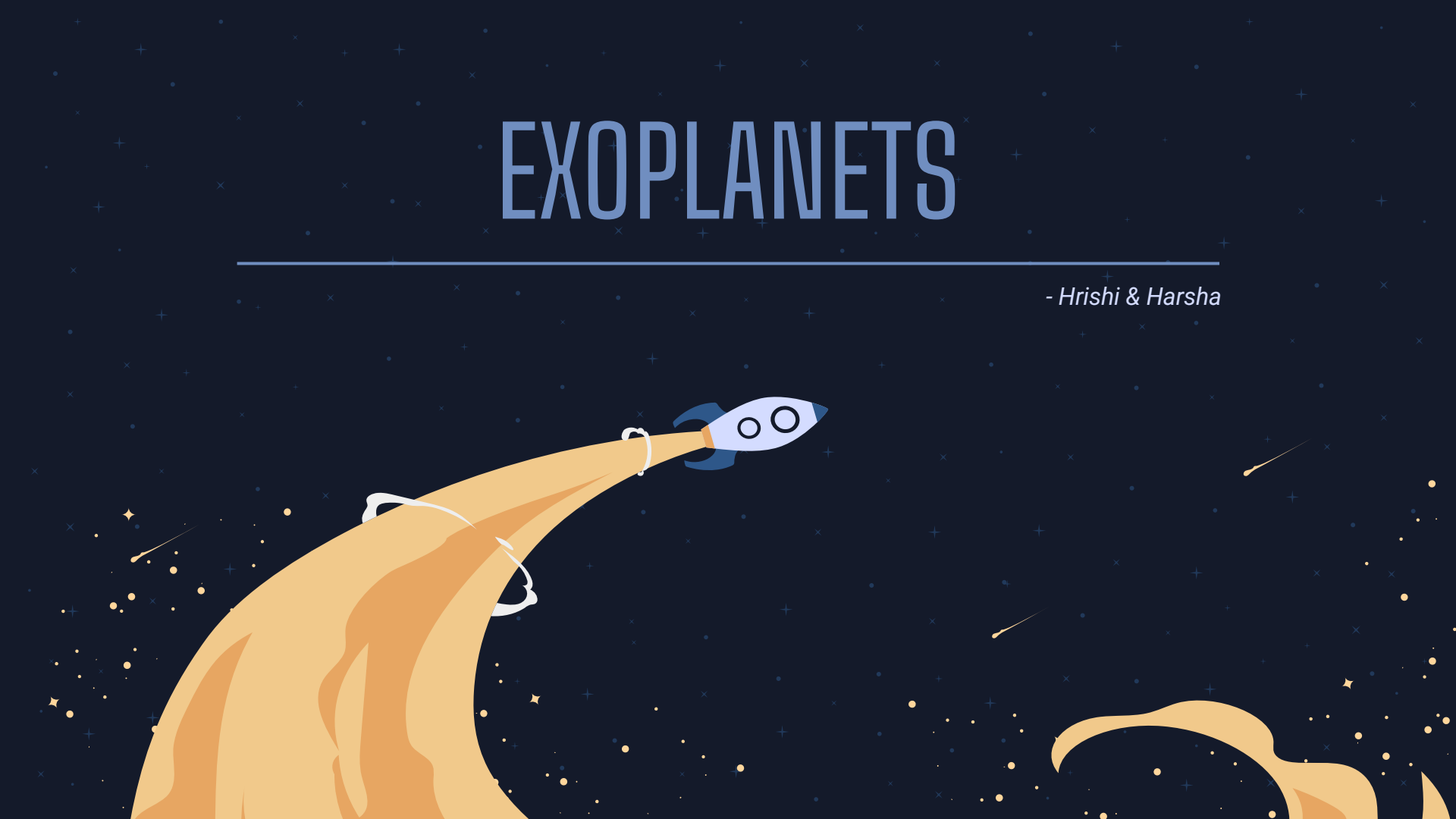
EXOPLANETS

- Hrishi & Harsha



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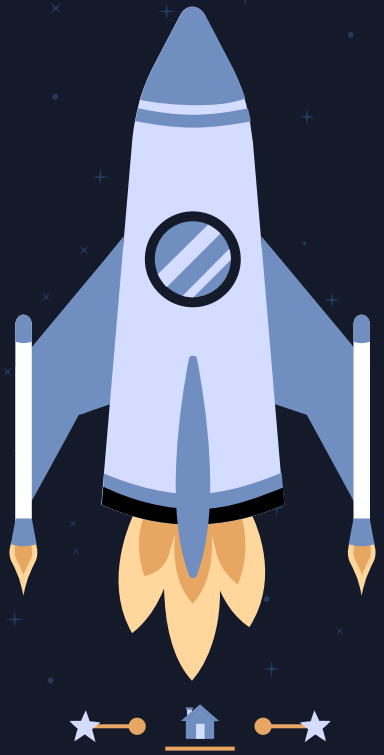


"The discovery of exoplanets is one of the most profound achievements of modern science. It brings us closer to understanding our place in the universe."

– Dr. Sara Seager, Astrophysicist and Exoplanet Expert.”

01

Introduction

What are Exoplanets?

What are Exoplanets?

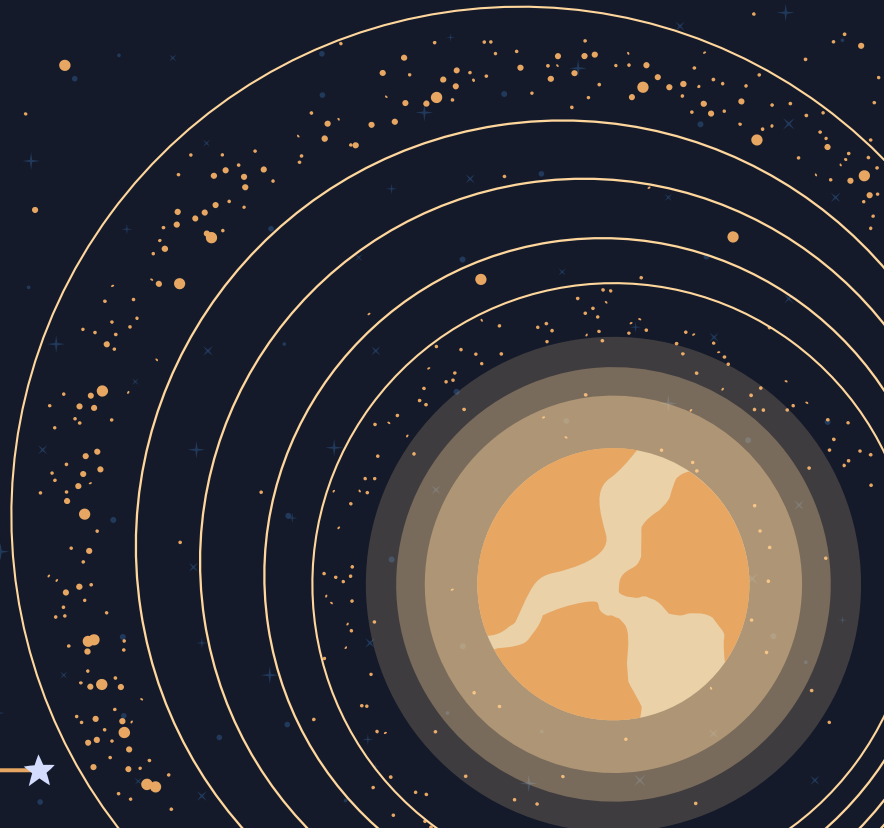
- Planets that orbit stars outside our Solar System
- Over 5,000 confirmed exoplanets (NASA, 2025)

✨ **Why Study Exoplanets?**

- Search for habitable worlds
- Understand planet formation

✨ **Data-Driven Discovery**

- Missions like Kepler, TESS, and JWST provide massive datasets



02

Big data

Exoplanet Research & LoD in Astronomy

Exoplanet Research

Kepler Space Telescope

Discovered thousands of exoplanets using transit method.

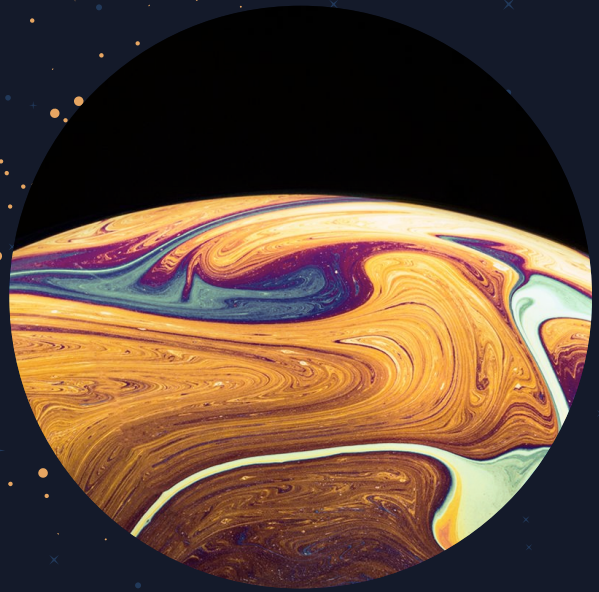
TESS

Transiting exoplanet survey satellite - scanning entire sky

JSWT

James Webb provides insights into exoplanet atmospheres, Composition.

Discovery Methods



01 Transit method

02. Radial Velocity Method

03. Direct Imaging

04. Gravitational Microlensing

Discovery Methods:

Transit Method

Measures the dimming of stars light when a planet passes in front of it

Radial Velocity Method

It identifies exoplanets by observing the small wobbles in a star's motion caused by gravitational pull of star

Direct Imagine

Capturing images of exoplanets by by blocking out the light from its parent star

Gravitational Microlensing

Takes advantage of gravitational field of a foreground star to bend and magnify light from a background star

03

Analysis of Exoplanets

- Size, Mass & radius
- Distance , temperature

Identify Trends in Exoplanets

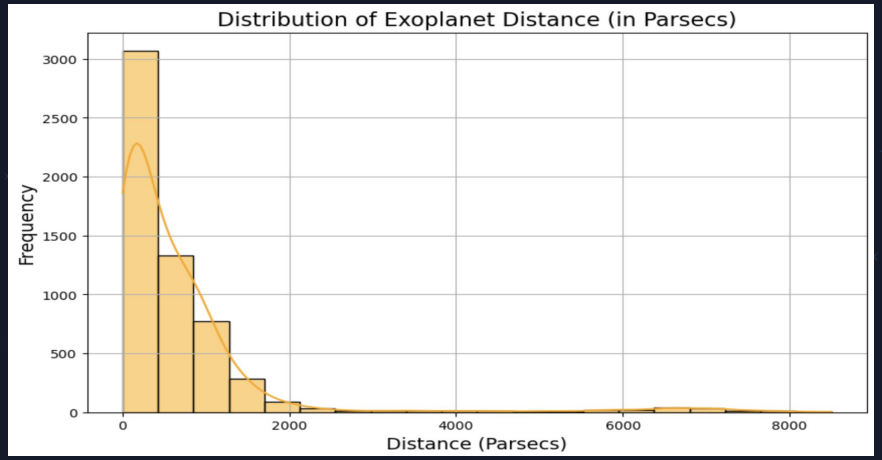
Size

Mass

Distance

Temperature

Exoplanet Distance Distribution (Parsecs)



Key Observations:

- Majority of exoplanets are closer (lower parsecs)
- Fewer exoplanets at higher distances, showing a right-skewed distribution

Interpretation:

- Clustering at lower distances may be due to detection limitations (closer exoplanets easier to detect).
- Right-skew suggests difficulty in detecting distant exoplanets.

Insights:

- Detection techniques likely favor nearby exoplanets.
- Most exoplanets lie within 2000 parsecs.

Distribution of Exoplanets Mass

Visualization

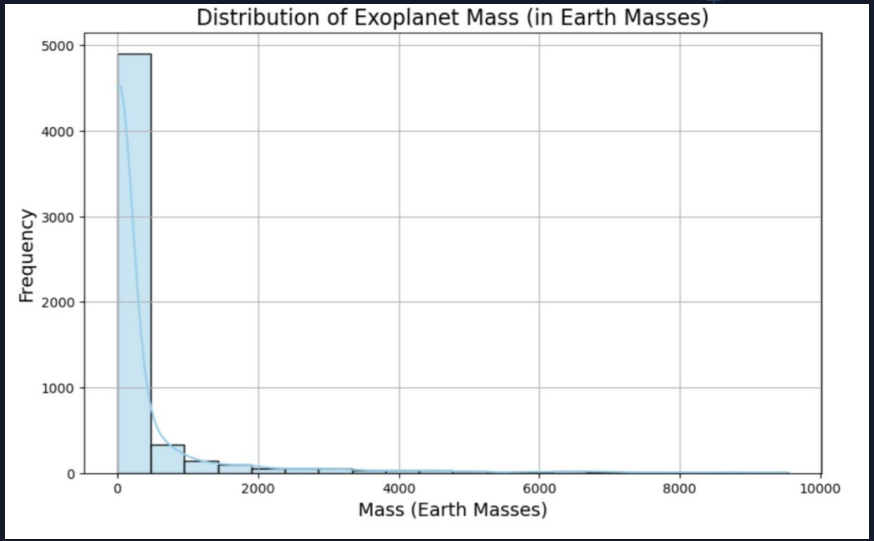
- X-axis: Mass (Earth masses)
- Y-axis: Frequency

Key Observations

- Right-skewed distribution: most exoplanets are **low-mass**
- Long tail: few **supermassive** exoplanets
- Majority have masses **< 2000 Earth masses**

Insights

- **Two possible categories**: rocky planets vs. gas giants (if bimodal)
- **Supermassive exoplanets are rare**, possibly formed in extreme environments



Exoplanet Mass vs. Distance Scatter Plot

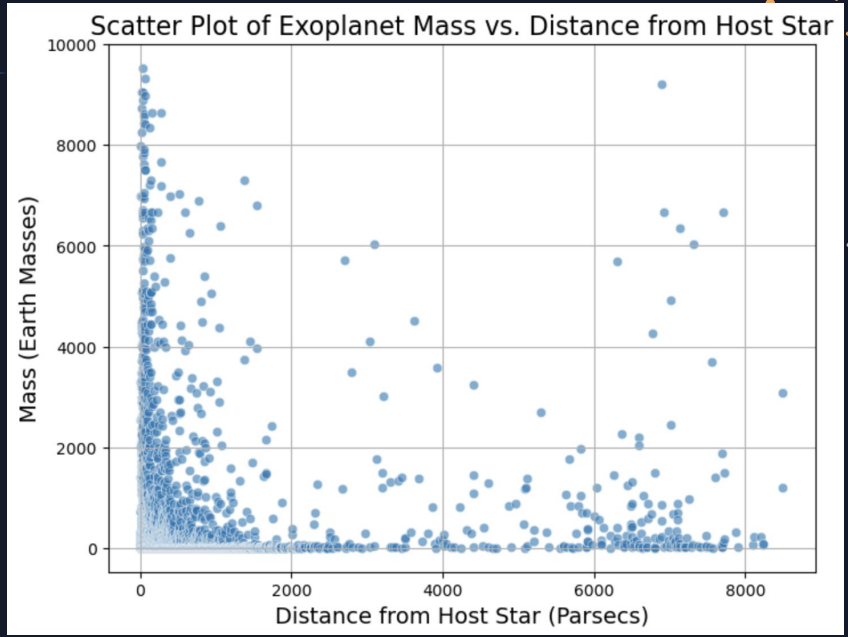
- **X-axis**: Distance from host star (parsecs)
- **Y-axis**: Exoplanet mass (Earth masses)
- **Alpha = 0.6**: Transparency to reduce overlap

Key Observations:

- Clustering of points: Distance (0-2000 parsecs) & Mass (0-4000 Earth masses)
- Sparse data beyond 2000 parsecs
- Outliers: High-mass exoplanets at both close and far distances

Interpretation:

- A clustering trend may indicate observational bias or formation patterns.
- Random scattering suggests weak correlation between mass and distance.
- Outliers may reflect detection biases (more easily observable massive exoplanets).



04 Conclusion

Key findings &
Future scope

Key Findings

- Statistical analysis of exoplanets using Linked Open Data (LoD) reveals strong dependencies between exoplanet properties (size, mass, orbital distance) and host star attributes (temperature, metallicity).
- SPARQL queries demonstrate LoD's effectiveness in structuring and analyzing astronomical datasets for efficient retrieval and interpretation of exoplanet data.

Advancements in LoD & AI:

- Integrating LoD with AI and machine learning can enhance exoplanet research.
- AI-driven exploration can refine predictive models and lead to new planetary classification schemes, improving habitable exoplanet detection.

Thanks!