

Current Research and Future Plans to Discover and Study Exoplanets

The field of exoplanet research is rapidly evolving, driven by advanced technology and innovative methodologies. Current research focuses on understanding the atmospheres, compositions, and potential habitability of exoplanets, while future missions aim to expand our knowledge even further. Key components of this landscape include upcoming space missions, recent discoveries, and the vital role of citizen science.

Upcoming Space Missions

1. James Webb Space Telescope (JWST):

- Launched in December 2021, JWST is designed to study the atmospheres of exoplanets and search for signs of life. Its capabilities allow it to observe a wide range of wavelengths, making it particularly effective in infrared spectroscopy.
- Recent observations have confirmed JWST's ability to image exoplanets directly, such as Epsilon Indi Ab, one of the coldest exoplanets ever studied, located about 12 light-years away. This discovery enhances our understanding of gas giant evolution and atmospheric conditions
- JWST has also been instrumental in revealing weather patterns on exoplanets like Ditsō and Wadirum, showcasing its ability to detect complex atmospheric phenomena

2. ESA's Ariel Mission:

- Scheduled for launch in 2029, the Ariel mission aims to survey the atmospheres of over 1,000 exoplanets, focusing on their chemical compositions and thermal structures. This mission will provide insights into how planets form and evolve.
- Ariel will utilize transit photometry and spectroscopy to analyze light from stars as it passes through planetary atmospheres, helping identify key molecules that could indicate habitability.

Recent Discoveries and Research Trends

- **TOI-4860 b:** An unusual Jupiter-sized planet discovered orbiting a low-mass star has challenged traditional models of planet formation. This finding suggests that even low-mass stars can host massive planets enriched with heavy elements, prompting a reevaluation of existing theories
- **LHS 475 b:** Confirmed as an Earth-sized exoplanet using JWST's Near-Infrared Spectrograph, LHS 475 b orbits a red dwarf star. While its atmosphere remains uncertain, the data collected opens new avenues for studying rocky planets. The confirmation of this planet underscores JWST's capability to characterize smaller exoplanets.
- **Spectroscopic Advances:** JWST has outpaced previous instruments like Hubble in observing exoplanet atmospheres. It has already studied close to 70 exoplanets since its

launch, focusing on carbon chemistry and other molecular signatures that inform us about planetary formation and evolution

Importance of Citizen Science in Exoplanet Research

Citizen science plays a crucial role in advancing our understanding of exoplanets. Platforms like Zooniverse allow amateur astronomers and enthusiasts to participate in data analysis by identifying transits in light curves from telescopes like TESS (Transiting Exoplanet Survey Satellite). This collaborative effort not only accelerates discoveries but also fosters public engagement in scientific research.

- **Data Collection:** Citizen scientists help process vast amounts of data generated by space missions. Their contributions can lead to the identification of new exoplanet candidates and enhance the overall efficiency of research projects.
- **Educational Outreach:** Involving citizens in scientific endeavors promotes education in astronomy and planetary science. Programs that encourage public participation help demystify scientific processes and inspire future generations of scientists.