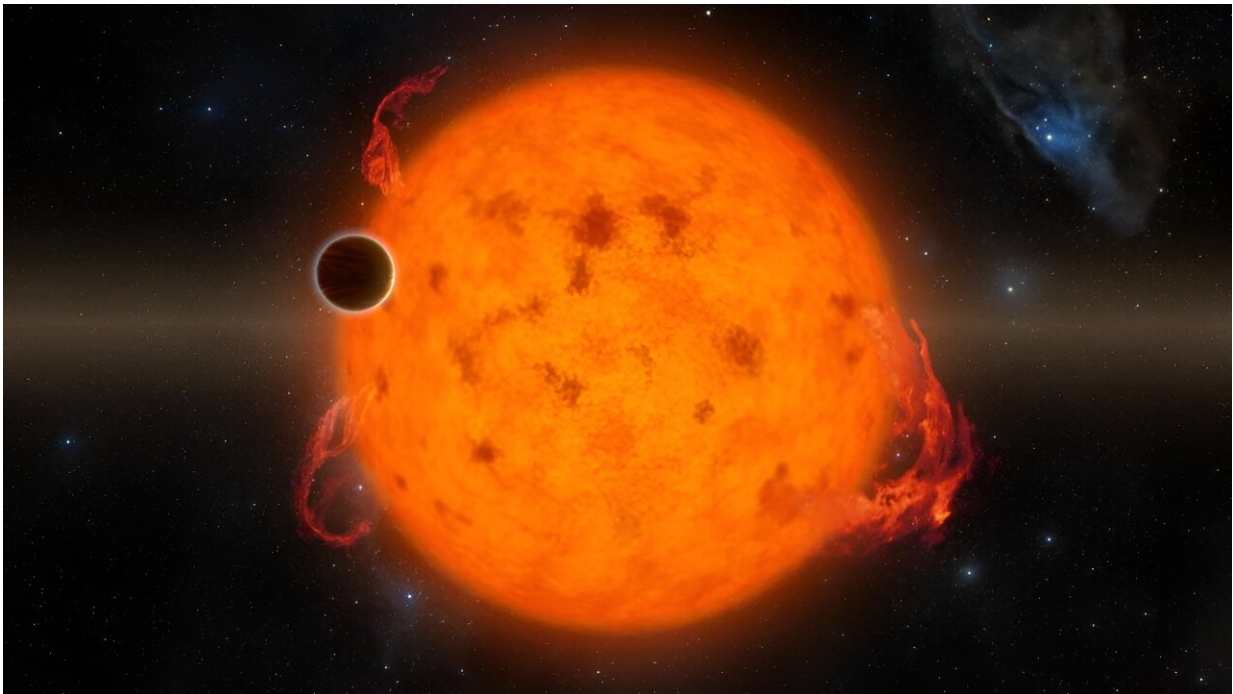


# How NASA citizen science fuels future exoplanet research

August 9 2024, by Lauren Leese

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This artist's concept shows the exoplanet K2-33b transiting its host star. Many citizen science projects at NASA invite the public to use transit data to make discoveries about exoplanets. Credit: NASA/JPL-Caltech

NASA's upcoming flagship astrophysics missions, the Nancy Grace Roman Space Telescope and the Habitable Worlds Observatory, will study planets outside our solar system, known as exoplanets. More than 5,000 exoplanets have been confirmed to date—and given that scientists

estimate at least one exoplanet exists for every star in the sky, the hunt has just begun.

Exoplanet discoveries from Roman and the Habitable Worlds Observatory may not be made only by professional researchers, but also by interested members of the public, known as citizen scientists.

Exoplanet research has a long involvement with citizen science. NASA's TESS (Transiting Exoplanet Survey Satellite) mission and the now-retired Kepler mission, which are responsible for the vast majority of exoplanet discoveries to date, made observations freely available to the public immediately after processing. This open science policy paved the way for the public to get involved with NASA's exoplanet science.

NASA's [Planet Hunters TESS](#) project invites the public to classify exoplanet light curves from TESS online. Another project, [Exoplanet Watch](#), allows citizen scientists to gather data about known exoplanets, submit their observations to NASA's public data archive, and receive credit if their observation is used in a scientific paper. Participants don't even need their own telescope—Exoplanet Watch also curates data from robotic telescopes for users to process.

"Anyone across the world who has access to a smartphone or a laptop can fully participate in a lot of these citizen science efforts to help us learn more about the cosmos," said Rob Zellem, the project lead and project scientist for Exoplanet Watch and astrophysicist at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

NASA's citizen science projects have discovered several new planets from Kepler and TESS data. They have also helped scientists refine the best time to observe important targets, saving hours of precious observation time on current flagship missions like NASA's James Webb Space Telescope.

Roman and the Habitable Worlds Observatory provide even more possibilities for citizen science. Expected to launch by May 2027, Roman will discover exoplanets through direct imaging, transits, and gravitational microlensing. Following that, the Habitable Worlds Observatory will take direct images of stars in our solar neighborhood to find potentially [habitable planets](#) and study their atmospheres.

Like Kepler and TESS before them, data from Roman and the Habitable Worlds Observatory will be available to both the scientific community and the public immediately after processing. With Roman's surveys expected to deliver a terabyte of data to Earth every day—over 17 times as much as Webb—there is a huge opportunity for the public to help sift through the information.

"The general public can get Roman data as quickly as I can as a scientist working on the mission," said Zellem, who also serves as Roman's deputy project scientist for communications at NASA Goddard. "It truly makes Roman a mission for everyone and anyone."

Although the Habitable Worlds Observatory's full capabilities and instrumentation have yet to be finalized, the inclusion of citizen science is expected to continue. The team behind the mission is embracing a community-oriented planning approach by opening up working groups to volunteers who want to contribute.

"It's already setting the tone for open science with the Habitable Worlds Observatory," said Megan Ansdell, the program scientist for the [mission](#) at NASA Headquarters in Washington. "The process is as open as possible, and these working groups are open to anybody in the world who wants to join." There are already more than 1,000 community working group members participating, some of whom are citizen scientists.

Future citizen science initiatives may be combined with cutting-edge tools such as [artificial intelligence](#) (AI) for greater efficacy. "AI can be exceptionally powerful in terms of classification and identifying anomalous things," said Joshua Pepper, the deputy program scientist for the Habitable Worlds Observatory at NASA Headquarters. "But the evaluation of what those anomalous things are often requires human insight, intervention, and review, and I think that could be a really fantastic area for citizen scientists to participate."

Before Roman and the Habitable Worlds Observatory launch, exoplanet [citizen scientists](#) still have plenty of data to analyze from the Kepler and TESS satellites, but the contributions of the community will become even more important when data begins pouring in from the new missions. As Zellem said, "We're in a golden age of [exoplanet](#) science right now."

Provided by NASA

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