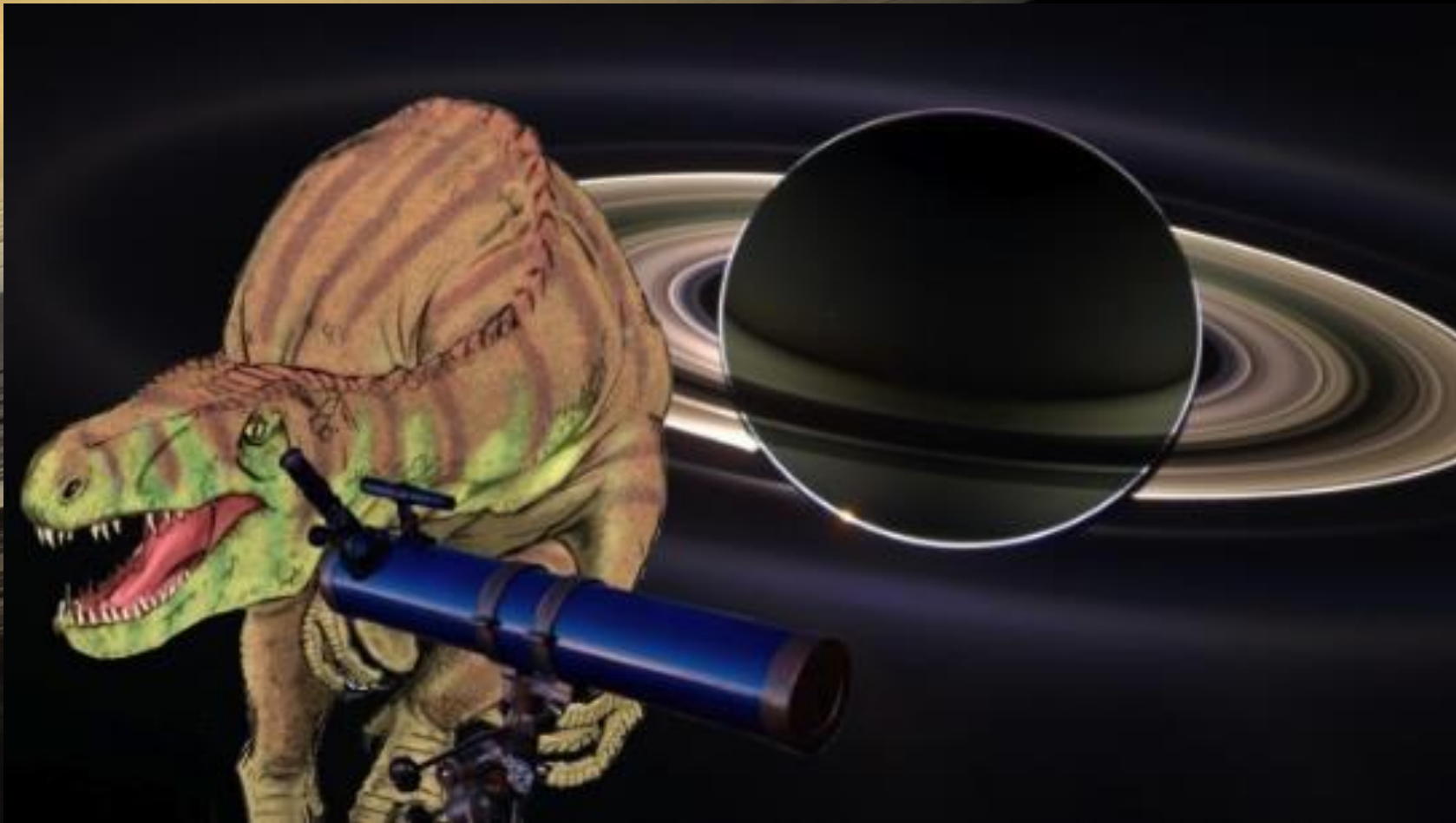


# Could the Dinosaurs have observed Saturn's Rings ?

N. Altobelli, SSW#16, Aranjuez, 2024



# Saturn's Rings May Be Younger Than the Dinosaurs

News

By Charles Q. Choi ( [space.com-astronomy](#) ) published January 17, 2019

New Research

## Dinosaurs Were Around Before Saturn Had Rings

Data from the Cassini space probe suggests that the rings may be as young as 150 million years old

Jason Daley

Correspondent

December 15, 2017

## Saturn is ancient, but its rings are only as old as the dinosaurs

How the gas giant got its rings.

BY NEEL V. PATEL | PUBLISHED JAN 18, 2019 12:24 AM EST

SCIENCE

## Saturn's rings may have formed as dinosaurs roamed Earth

And they won't last long, scientists say.

By [Elisha Savers](#) on May 16, 2023



Knowledge

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Columns

Podcasts

Features



The Universe. Space. Tech > Astronomy news, astrophysics and space science > Saturn's rings are formed during the time of the dinosaurs



## Saturn's rings are formed during the time of the dinosaurs



16.05.2023

Saturn's rings are much younger than previously thought, and their age does not exceed several hundred million years. This conclusion was reached by a team of American researchers from the University of Colorado at Boulder.

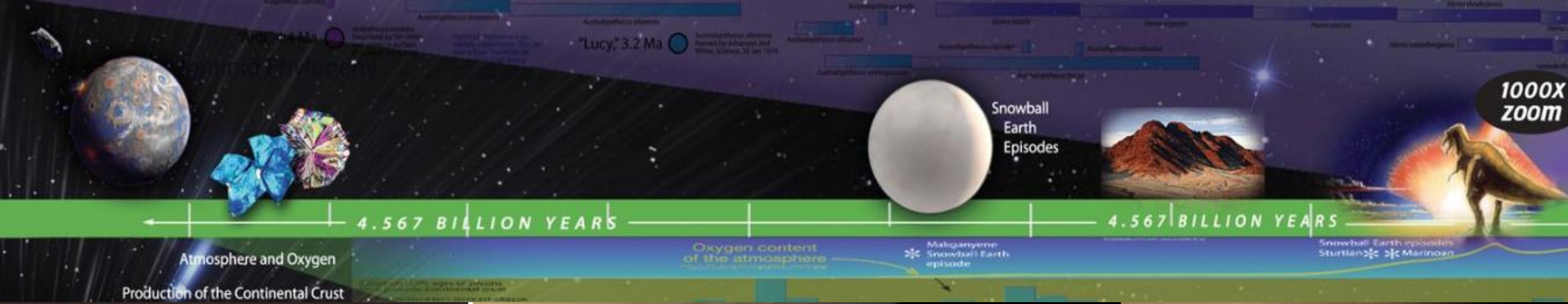


The rings don't point to billions of years and random chance processes. They point to God's creative handiwork. The reason these rings are still so pristine is that they were created by God

just 6,000 years ago, on day four of creation

week. Naturalistic scientists have a difficult





ARE THE RINGS YOUNG OR OLD?



~ 4 billions years ago  
'OLD RINGS'

VS

100-10 millions years ago  
'YOUNG RINGS'



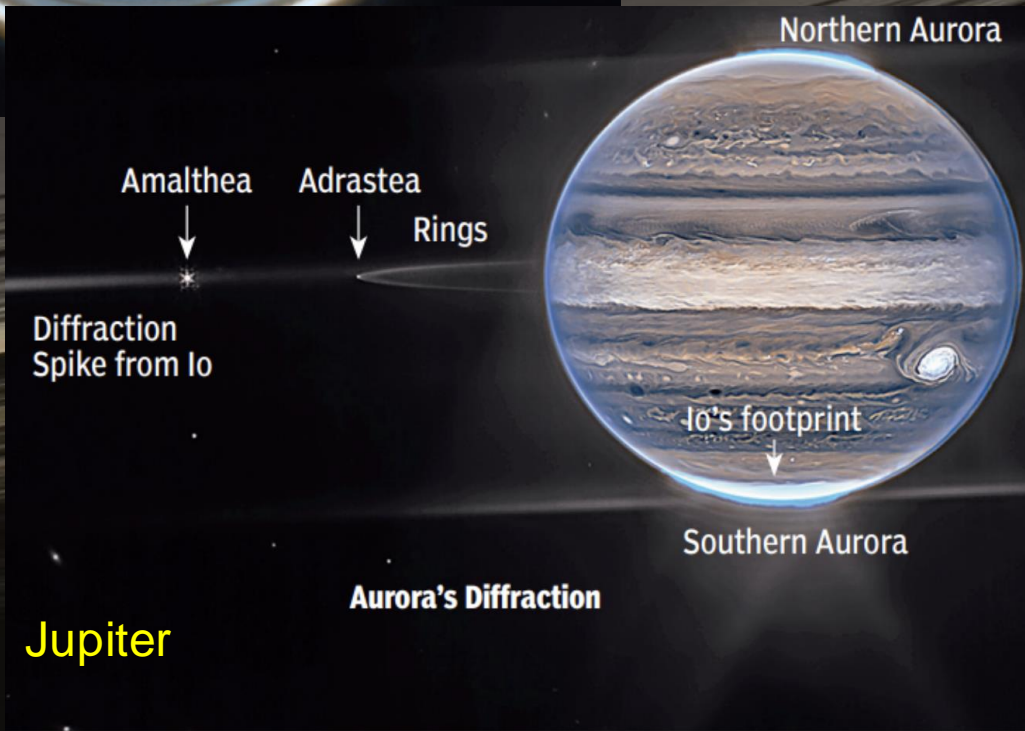
# WHO CARES (1/2) ?



Uranus

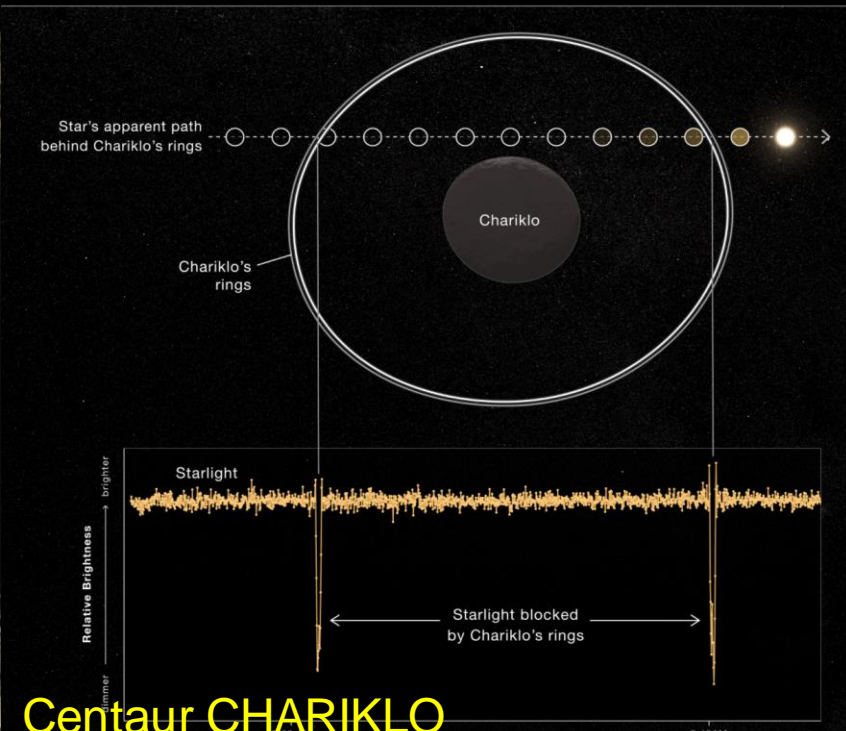


Neptune



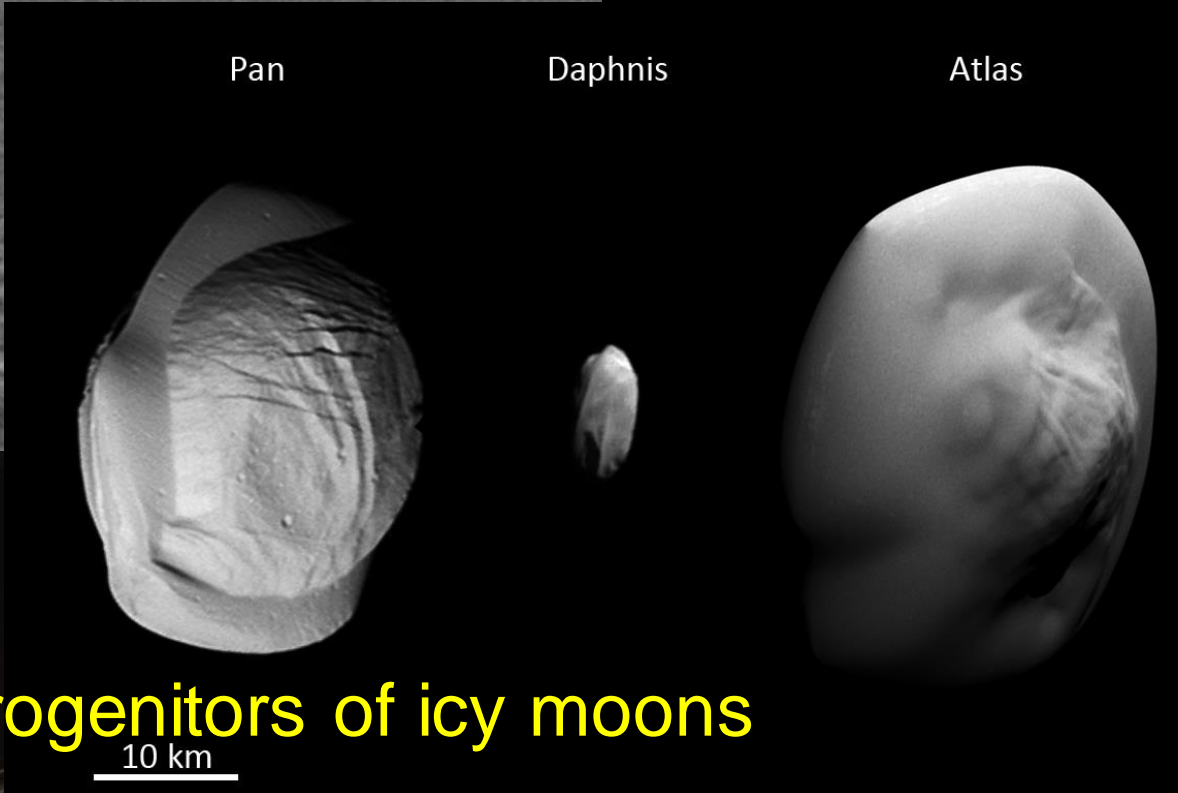
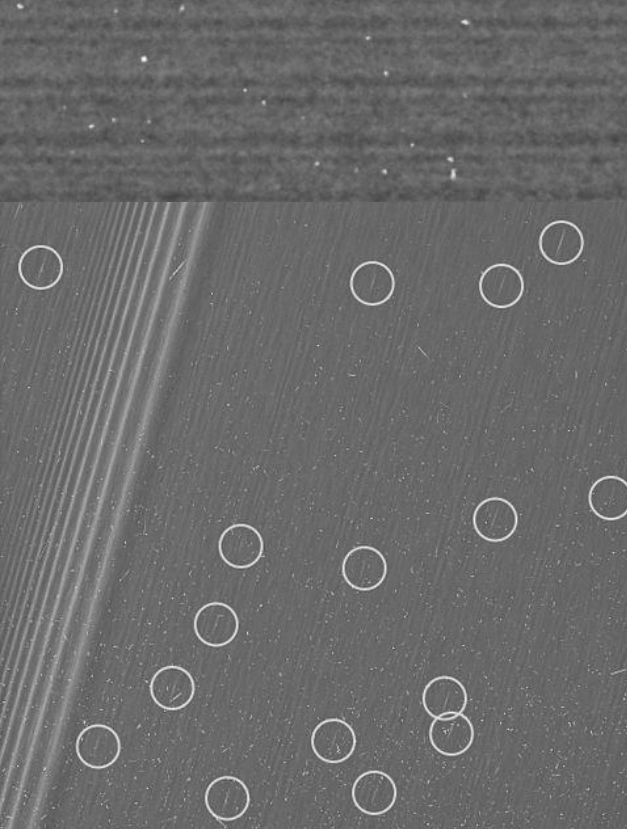
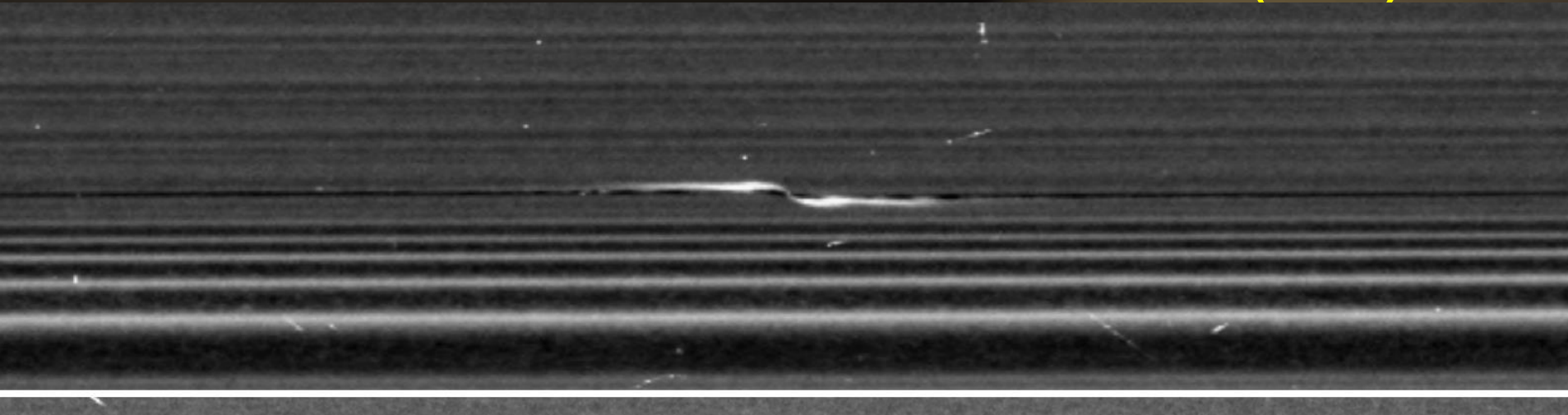
Jupiter

CENTAUR 10199 CHARIKLO  
OCCULTATION LIGHT CURVE



Centaur CHARIKLO

# WHO CARES (2/2) ?



Massive rings are progenitors of icy moons

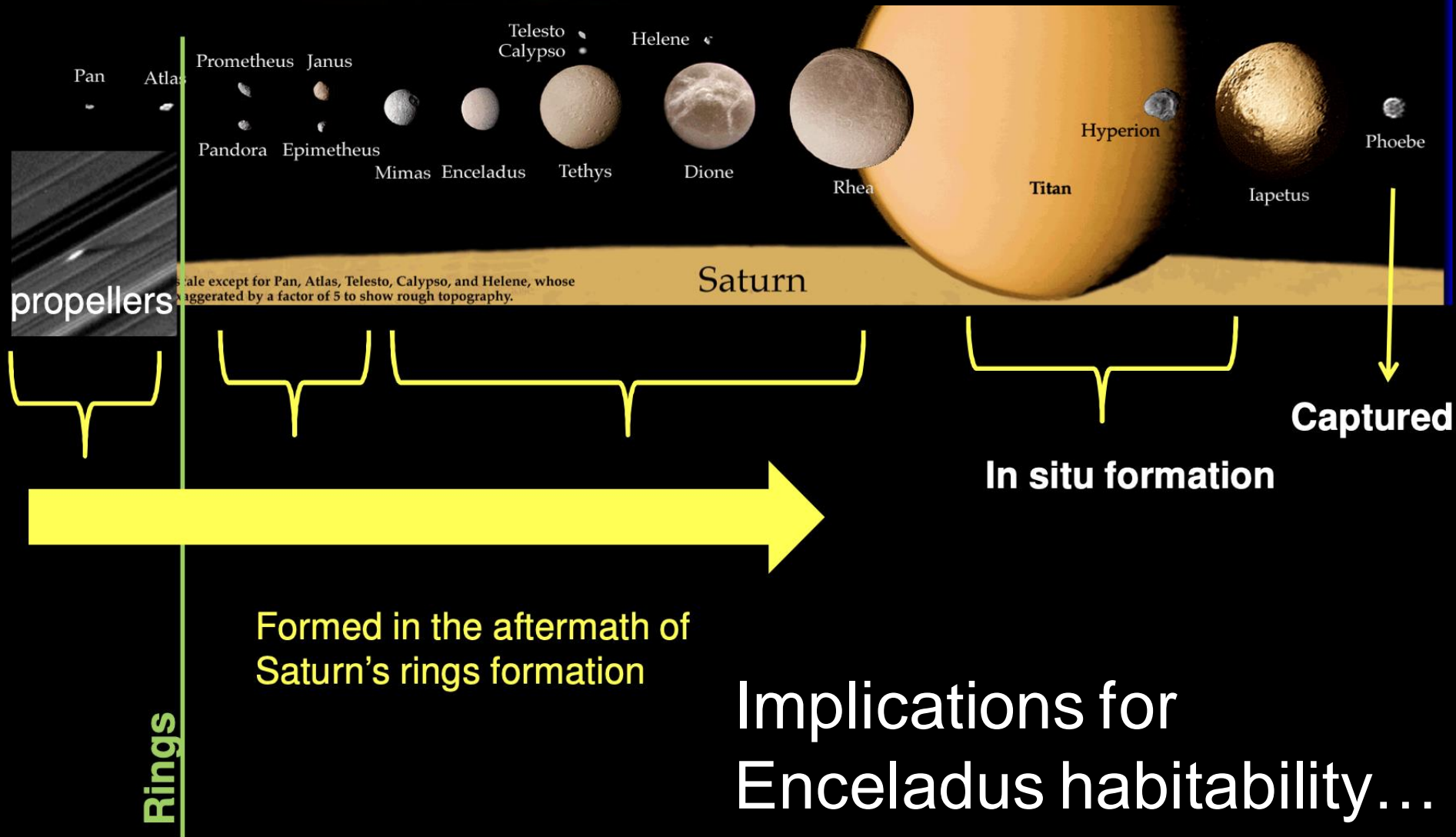
10 km



# Forming Saturn's Satellites by Viscous Spreading of Rings

ESLAB 2012

Sébastien CHARNOZ (Univ. Paris Diderot)



propellers

Scale except for Pan, Atlas, Telesto, Calypso, and Helene, whose size is exaggerated by a factor of 5 to show rough topography.

Saturn

Captured

In situ formation

Formed in the aftermath of Saturn's rings formation

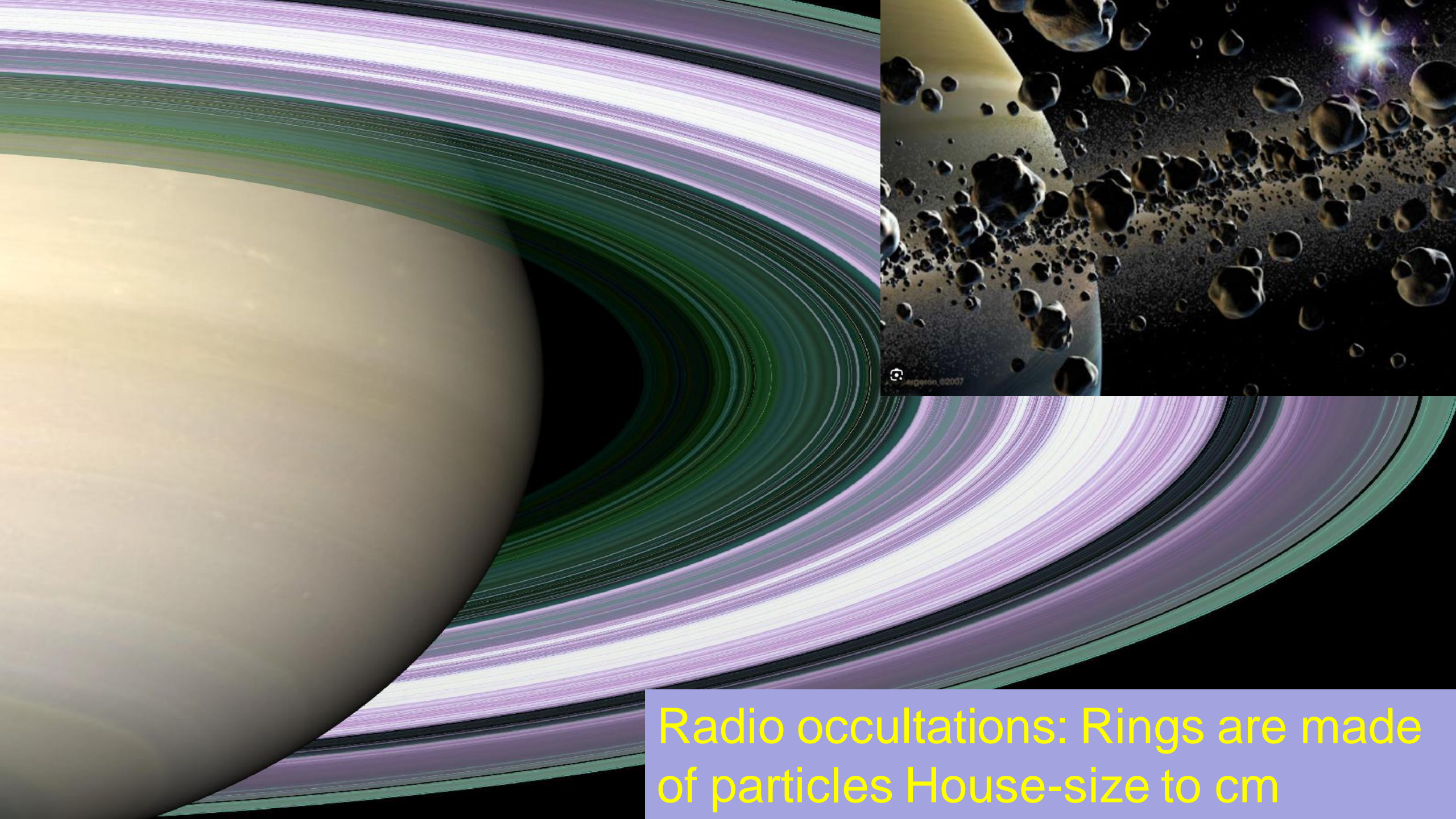
Implications for Enceladus habitability...

**WE CARED SO MUCH THAT...  
THE MISSION CASSINI-HUYGENS HAPPENED**

2004 -2017 NASA/ESA/ASI CASSINI-HUYGENS MISSION  
(Saturn orbiter + Titan lander)

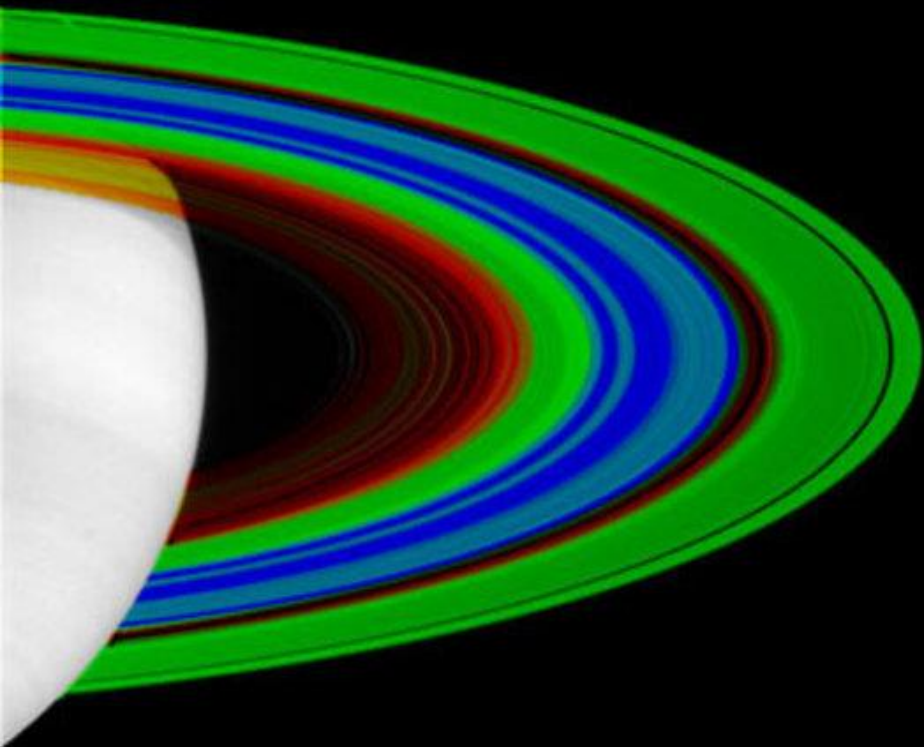




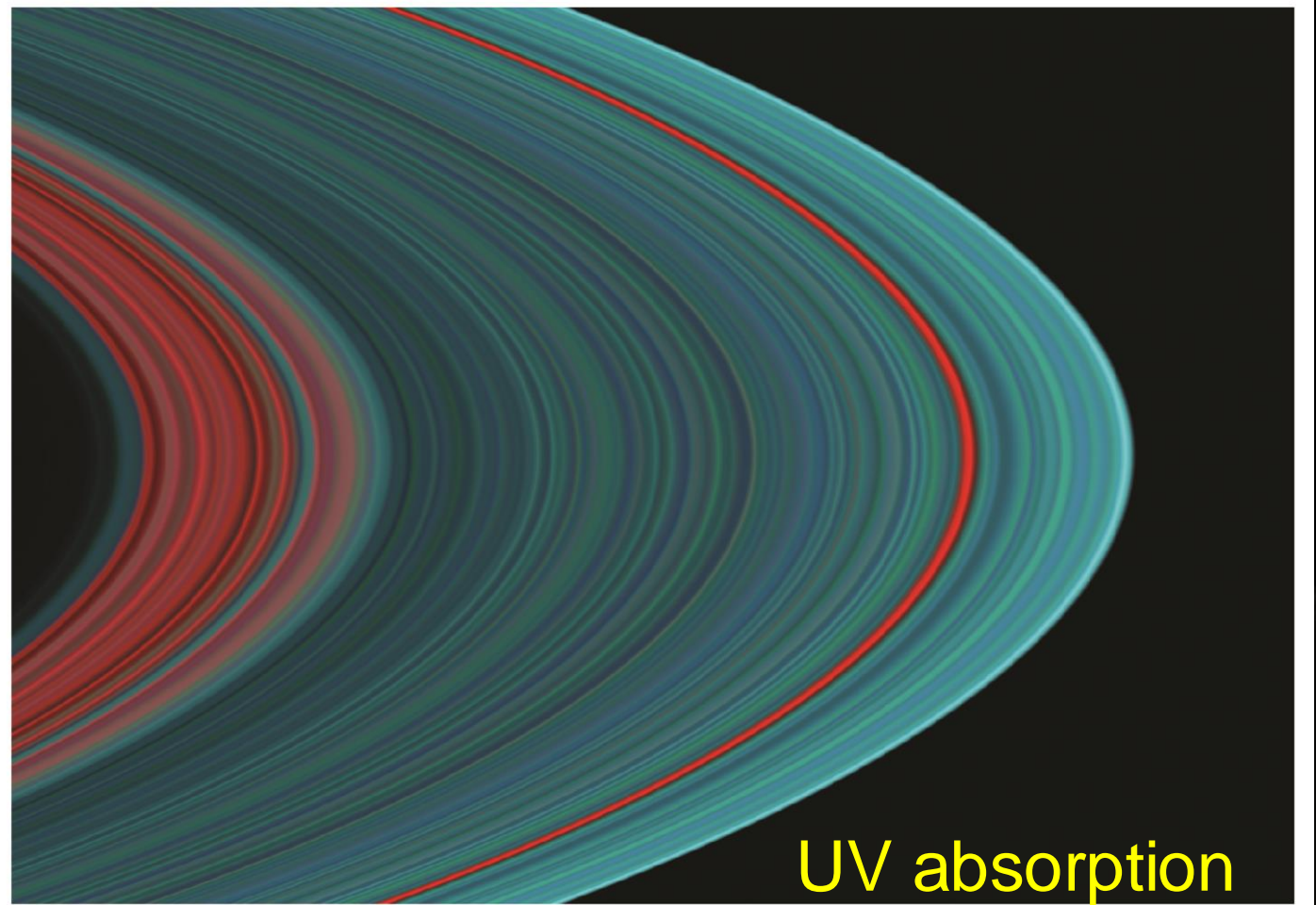


Radio occultations: Rings are made of particles House-size to cm





Infrared thermal mapping



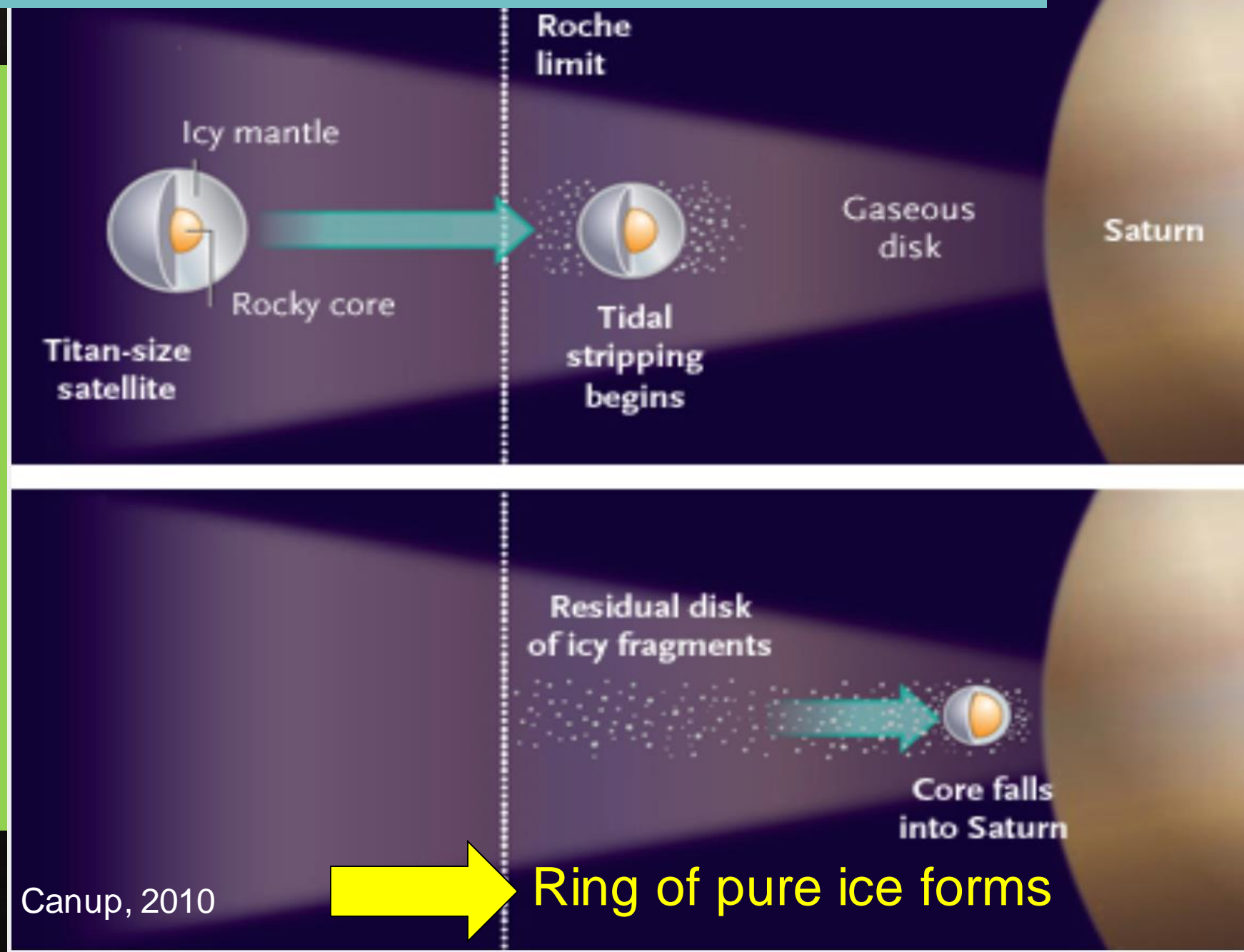
UV absorption

RINGS ARE MADE OF NEARLY PURE WATER ICE (0.1-2 % volume fraction of non-icy material)

# The OLD RING/PURE ICE SCENARIO (2010)

## Ingredients:

- Large and differentiated icy moon
- Inward migration (requires remaining sub-nebulae gas)
- Tidal ice 'peeling' within **Roche Zone**



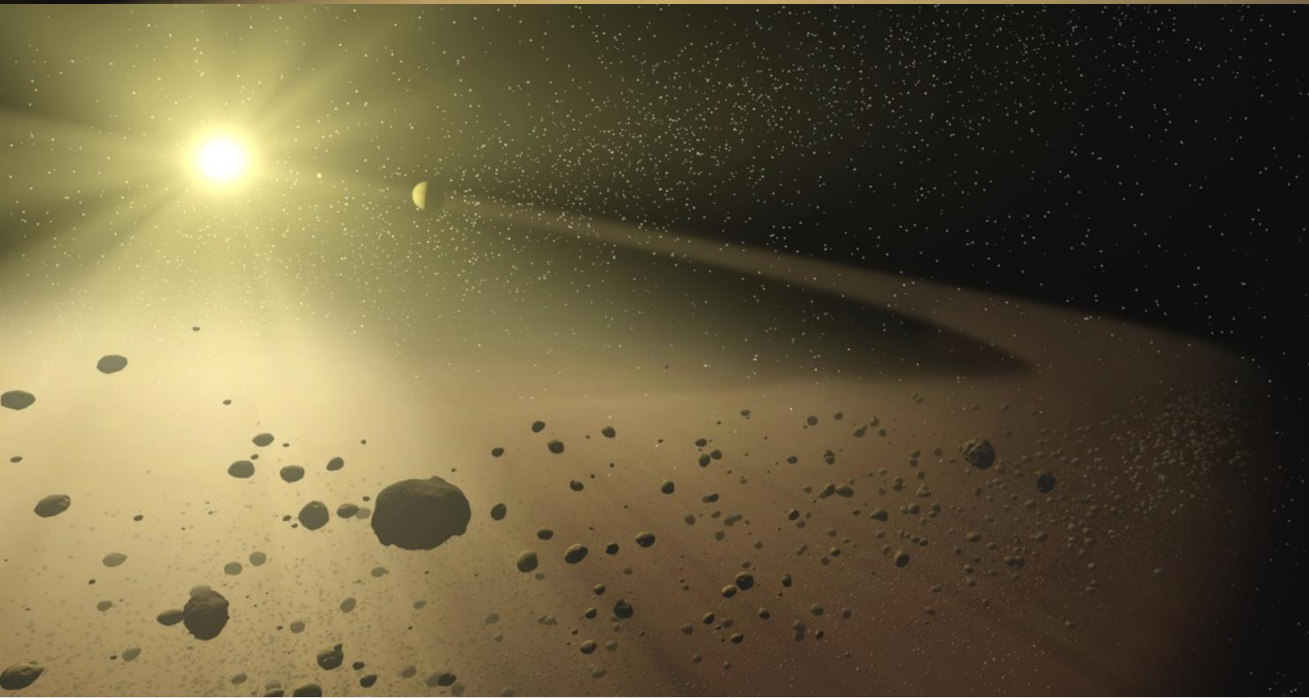
Canup, 2010



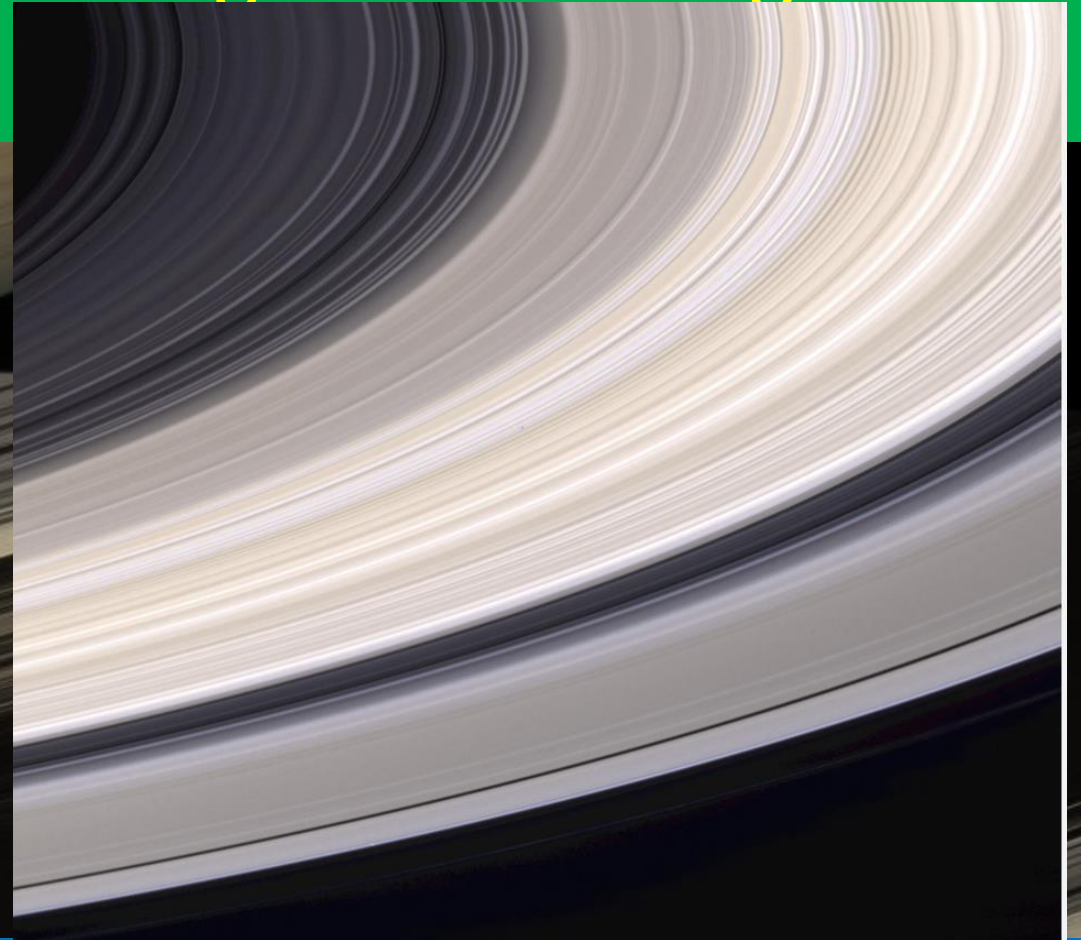
Ring of pure ice forms



BUT....., the Solar System is a very dusty place...  
dark silicates/carbon particles polluting and eroding the  
rings since their formation...



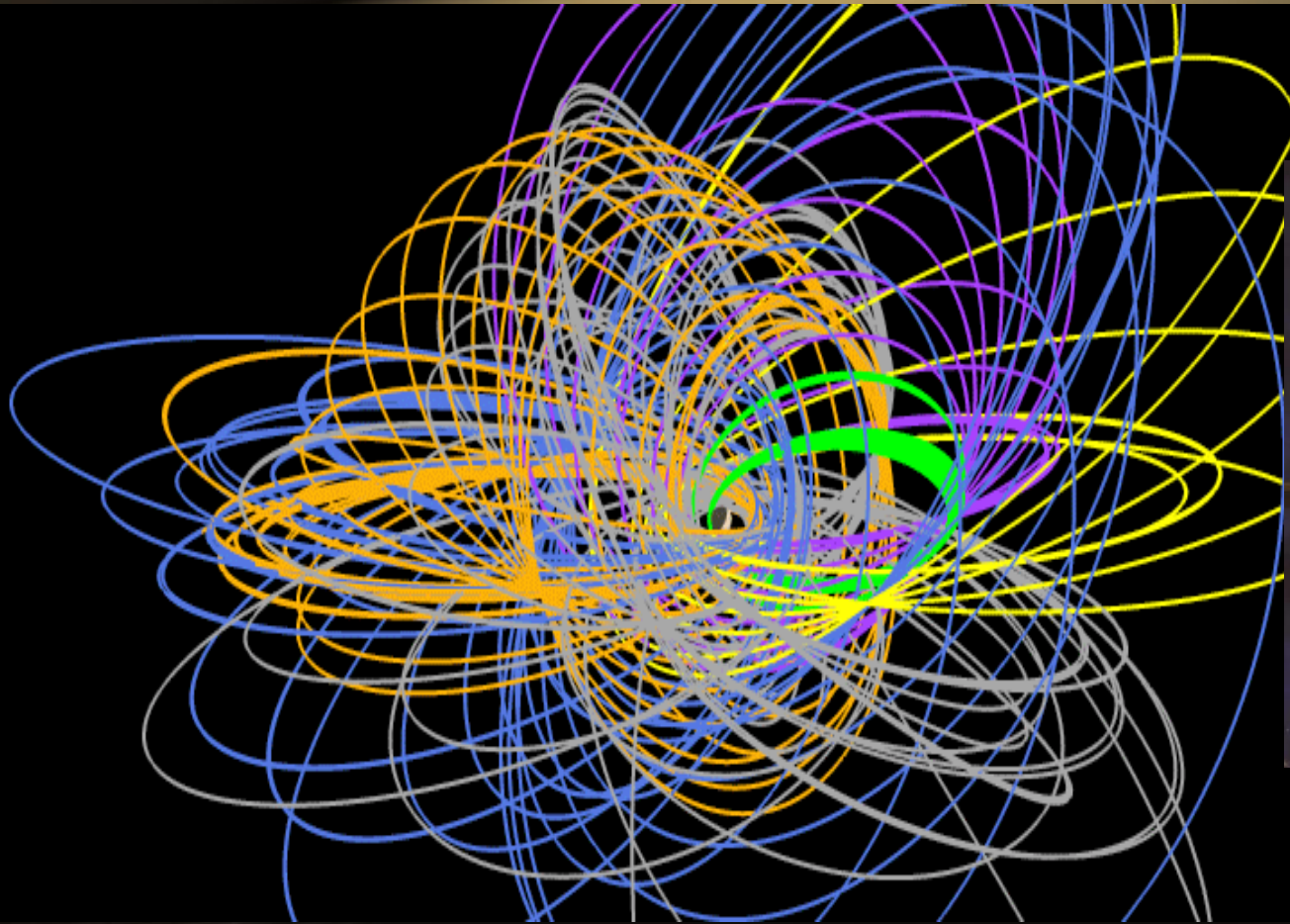
*Credit: NASA/JPL-Caltech/T. Pyle (SSC)*



Can a ~4 billions years old ring still look so 'ice clean'  
and not have been 'eroded away' by now ?



# Enter CASSINI-CDA: measuring the current dust infall-ring erosion/polution rate



The in-fall rate of today *is a lower boundary for the past* (more collisions, more dust)



# WE FOUND THAT: RINGS CANNOT BE OLD!

Kempf, Altobelli et al. 2023, Science Advances

RESEARCH ARTICLE | SPACE SCIENCES



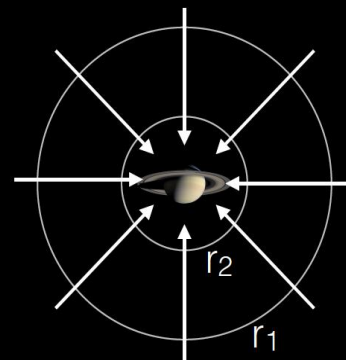
## Micrometeoroid infall onto Saturn's rings constrains their age to no more than a few hundred million years

SASCHA KEMPF, NICOLAS ALTOBELLI, JÜRGEN SCHMIDT, JEFFREY N. CUZZI, PAUL R. ESTRADA, AND RALF SRAMA

Authors Info & Affiliations

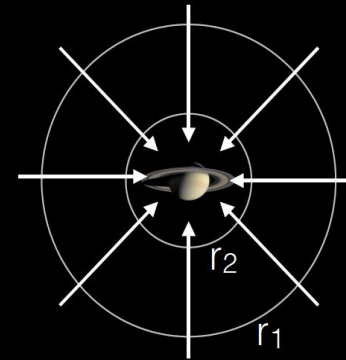
A FEW HUN...

Concentric Infall



$$\frac{F(r_1)}{F(r_2)} = \left(\frac{r_2}{r_1}\right)^2$$

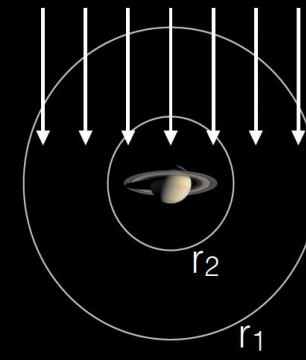
General



$$F(r) = f(r, v_\infty) F_\infty$$

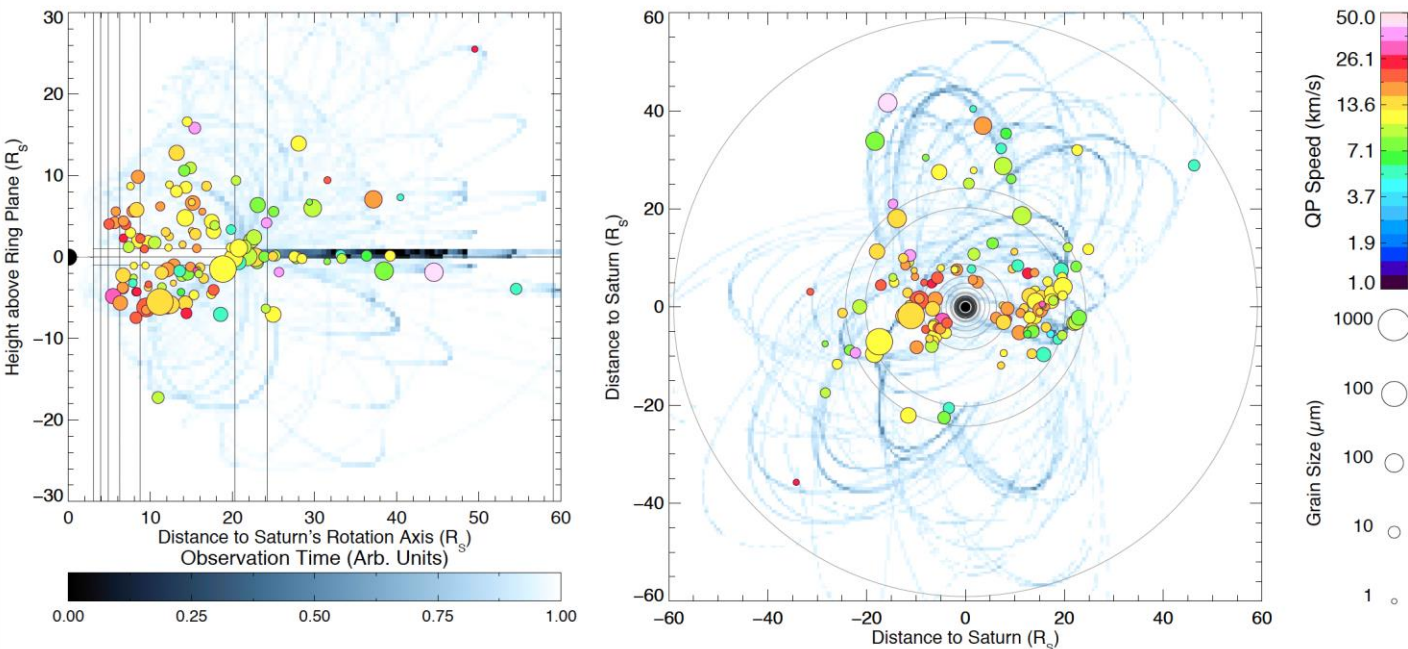
Colombo et al., JGR, 71, 1966

Fast Stream



$$\frac{F(r_1)}{F(r_2)} = 1$$

Altobelli, Kempf et al. 2024 (Dust populations at Saturn, (in prep))



Kuiper belt dust dominates, strongly focused gravitationally at Saturn

**Mass Flux:**

$$6.9 \cdot 10^{-17} \text{ and } 2.7 \cdot 10^{-16} \text{ kg m}^{-2} \text{ s}^{-1}$$

**Ring Exposure Age:**

≈ 100 to 400 million years

The background features a series of curved, overlapping lines in shades of grey and black, creating a sense of depth and movement. A solid purple horizontal banner is positioned across the middle of the image.

END OF STORY ?



# NOPE! CONCLUSION...

## Scenario of Young Rings formation problematic

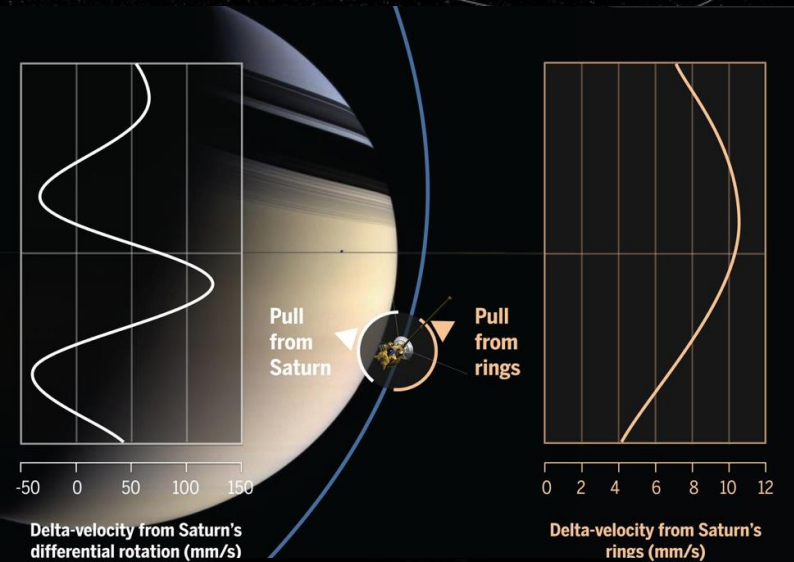
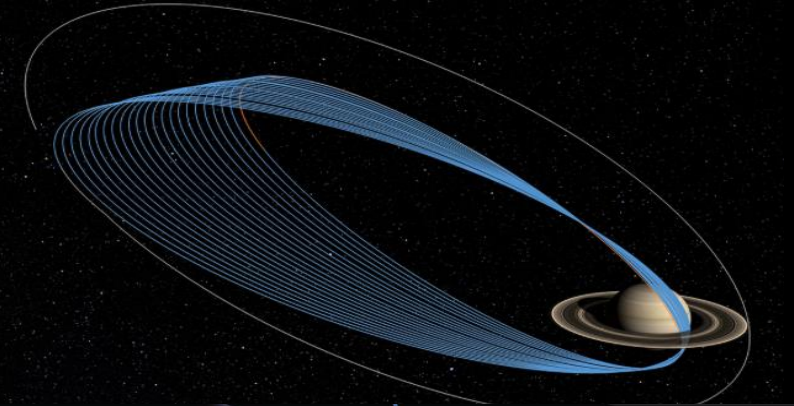
- Recent *two bodies collision* required near Saturn's Roche zone (moon-moon or moon-comet...): *highly unlikely* in a dynamically evolved Solar/Saturn System

- *Low value of ring mass* measured can be reached by massive primordial rings + *billions of years of viscous spreading*

## Ring 'cleaning' mechanism may be at play

- Make Rings 'look' young by removing in-falling pollution

- CASSINI-CDA showed ring emission of silicates >> ice during mission's Grand Finale



0.4 x



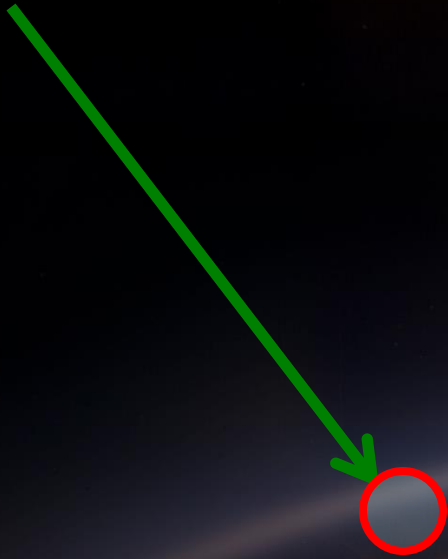
=  $1.5 \times 10^{19}$  kg

The background features a series of curved, overlapping bands of light and dark colors, creating a sense of depth and movement. The colors range from bright yellow to deep black, with the text centered in the middle.

**BACKUP SLIDES**



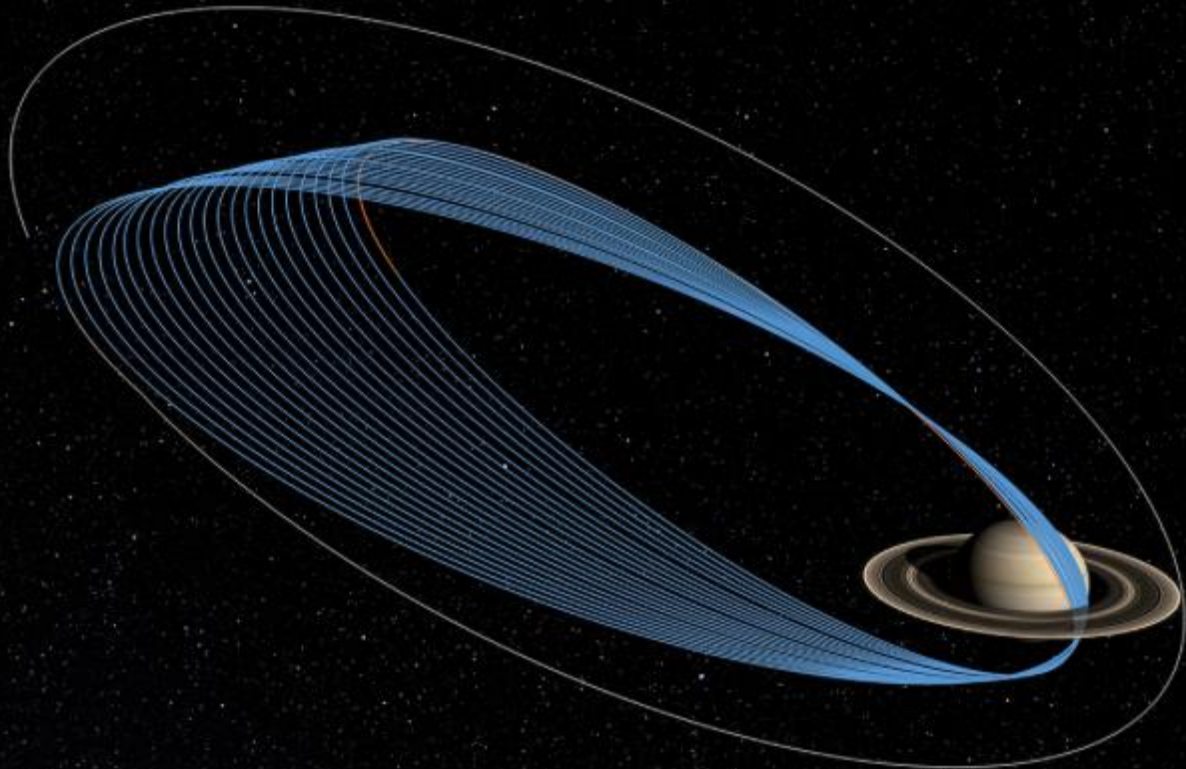
'Pale blue dot'



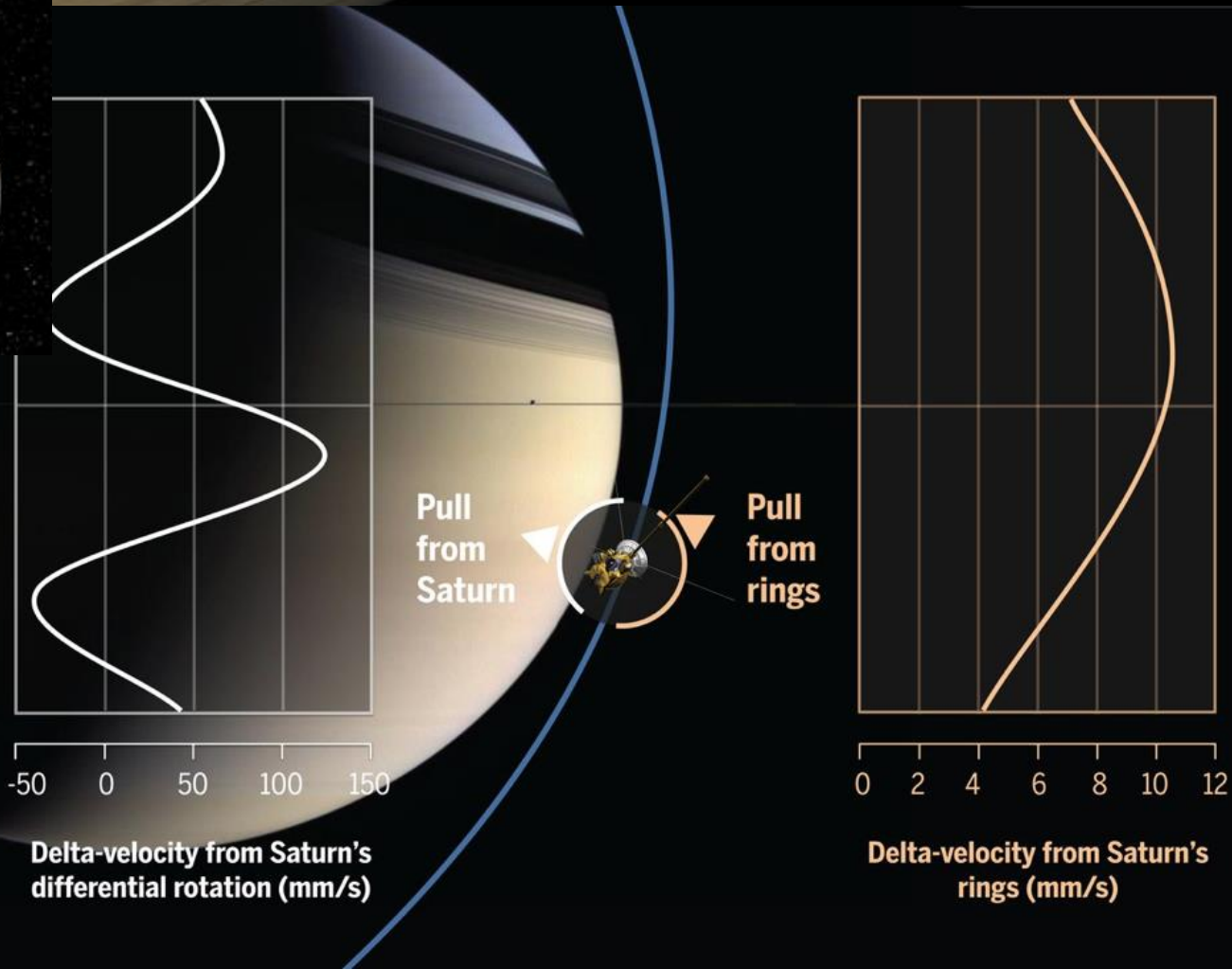
- First, get a selfie -

*(establish clear superiority vs dinos...evolution works...)*

# TOTAL MASS OF THE RINGS:

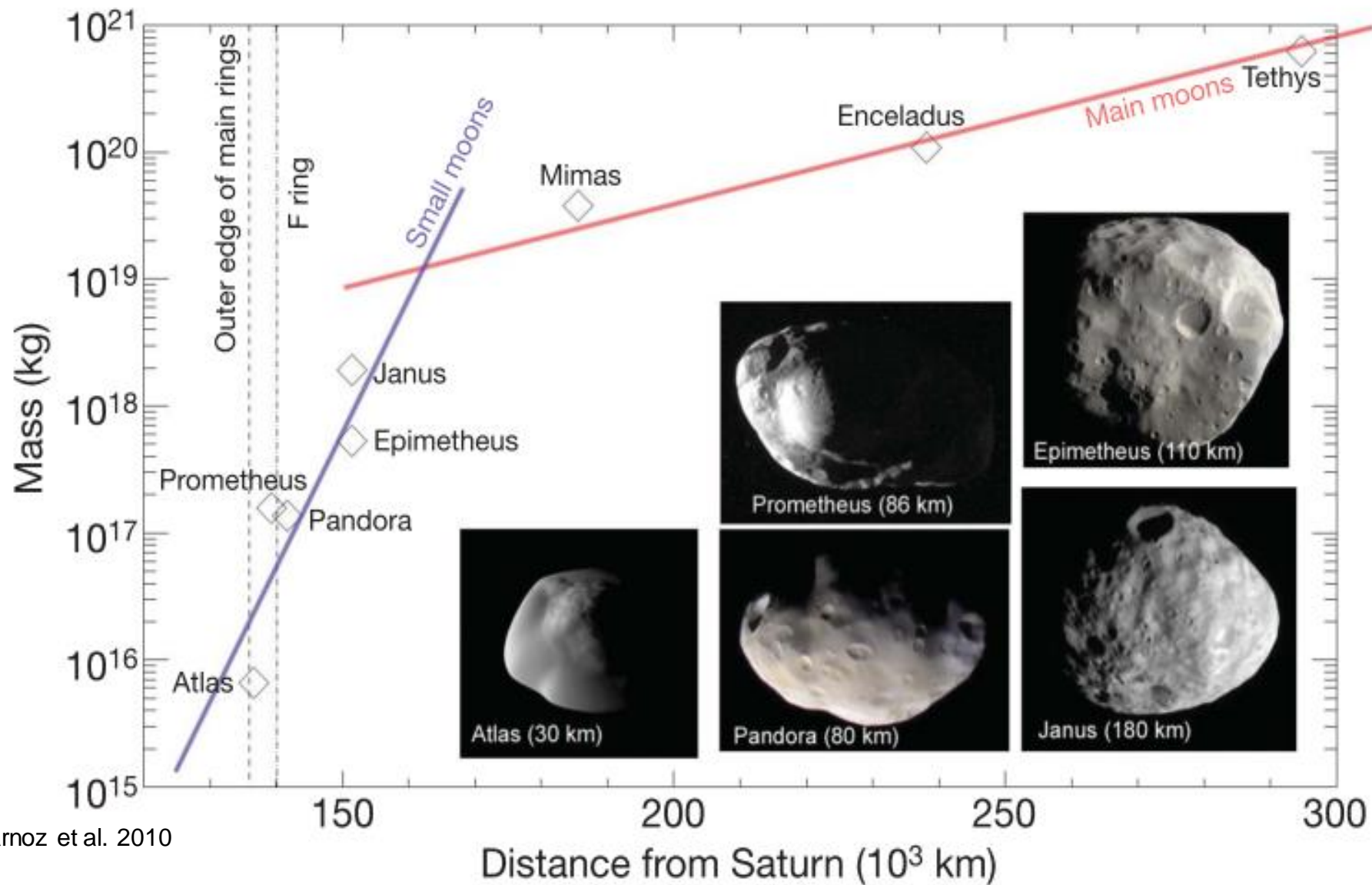


$0.4 \times$   
 $=$   
 $1.5 \times 10^{19} \text{ kg}$

A photograph of the moon Mimas, showing its heavily cratered surface. It is positioned to the right of the text, serving as a visual comparison for the mass of the rings.



# Massive rings are potential pro-genitor of Icy Moons





*Sketch of Saturn by Galileo in 1610*



*Sketch of Saturn by Huygens in 1655*



*Cassini's Sketch of Saturn in 1676  
Showing the Gap in the Rings*

Humankind scrolls forward a few years...made of (mainly) realizing that the Earth is not the center of the Universe... inventing Excel ... one generation going through: proposal writing, project selection, cancelation, redefinition, de-scope, de-de-scope, implementation, testing, launching, 7 years of interplanetary cruising...