



**Psyche and Bennu**  
The Future of Science  
and Space





# The Psyche Mission

- Discovered in **1852** by Italian Astronomer Annibale de Gasparis
- Orbits the sun in the outer part of the main asteroid belt, between Mars and Jupiter
- Thought to be part or all of the iron-rich core of a **planetesimal**, a building block of a rocky planet; it is believed that this asteroid is likely a survivor of multiple violent hit-and-run collisions during our solar system's early formation
- Unlike other asteroids that are made of rock or ice, it is believed to be made mostly of metal (iron and nickel)
- Launched from the Kennedy Space Center in Florida on October 13, 2023 on a 2.2 billion mile mission
- Psyche's gravity will capture the aircraft in late July 2029 and will spend 2 years orbiting it to take pictures, map the surface, and collect data to determine Psyche's composition.

The main goal of this mission is to study a metal-rich asteroid for the first time which can give the world a unique insight on our universe and our place inside of it, especially regarding the mysterious and impossible to reach metal core of Earth.



# The Bennu Asteroid

- Named after an ancient Egyptian mythological bird, Bennu. In ancient Egyptian mythology, Bennu was associated with the sun, creation, and rebirth. It was often depicted as a heron or crane-like bird. The choice of this name for the asteroid reflects its connection to the sun and the idea of new beginnings, aligning with the mission's goal of obtaining a pristine sample from a celestial body that has remained relatively unchanged since the early solar system
- 4.5 billion year old asteroid that was formed in the first 10 million years of our solar system's history
- Has a 1 in 2700 chance of hitting the Earth before 2182
- Has a high-carbon content as well as water, possibility indicating building blocks of life on the rock
- OSIRIS-REx probe has been measuring the rock for the last couple of years and, in September 2023, dropped samples from the surface onto the Earth

# What these asteroids mean for the future

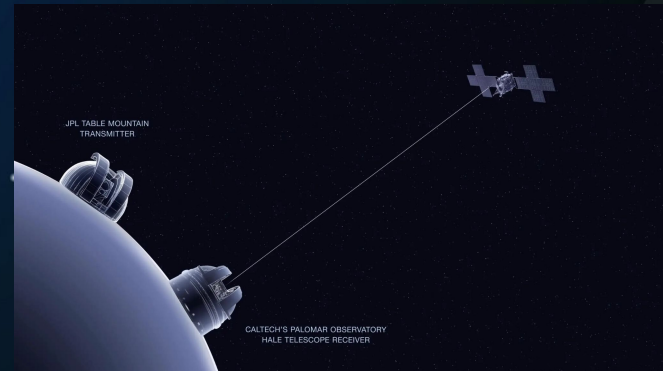
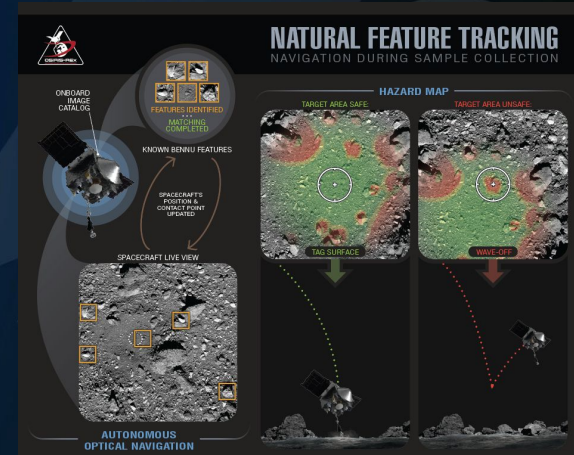
- Psyche is expected to unlock the secrets of how planets form and evolve” as it is Nasa’s “first mission to a metal world”
- 16 Psyche has the potential to offer us a uniquely serendipitous way to study the core of planet Earth.
- Both Psyche and the core of Earth are expected to have similar metallic compositions, possessing some combination of iron and nickel, so any intellect gathered from Psyche will help us to learn about Earth
- While the chances of an impact are small, studying Bennu helps scientists develop strategies for planetary defense and gain insights into the broader dynamics of our solar system
- The new Bennu sample, and future samples, will be able to help scientists investigate the origins of life on our own planet for generations to come.
  - The biggest carbon-rich asteroid sample ever delivered to Earth

The background is a dark blue space scene with various celestial bodies. In the top left is a large orange planet with wavy bands. To its left is a small purple moon. In the top right is a grey planet with a white crater. In the bottom center is a small yellow planet. In the bottom right is a large yellow planet. The background is filled with small white stars and larger, fainter stars.

# Advancing Frontiers with Bennu and Psyche Tech

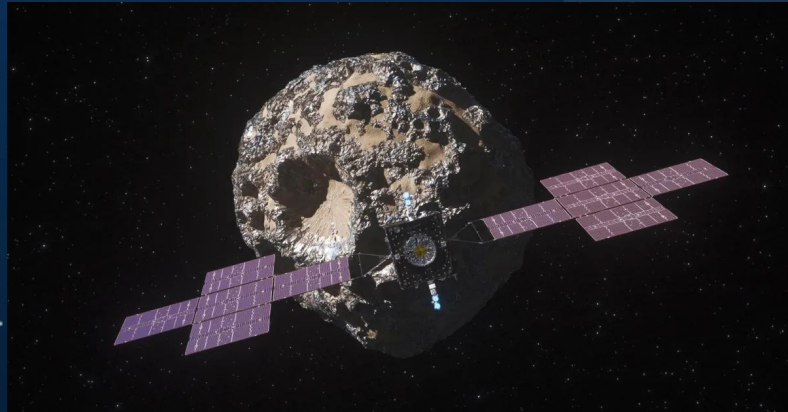
# Advances in Spacecraft Guidance and Communication

- Optical Navigational System (OSIRIS-REx):
  - Autonomously navigates by mapping asteroid terrain and planning safe sample collection paths.
  - Employs computer vision AI to process terrain imagery and execute dynamic trajectory adjustments.
- Deep Space Optical Communication System (Psyche Mission):
  - Uses advanced laser technology to encode data in photons, significantly boosting communication bandwidth compared to traditional radio waves.
  - Facilitates high-rate data transmission over vast distances in deep space.



# Mission-Specific Technologies: Sampling on Bennu and Probing Psyche

- OSIRIS-REx:
  - TAGSAM: Robotic arm enabling dust collection without asteroid landing.
  - Sample Capsule: Securely transports collected asteroid material back to Earth.



- Psyche mission:
  - Imaging System: High-res imaging to distinguish metallic from silicate elements.
  - Elemental Analysis: Gamma rays and neutrons map asteroid's composition.
  - Magnetic Field Mapping: Magnetometer to reveal clues of planetary formation.
  - Gravity Field Measurement: X-band radio system provides insight into asteroid's interior.



# Bennu: Easing Space Exploration

## **In Situ Resource Utilization:**

Use resources found in space rather than transporting them from earth

- Extracting Water and Metals
- Processing organic compounds into methane and other propellants
- Synthesizing building materials from the regolith(Through 3D Printing)

## **New Testing Ground:**

The unique environment offered by the asteroid offers a testing ground for new technologies

- Advanced Propulsion Systems - Electric Propulsion
- Radiation Shielding and Life Support Systems