 1, \ldots \\
z_j &= -|z_M| + j\Delta \le |z_M| \qquad j = 0, 1, \ldots \\
\dot{y}_k &= -|\dot{y}_M| + k\Delta \le |\dot{y}_M| \qquad k = 0, 1, \ldots \\
\dot{z}_l &= -|\dot{z}_M| + l\Delta \le |\dot{z}_M| \qquad l = 0, 1, \ldots
\end{aligned}
$$

h	n_T	n_C	n_E
−1,500455	90079	3175	27008
−1,500450	368532	917	125307
−1,500445	867656	9192	357284
−1,500440	1519842	54007	682551
−1,500435	2408472	120699	1170292
−1,500430	3517567	206755	1803512
−1,500425	4855259	306913	2587770
−1,500420	6431547	414766	3519758
−1,500400	15324590	936223	8640261
−1,500380	28920546	1796566	16613406

Δt_{MAX}=100 (~22 year)

Results



Gall-Peters' Projection

$$X = R\,\theta_1\,\cos(\alpha)$$
$$Y = R\,\sin(\theta_2)/\cos(\alpha)$$

α=45º

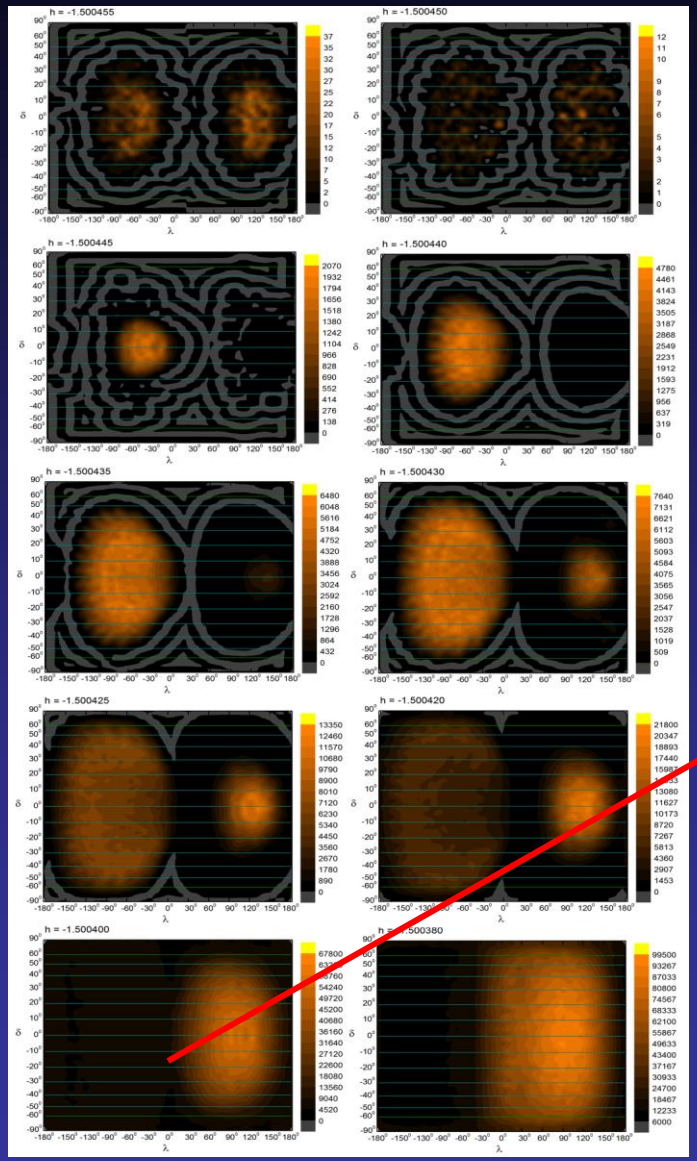
Count of collisions

↓

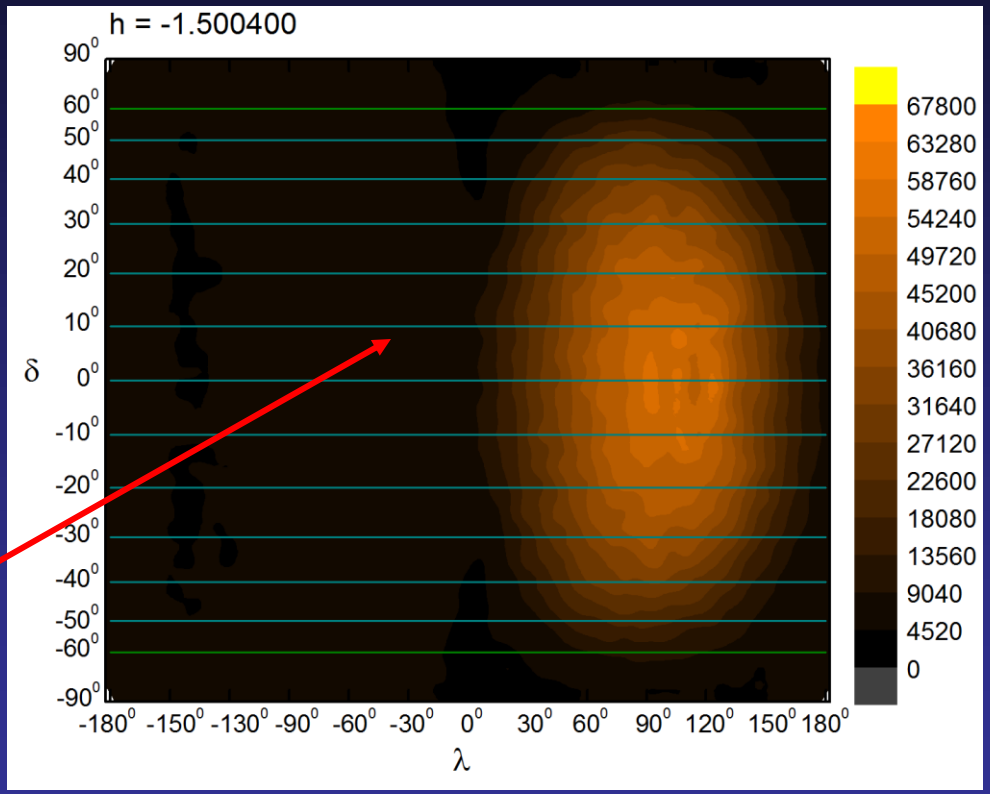
conservation of areas

80 x 40 cells

Distributions with Constant Flux

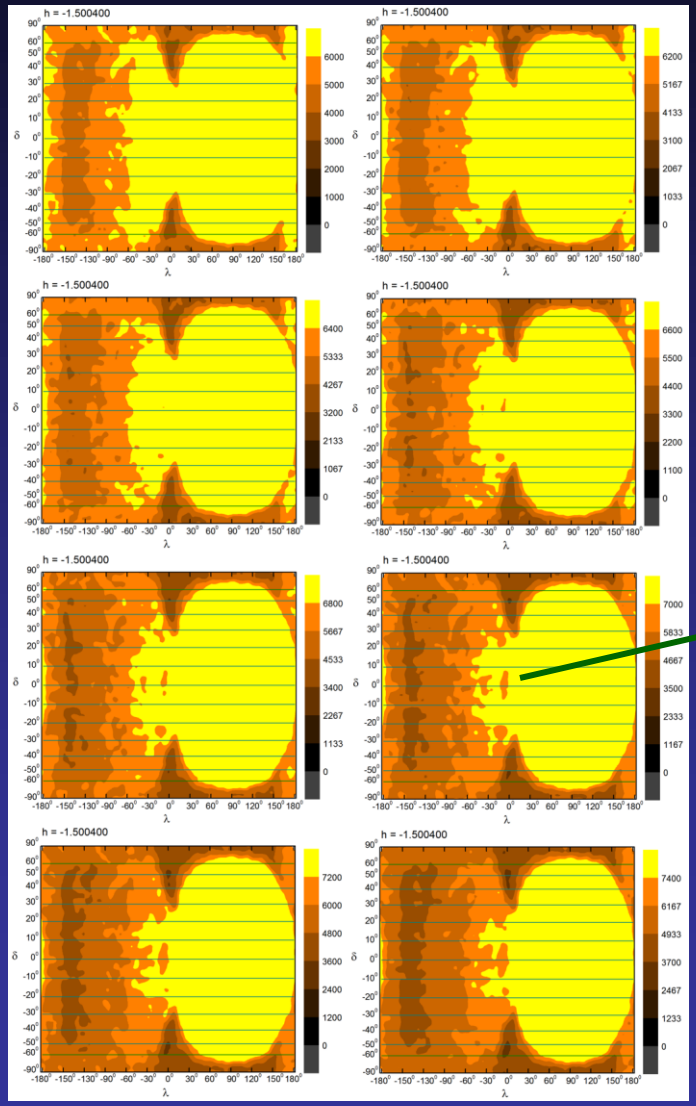


Factor $\Delta t_{MAX}/\Delta t_C$

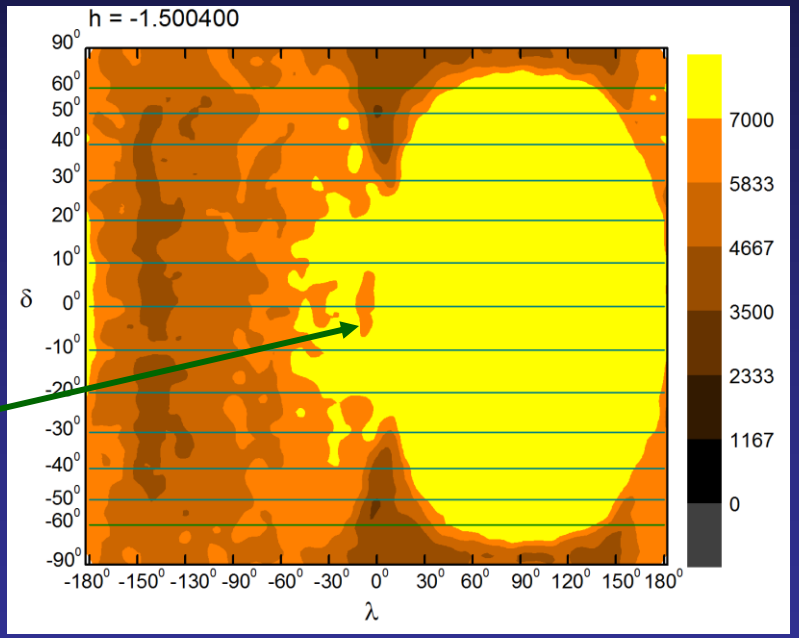


- **Particular Case h=-1.500400**

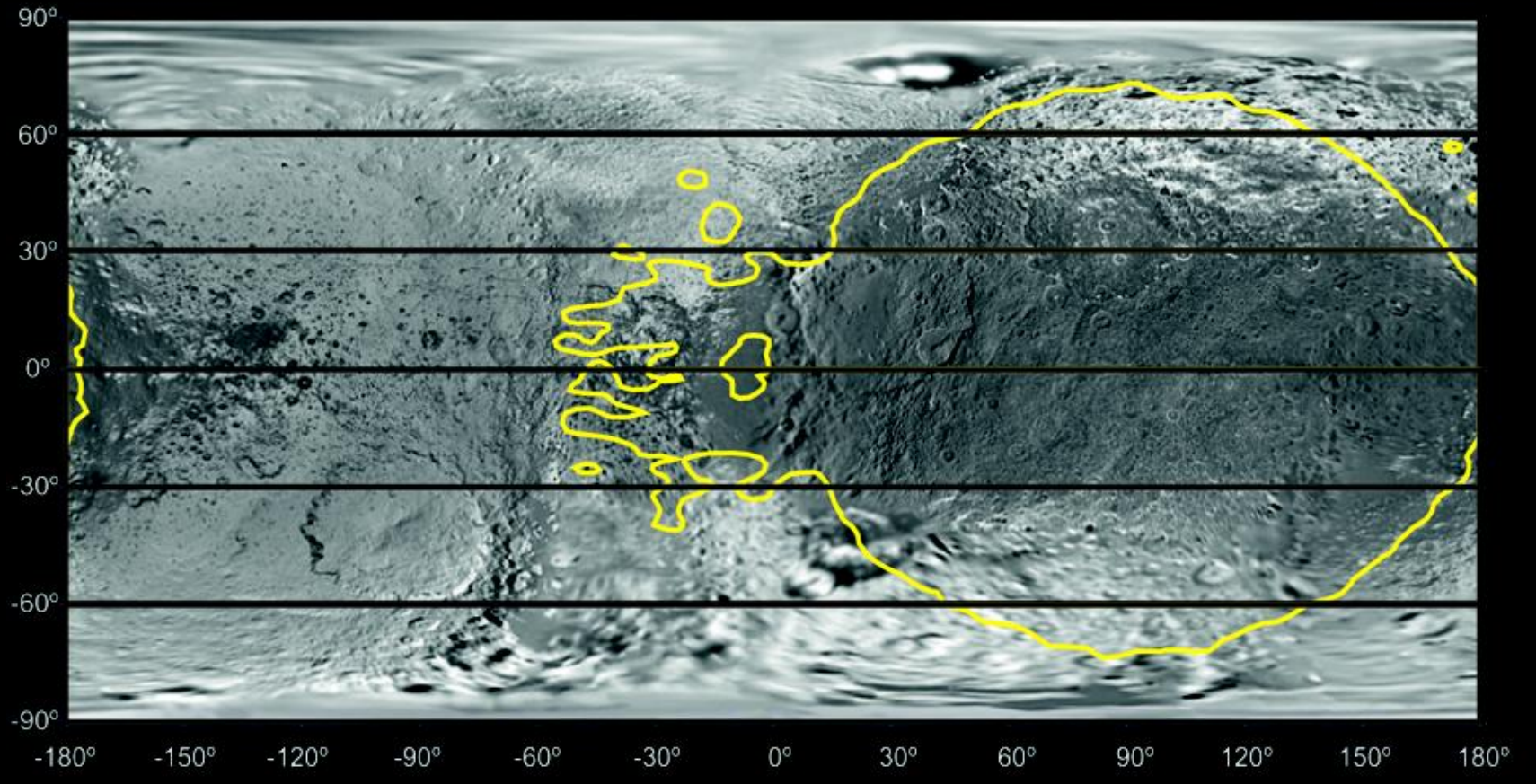
Saturated Distribution



7000 impacts

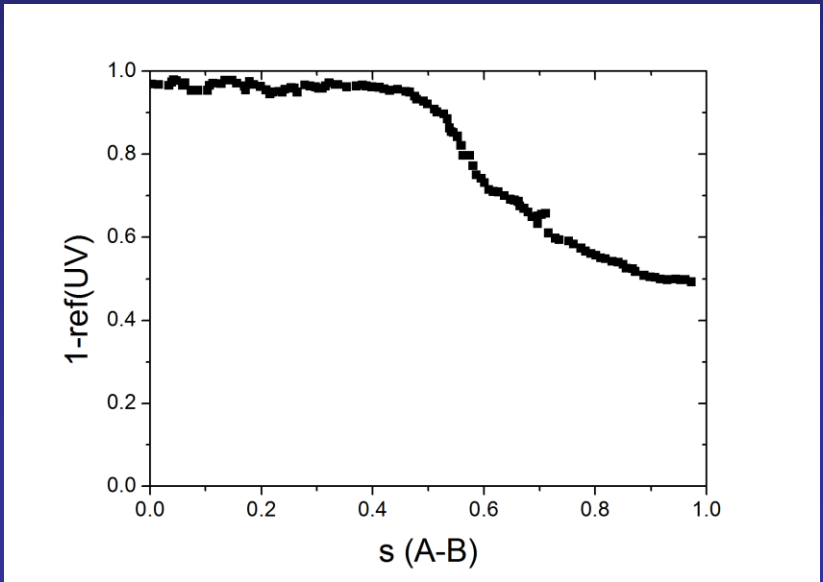


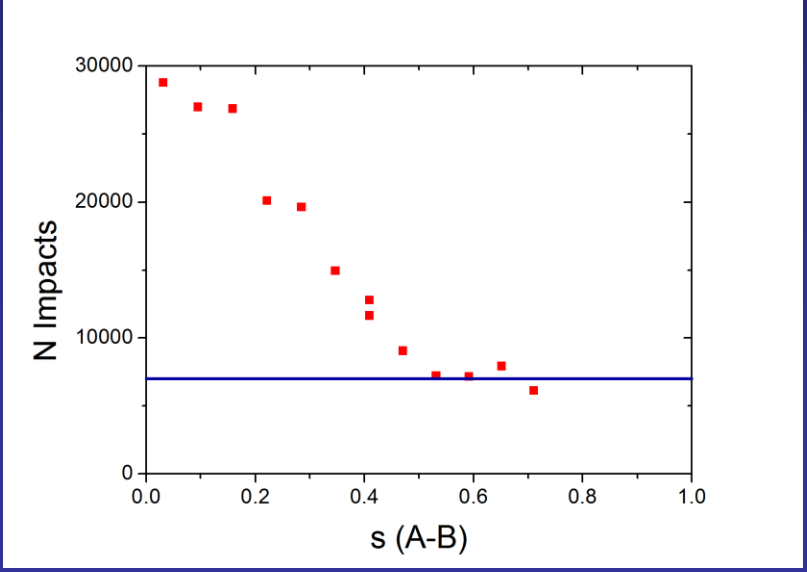
- **Comparison…**



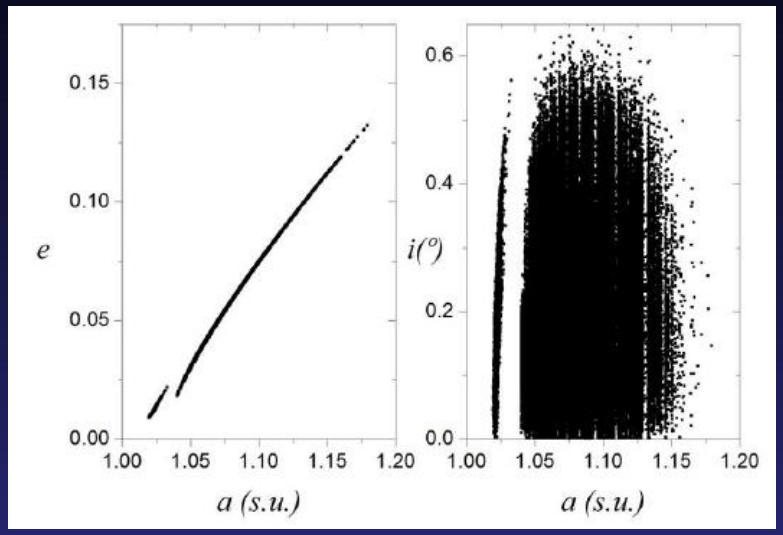
- Discussion…
  - Bounded range of values for h
  - RTBP
  - Value of Saturation
  - Where does the dust come from?

Buratti et al. 2002





- **Where does the dust come from?**

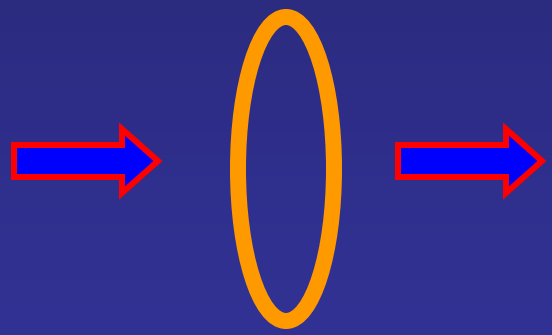


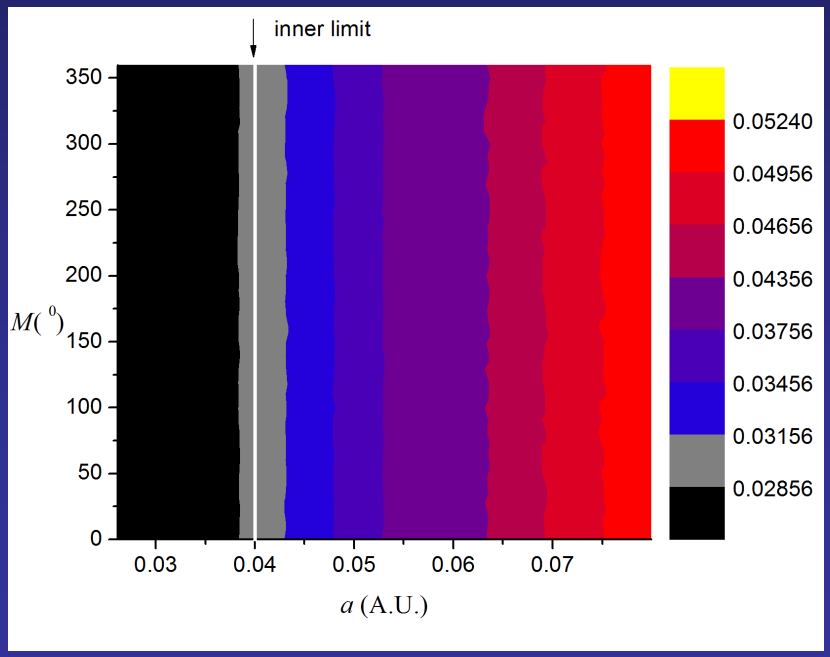
reverse-time…

d_{MAX}~1.33 s.u.

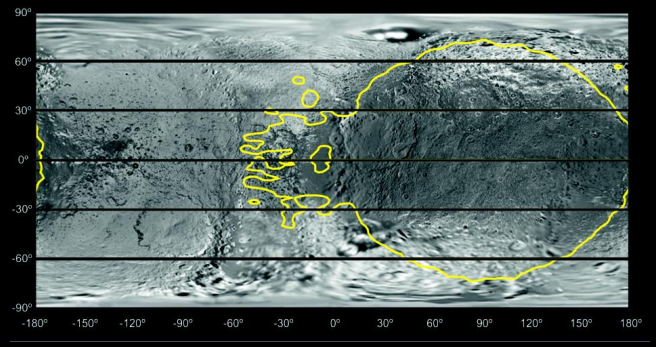
~~PHOEBE~~

Disturbing the RING





The End (FIN)



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