

# Xylaris.

The chemosynthetic world beneath the ice

NASA Space Apps Challenge

# Overview.

- Xylaris is an alien ocean world located deep within our galaxy.
- The planet exists far from any star, where life thrives without sunlight.
- A thick ice layer covers the surface, with a vast ocean beneath.
- The ocean is heated by internal geothermal energy.
- Chemosynthetic organisms form the foundation of the ecosystem.
- These organisms derive energy from chemical compounds emitted by hydrothermal vents.
- Xylaris showcases how life could exist in extreme conditions, similar to icy moons like Europa and Enceladus.



# Energy Source:

- The primary energy source for life on Xylaris is chemosynthesis.
- Organisms convert hydrogen sulfide ( $\text{H}_2\text{S}$ ) and methane from hydrothermal vents into energy.
- Microorganisms perform chemosynthesis at the ocean floor instead of relying on sunlight.
- This process enables the entire ecosystem to thrive in darkness.

# Geological features:

- **Icy Surface:** The planet's surface is a solid sheet of ice, several kilometers thick, shielding the ocean from harsh cosmic radiation.
- **Hydrothermal Vents:** These are abundant on the ocean floor, created by geological activity from the planet's molten core. These vents release gases like methane and sulfur compounds, fueling chemosynthetic life.
- **Volcanic Activity:** Similar to Earth's deep-ocean ridges, Xylaris features vast underwater volcanoes that enrich the ocean with minerals, feeding the ecosystem.

# Biosphere and lifeforms:

- Primary Lifeforms: Chemosynthetic bacteria thrive around the vents, forming microbial mats that serve as the base of the ecosystem. These bacteria break down chemicals into usable energy for other organisms.
- Secondary Lifeforms: Slow-moving, armored mollusk-like creatures graze on the microbial mats. Predatory organisms resembling giant crustaceans feed on the mollusks, using hardened exoskeletons to protect themselves from extreme pressure.
- Complex Lifeforms: The most complex organisms are large, slow-moving filter feeders that swim near the vents. These creatures have adapted to capture free-floating bacteria in the water.



# Ecosystem dynamics:

- The ecosystem revolves around the stability of the hydrothermal vents. Microbes rely on these vents for survival, while larger organisms depend on microbes for food.
- Shifts in vent activity can cause local extinctions and force life to adapt or migrate to other areas of the ocean, showing how life on Xylaris must continually adjust to the planet's geological activity.
- A complex food web, from microbes to large predators, demonstrates the resilience of life in extreme environments, where chemical energy flows through the ecosystem in intricate ways.



# Potential impact:

- Challenges traditional views of habitability by exploring life in extreme environments.
- Sustained by chemosynthesis, showing alternative energy sources for life.
- Provides insights into the potential for finding life in ocean worlds, such as Europa or Enceladus.
- Broadens the search for extraterrestrial life beyond Earth-like conditions.
- Demonstrates how life can adapt to energy sources independent of sunlight.

Xylaris offers a bold new vision of habitability, expanding the boundaries of where life could exist in our universe. By exploring chemosynthetic ecosystems, this project demonstrates how life could thrive under extreme conditions far from any star.