Planets: Earth, Mars, & Beyond Research

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Aqueous Geochemistry and Astrobiology

- **Dr. Elisabeth (Libby) Hausrath**
- Professor
- Department of Geoscience
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- Website: https://hausrath.faculty.unlv.edu/

Expertise

- Using laboratory experiments, field work, and modeling to interpret water-rock interactions and soil-forming processes on Earth and Mars
- Interpreting the signatures of past aqueous and biological impacts on minerals
- Participating Scientist on the Mars Science Laboratory Curiosity and the Mars2020 rover Perseverance and member of the Network for Life Detection (NFOLD) Steering Committee..

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Holes made by sampling soil on Mars

Image credit: NASA/JPL-Caltech

https://mars.nasa.gov/news/9311/nasas-perseverance-rover-gets-the-dirt-on-mars/#:~:text=The%20mission's%20first%20two%20samples,prepare%20for%20future%20missions%20there.

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Geochemistry & Cosmochemistry

Dr. Yan Hu

- Assistant Professor
- Department of Geoscience
- Email: yan.hu@unlv.edu
- Website: https://sites.google.com/view/yan-hu; Google Scholar

Expertise

- Composition and evolution of Earth and early Solar System
- Subduction zone processes
- Non-traditional stable isotopes (e.g., Li, Mg, K, Ca, Fe)
- Multi-Collector Inductively Coupled Plasma Mass Spectrometry

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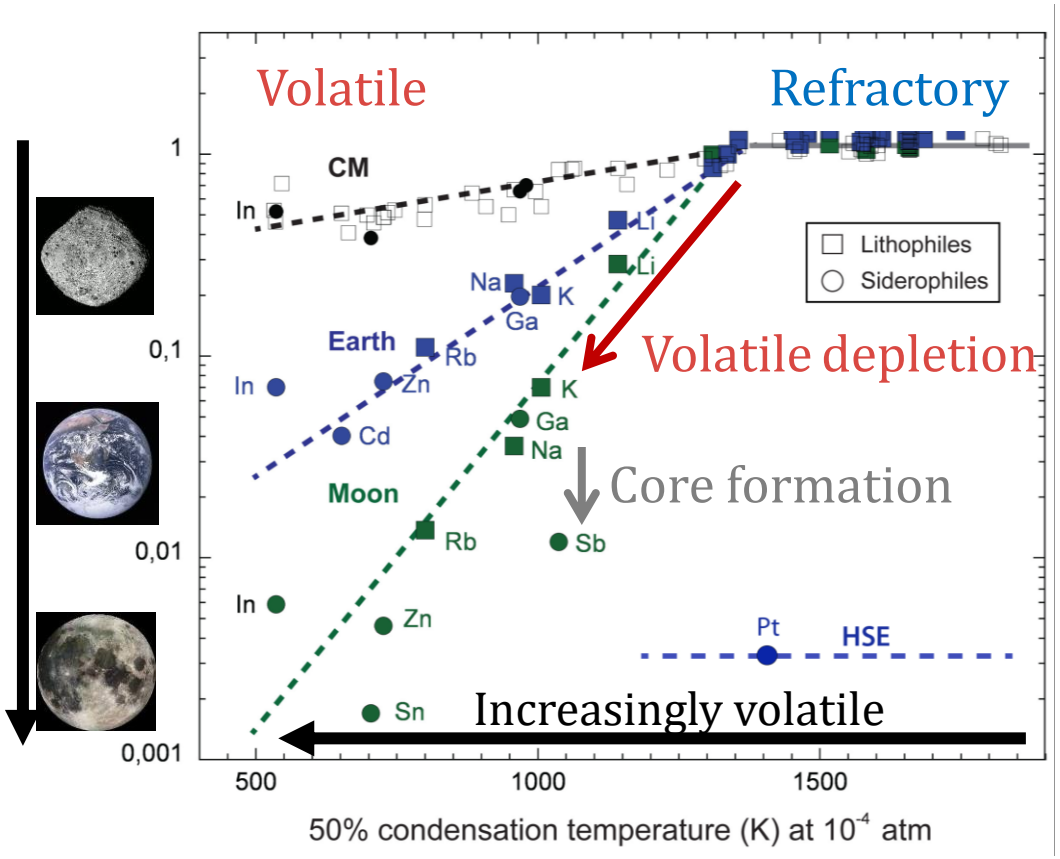
How planets formed and became habitable?

I study meteorites and mission-returned samples to learn about the building blocks of terrestrial planets and how condensation/evaporation shape their volatile inventory.

Abundance normalized to Sun



Volatile elements are variably depleted, making each planetary body unique.

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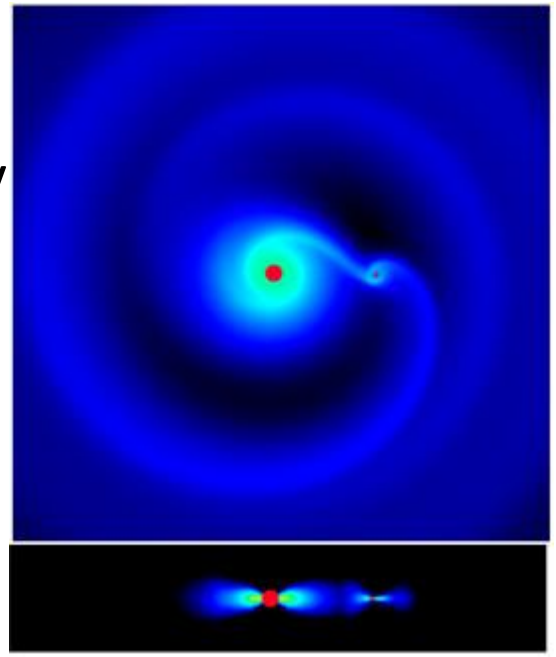
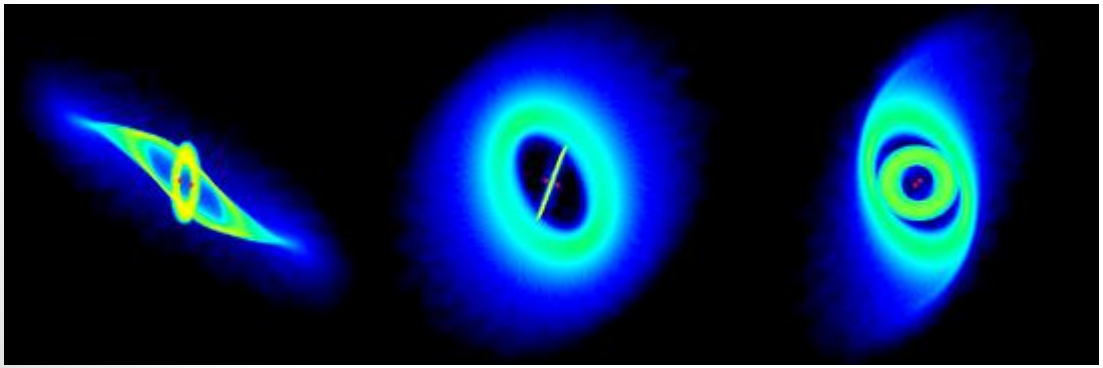
Rebecca Martin

- Professor of Astronomy
- BPB 233
- Department of Physics and Astronomy
- Email: Rebecca.martin@unlv.edu



Expertise

- Star and planet formation
- Astrophysical Fluids
- Binary Star Systems
- Planetary System Dynamics



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Geomicrobiology

Dr. Aude Picard

Assistant Research Professor

School of Life Sciences

audeamelie.picard@unlv.edu

Expertise

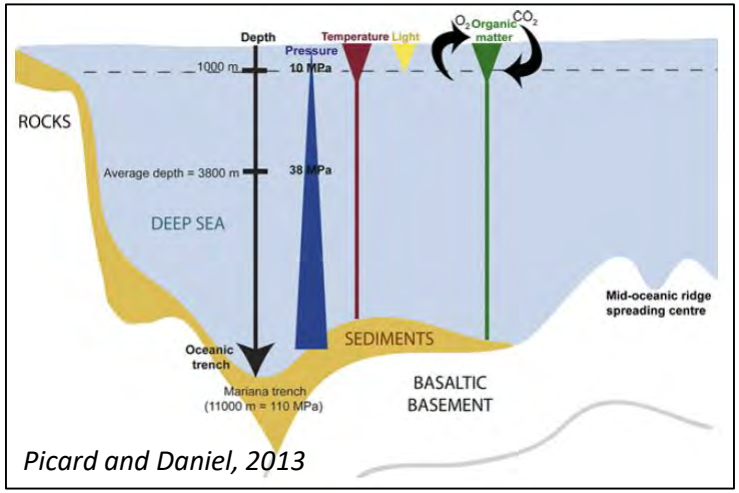
- Anaerobic microbiology
- Microbial physiology
- Biomineralization
- Astrobiology and biosignatures
- Microscopy & spectroscopy

Microbial life in extreme conditions

1 Microbial life under high pressure

◦ What are the pressure limits for microbial life?

High-pressure environments represent the largest habitat for microbial life on Earth



Picard and Daniel, 2013

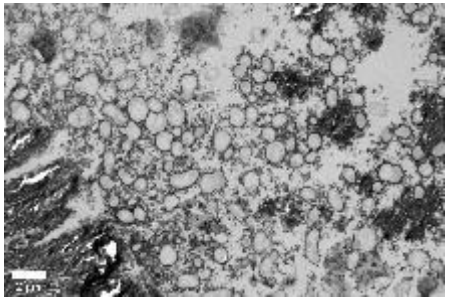
Oceans on icy moons (e.g. Europa) are potential habitats for microbial life in the outer Solar System

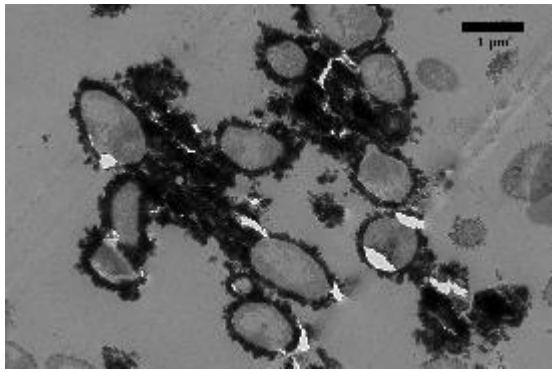
Europa (image credits: NASA)

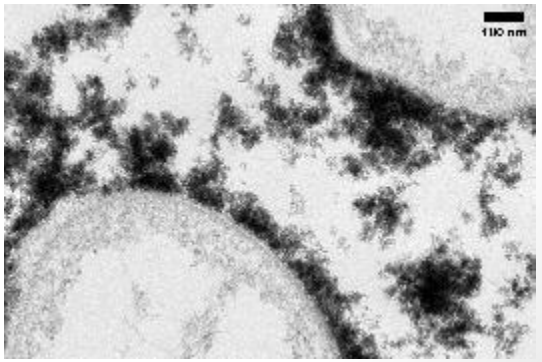
2 Microbe-mineral interactions

◦ How do bacteria cope with mineral encrustation?
◦ Do minerals play a role in long-term survival of bacteria?

Transmission electron microscopy images of bacteria encrusted in iron sulfide minerals







Research Group of Dr. Steffen

- **Dr. Jason H. Steffen**
- Associate Professor
- Department of Physics and Astronomy
- Email: jason.steffen@unlv.edu
- Website: jasonhsteffen.com

Expertise

- Understanding the properties of extrasolar planets and planetary systems
- Planetary dynamics
- Planet interior modeling
- Composition of planet-forming materials

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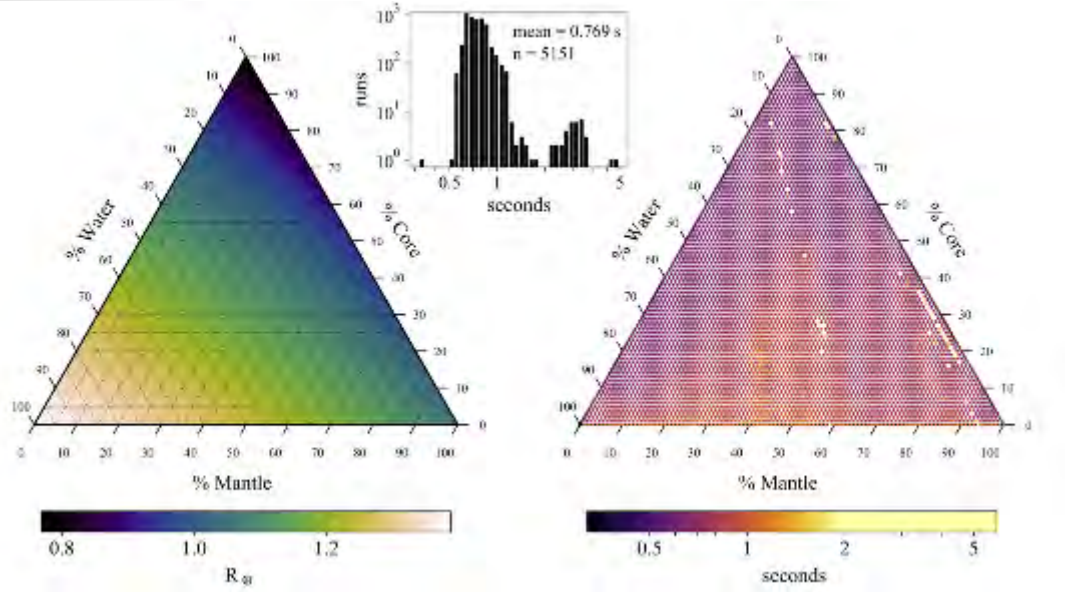
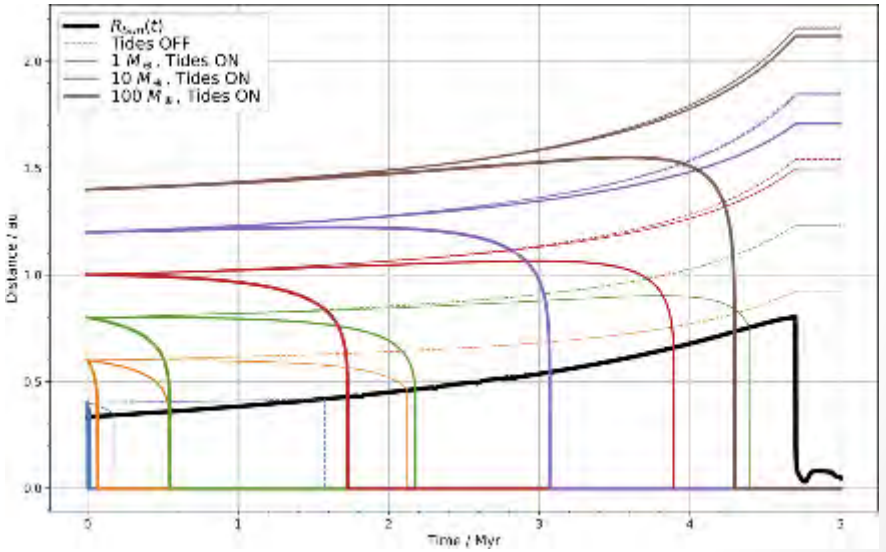


Timing results for planet models using the MAGRATHEA code, developed by our group at UNLV.

Future of planets in a system during the late stages of stellar evolution, including the effects of tides and stellar mass loss.



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Planetary petrology

Dr. Arya Udry

- Department of Geoscience
- Phone: (702) 895-1239
- Email: arya.udry@unlv.edu
- Website: aryaudry.com

Expertise:

Planetary petrology

Martian igneous geology

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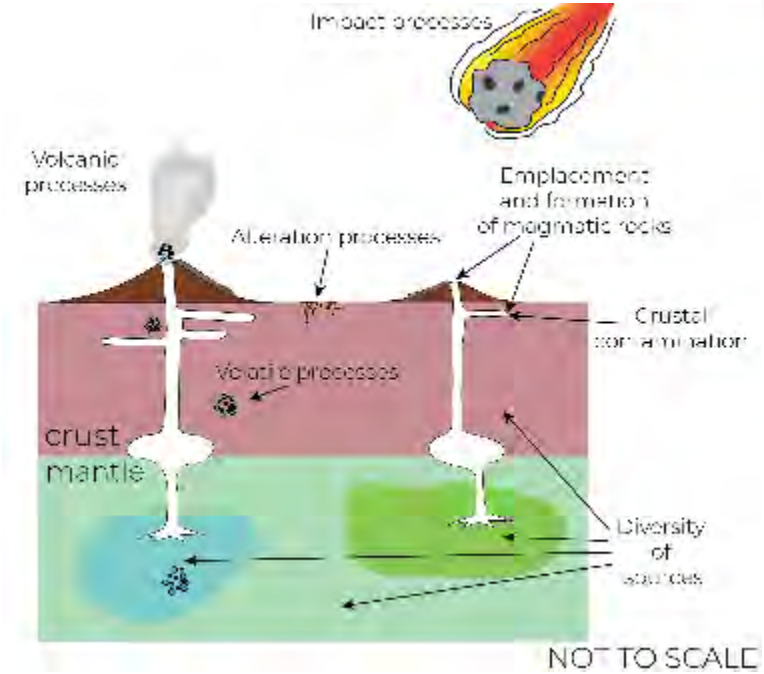
Martian geologic evolution using meteorites

Polarized thin section image of nakhlite meteorite MIL 090030



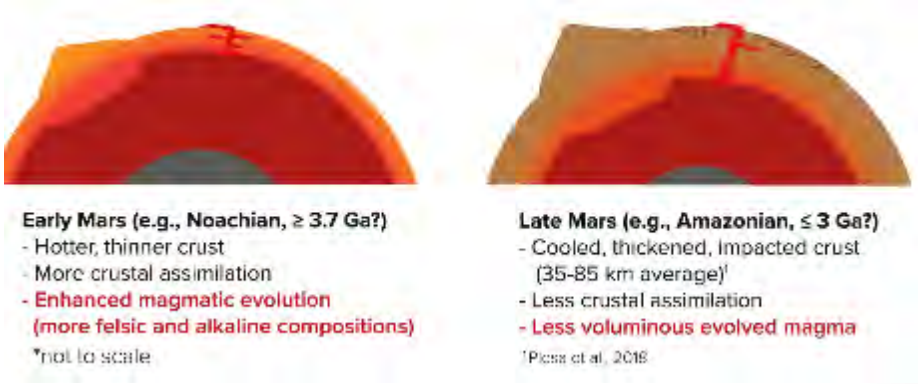
Processes that can be understood using meteorites (Udry et al. 2020)

193 nm Excimer laser ablation system – Installed in 2021 to analyze mineral trace elements

- I use meteorites, the only samples that we possess from Mars, to better constrain the interior composition and evolution of this planet
- Bulk rock and mineral geochemical down to the ppm scale

Martian geologic evolution using rover analyses

Mars 2020 Perseverance and Ingenuity on Jezero crater – JPL/NASA image



Models of magma on Mars (Ostwald et al., 2022)

- Thermodynamical modeling to understand formation of unique compositions of martian surface
- I am a participating scientist on the Mars2020 mission and I conduct modeling analyses to help understand the formation of magmatic rocks at Jezero crater

Astrophysical Fluid Dynamics

Dr. Zhaohuan Zhu

Department of Physics and Astronomy

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Email: zhaohuan.zhu@unlv.edu

Expertise:

Fluid dynamics for astronomical project

Star and planet formation

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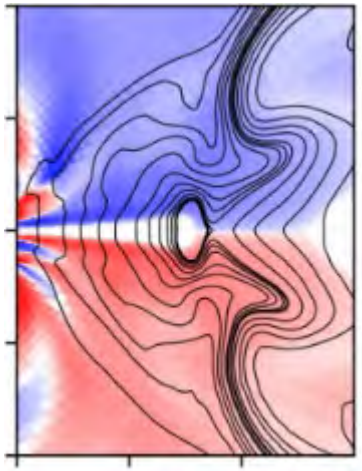
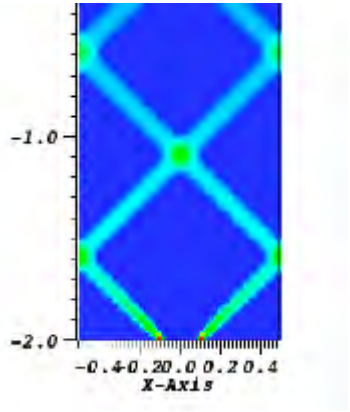
Fluid dynamics:

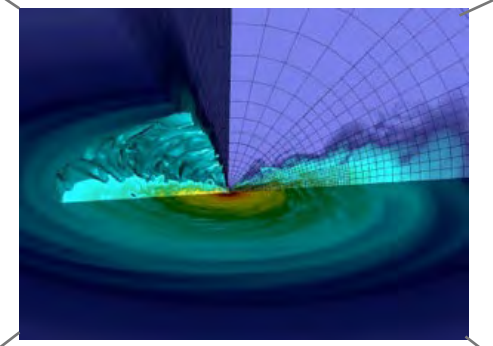
- Developing and using the state of the art numerical code to solve astrophysical fluid problem.

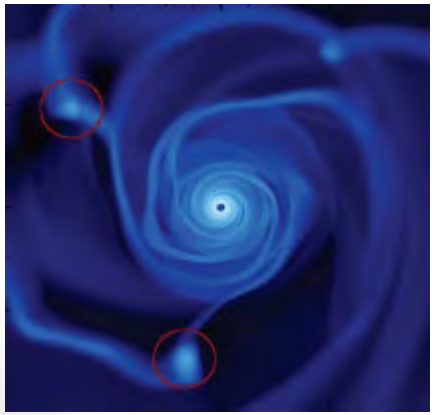


Magnetic field

Radiation

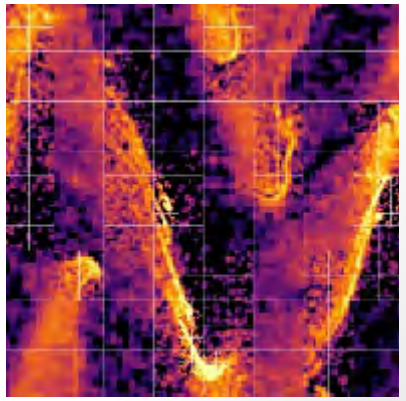






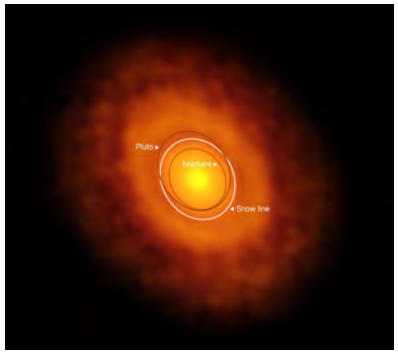
gravity

particles



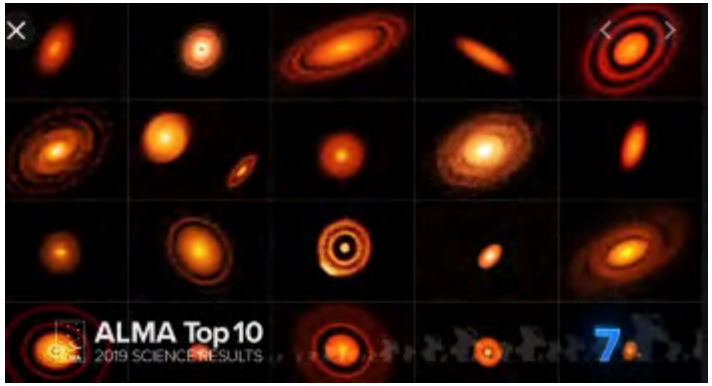
Star and planet formation:

- Protoplanetary disk dynamics:



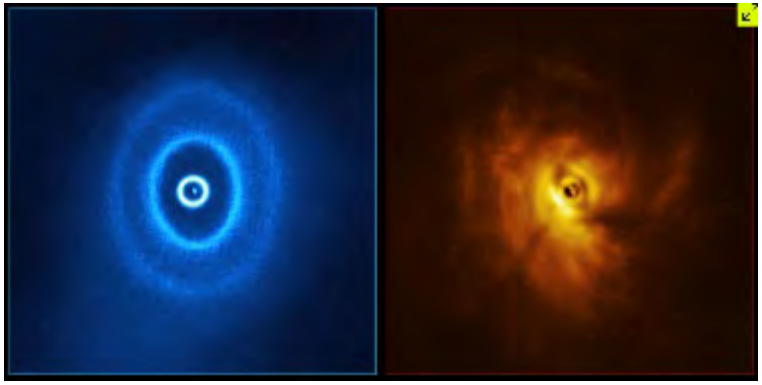
V883 Ori, *Nature*

- Planet formation



DSHARP

- Planet-disk interaction



GW Ori, *Science*