Astronomers identify 164 promising targets for the habitable worlds observatory

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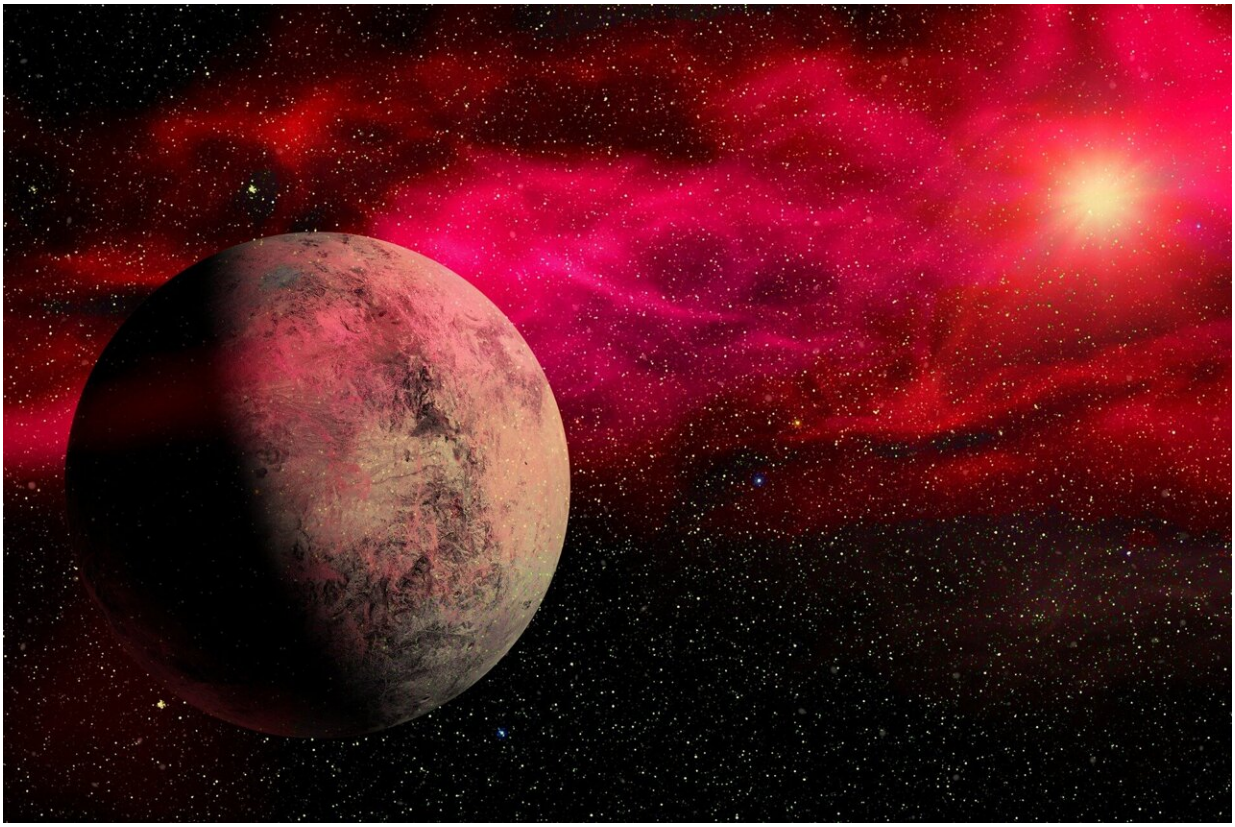

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Planning large astronomical missions is a long process. In some cases, such as the now functional James Webb Space Telescope, it can literally take decades. Part of that learning process is understanding what the

mission will be designed to look for. Coming up with a list of what it should look for is a process, and on larger missions, teams of scientists work together to determine what they think will be best for the mission.

In that vein, a team of researchers from UC Berkeley and UC Riverside have released a paper on the *arXiv* preprint server describing a database of exoplanets that could be worth the time of NASA's new planned habitable planet survey, the Habitable Worlds Observatory HWO.

Astronomy's decadal surveys are the starting point for many ambitious projects, and the Astro2020 Decadal Survey didn't disappoint. It called for NASA to develop a 6-meter space telescope capable of high-contrast observations in optical, infrared, and ultraviolet wavelengths.

That project became known as the HWO; its primary mission is to observe 25 different exoplanets in their parent star's habitable zones and look for biosignatures on them. Essentially, it will be humanity's best alien finder. While not searching biosignatures, it can also do general astronomy, but knowing what planets to look at is critical to its mission.

To tackle that part of the project, a NASA project known as the Exoplanet Exploration Program developed a list of 164 candidate exoplanets "whose [hypothetical] exo-Earths would be the most accessible" for the HWO. Mainly, that accessibility had to do with the characteristics of the planet's parent star, but its separation from that star was also considered.

While those are helpful characteristics to consider, there are plenty more factors that we believe go into whether a planet is habitable or not. These include the frequency of flares and the abundance of certain elements in the star itself. That is precisely the kind of information the new catalog contains.

Specifically, the measurements the authors collected can be broken down into five categories: stellar element abundance, photometric values, flare rates, variability estimates, and X-ray emissions. However, each of those categories has plenty of nuance in it. For example, the researchers collected 1,700 stellar measurements of elemental abundance for 14 different elements. However, they could only find X-ray emission data for 41 of the 168 stars in the catalog.

The lack of data isn't surprising, as they were simply collecting data from other publicly available sources. Some of those sources focused on thousands of stars and weren't paying close attention to the ones needed from this data set. Data came from various places, including the Gaia, TESS, and WISE.

Even the database itself was modeled on a similar one, known as ExEP Mission Star List (EMSL), that was originally developed for two other Great Observatories, LUVOIR and HabEx. Each has its own specialization, and while there is some overlap with HWO, the data defining those missions wasn't complete enough to help define HWO.

As such, there is still work to do in drawing up a project definition and finalizing the scientific and technical goals for HWO. The authors pointed out that this paper was only the first of a series of precursor papers that would help flesh out what this new observatory would be able to do. Luckily, the catalog they have created is freely available, so any interested party can explore the data they've collected and potentially contribute to some of the future work defined at the end of the paper. There's always more science to be done.

More information: Caleb K. Harada et al, Setting the stage for the search for life with the Habitable Worlds Observatory: Properties of 164 promising planet survey targets, *arXiv* (2024). DOI: 10.48550/arxiv.2401.03047

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