Summary of the Last Lecture

- Multiple moons are Ocean worlds
- Liquid water in far reaches of the solar system *(How is it stable there?)*
- Moons as astrobiological targets – answering the fundamental question of life (origin & evolution)
- Earth's Moon
  - *Stabilized Earth environment*
  - *Biological rhythms aligned with lunar cycle*

"A highly sensitive 'low light sensor' for moonlight detection"
Inspiration for new range of sensitive detectors !

(https://www.nhm.ac.uk/discover/how-does-the-moon-affect-life-on-earth.html)

https://www.smithsonianmag.com/science-nature/how-lunar-cycles-guide-the-spawning-of-sea-creatures-180981732/

Further Readings on Moon – Life connections

ANNUAL REVIEWS | Publications A-Z | Journal Information

Home / Annual Review of Marine Science / Volume 15, 2023 / Häfker, pp 509-538

Rhythms and Clocks in Marine Organisms

Annual Review of Marine Science
Vol. 15:509-538 (Volume publication date January 2023)
First published as a Review in Advance on August 26, 2022
https://doi.org/10.1146/annurev-marine-030422-113038

N. Sören Häfker,[1,2,*] Gabriele Andreatta,[1,2,*] Alessandro Manzotti,[3*] Angela Falciatore,[3] Florian Raible,[1,2] and Kristin Tessmar-Raible[1,2,4,5]

nature communications

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Article | Open Access | Published: 05 September 2022

A Cryptochrome adopts distinct moon- and sunlight states and functions as sun- versus moonlight interpreter in monthly oscillator entrainment

Birgit Poehn, Shruthi Krishnan, Martin Zurl, Aida Coric, Dunja Rokvic, N. Sören Häfker, Elmar Jaenicke, Enrique Arboleda, Lukas Orel, Florian Raible, Eva Wolf & Kristin Tessmar-Raible

Nature Communications **13**, Article number: 5220 (2022) | Cite this article

Paleoceanography and Paleoclimatology™

Imprints of changing Earth-Moon distance in bodies of organisms from the past (fossils)

Research Article | Free Access

Subdaily-Scale Chemical Variability in a *Torreites Sanchezi* Rudist Shell: Implications for Rudist Paleobiology and the Cretaceous Day-Night Cycle

Niels J. de Winter, Steven Goderis, Stijn J.M. Van Malderen, Matthias Sinnesael, Stef Vansteenberge, Christophe Snoeck, Joke Belza, Frank Vanhaecke, Philippe Claeys

First published: 05 February 2020 | https://doi.org/10.1029/2019PA003723 | Citations: 14

Summary of the Last Lecture (continued)

- Impact environment and its current status
- The largest explosion in recent times (Chelyabinsk) was missed by monitoring sensors
- Need to scan the skies !

What is falling from the sky?

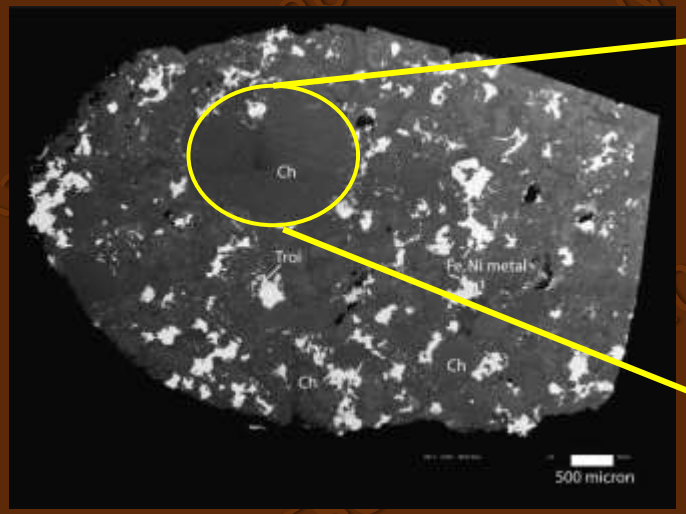
Is it telling us something?

Modern Day Impacts (India)

(Source: http://www.woreczko.pl/meteorites/falls/Population/Meteorite_Map-India.htm)

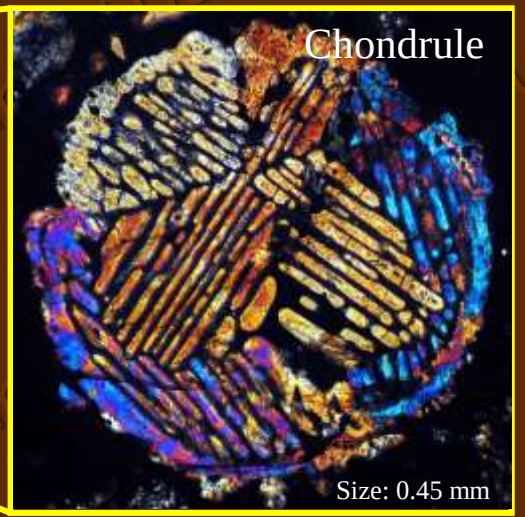
Villagers and farmers pose around the crater of a suspected meteorite that crashed in a field at Mahadeva village in the indian eastern state of Bihar.

(Source: https://edition.cnn.com/2019/07/26/asia/india-meteorite-bihar-intl-hnk/index.html)



(Panda et al., 2020)

(Source: https://doi.org/10.1016/j.pss.2020.105111)



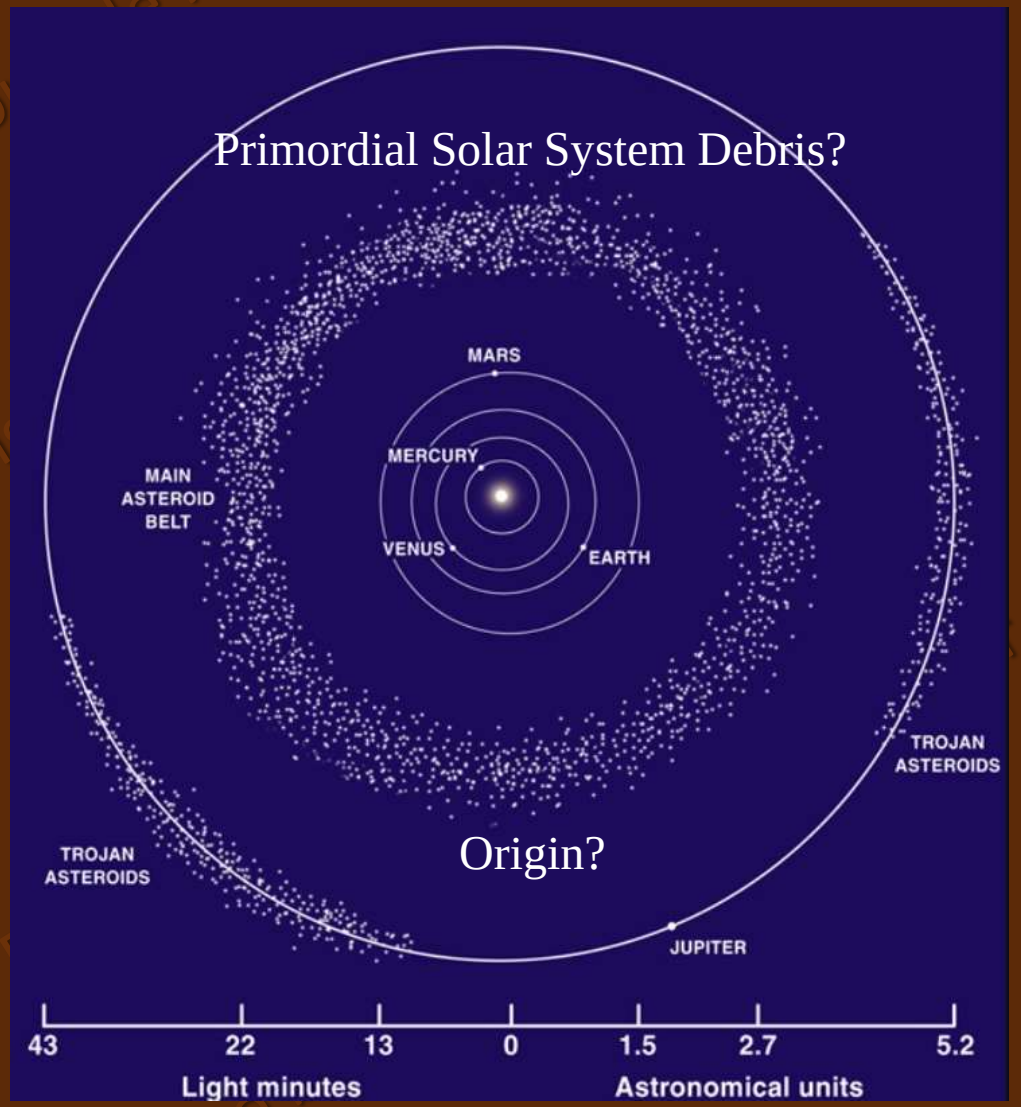
(Source: https://www.meteorite-times.com/asu-higher-magnification/)

Tour of the Solar System continues..

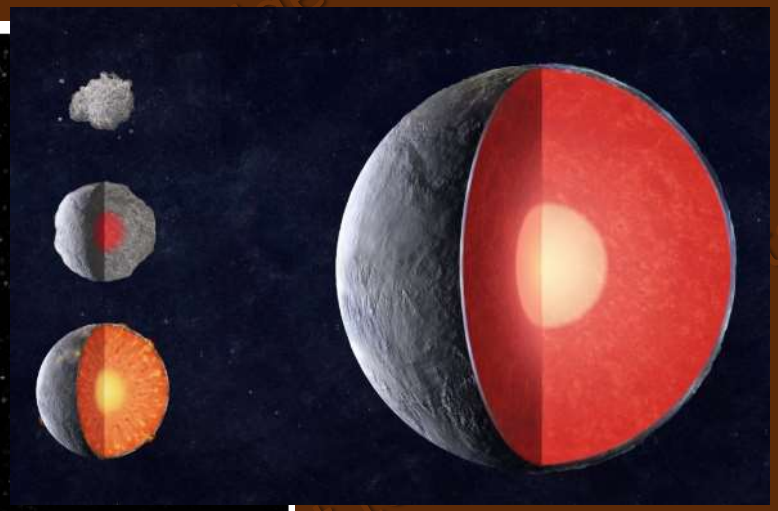
(Source: https://www.jpl.nasa.gov/edu/learn/video/solar-system-size-and-distance/)

Asteroid

- A relatively small (km) and rocky object that orbits a star



Mission to a Metallic Asteroid



- Metallic asteroid – Economic relevance

- Psyche – planetary core?
- Multiple types of Iron meteorites indicate core is not the only possibility
- How landscape of a metallic surface is carved by geological processes?

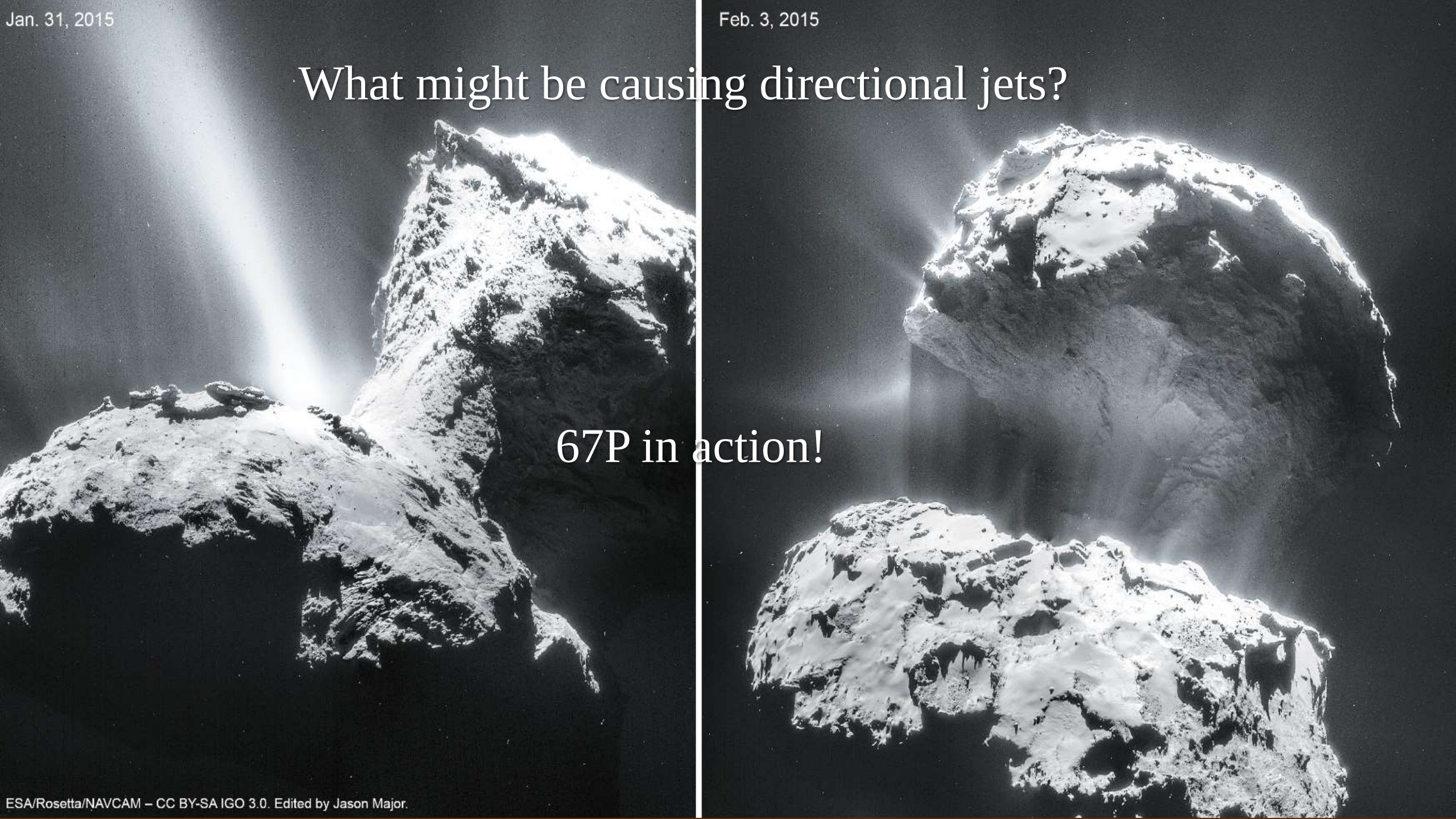
Comet

67P Churyumov-Gerasimenko
(~ 4 km)

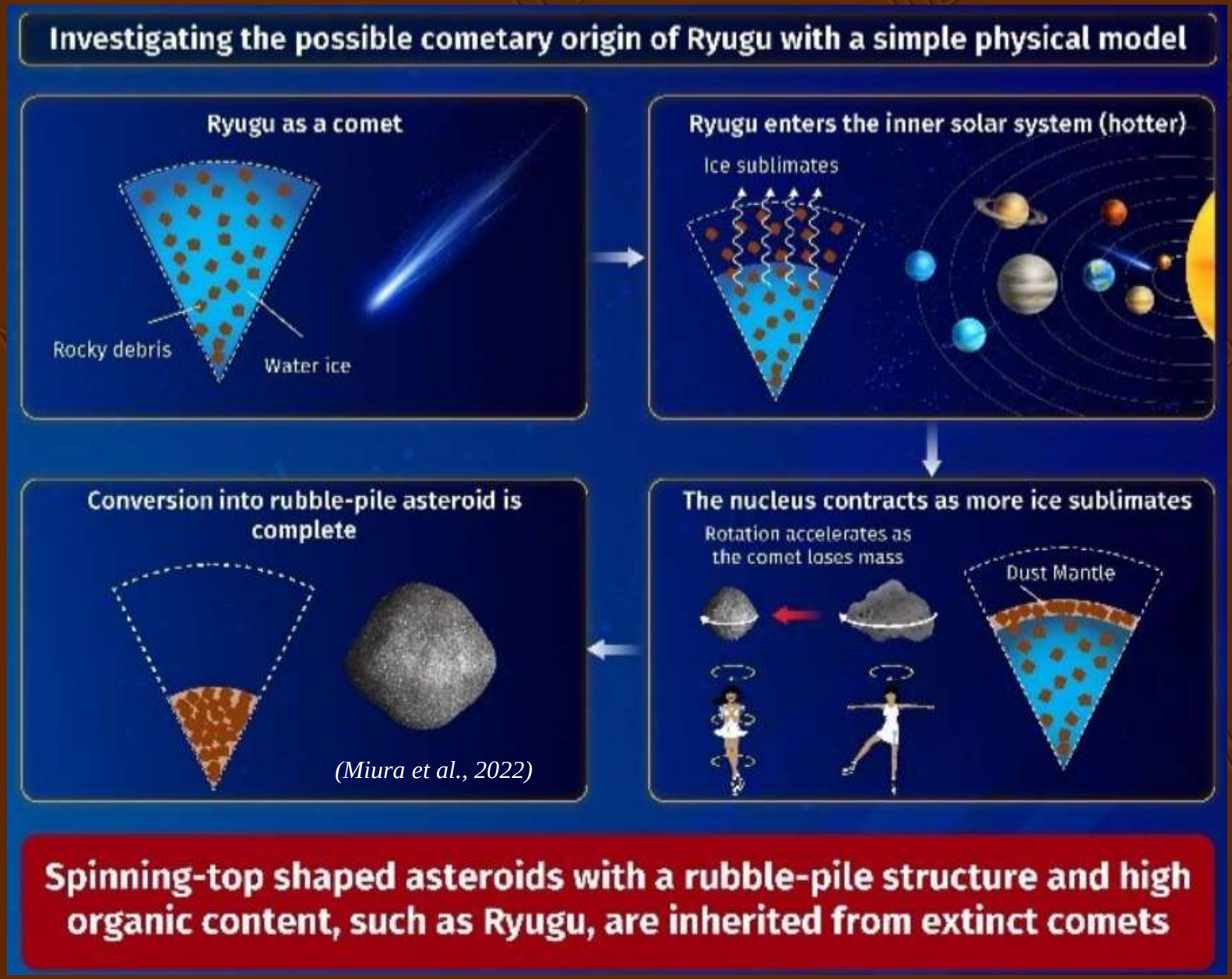
- A relatively small and icy object that orbits a star.

- Comets display energetic jet activity when they come close to the Sun.

(Image Credit: European Space Agency)


Jan. 31, 2015
Feb. 3, 2015
What might be causing directional jets?
67P in action!
ESA/Rosetta/NAVCAM – CC BY-SA IGO 3.0. Edited by Jason Major.

Asteroid – Comet Links?



- Some of the asteroids have large bulk porosities (>50%)
- Class of asteroids: Rubble piles (stack of rubble)
- Could these be leftover remanents of extinct comets?
- What could be an evidence for the same?
- Water – rock interactions?
- Altered minerals (rust?)
- What else?