

Simulated HWO reflected light retrievals to rule out waterworld O₂ biosignature false positives by detecting land

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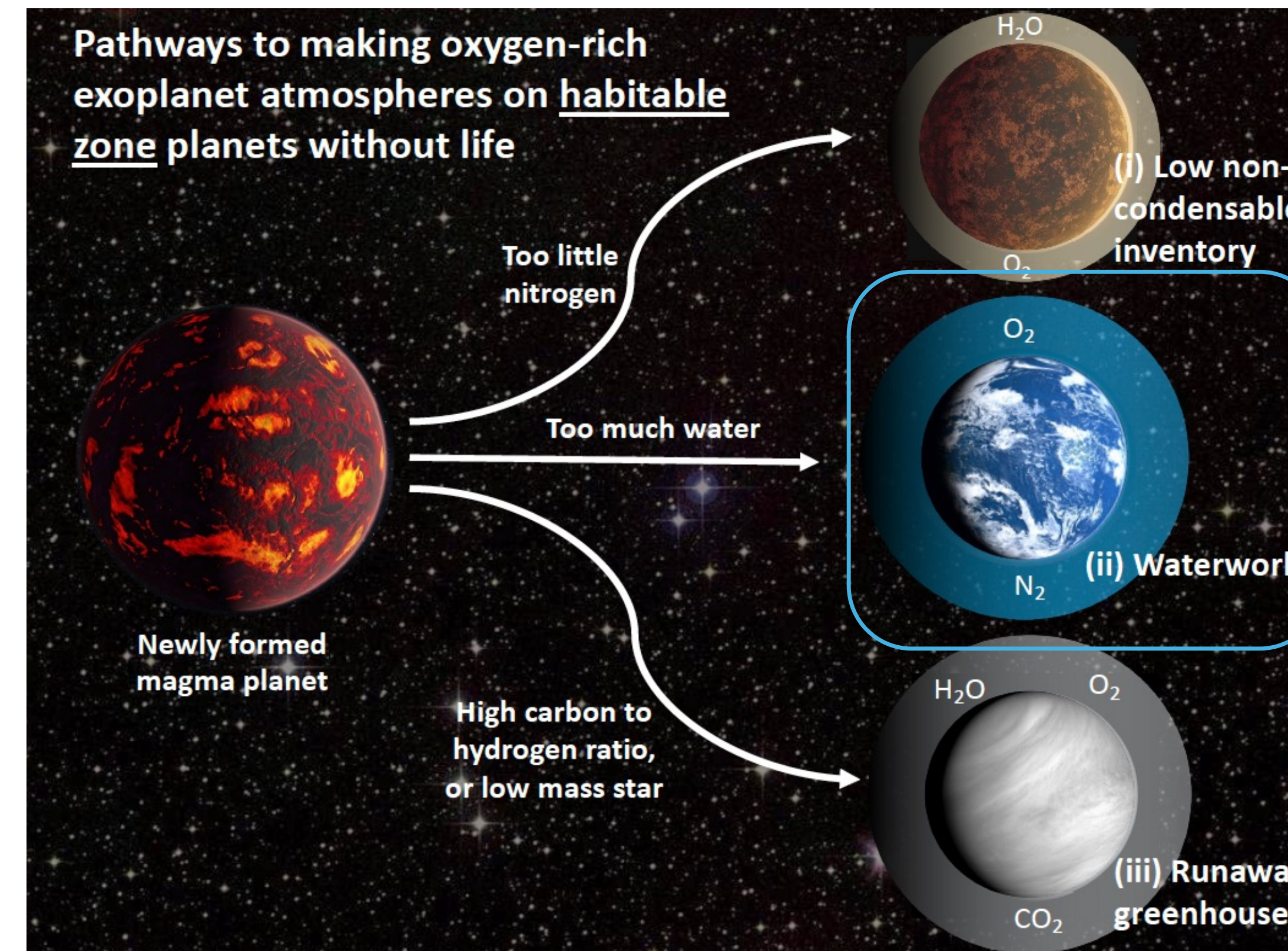
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O₂ as a false-positive for HWO

Abiotic O₂ can be generated on habitable zone planets around F/G/K stars, resulting in ‘false-positive’ biosignatures, one example being **waterworlds**¹.

Method

We investigate the HWO telescope capabilities needed to detect land by using rfast² to **simulate reflected light retrievals** of Earth-like and waterworld planets.

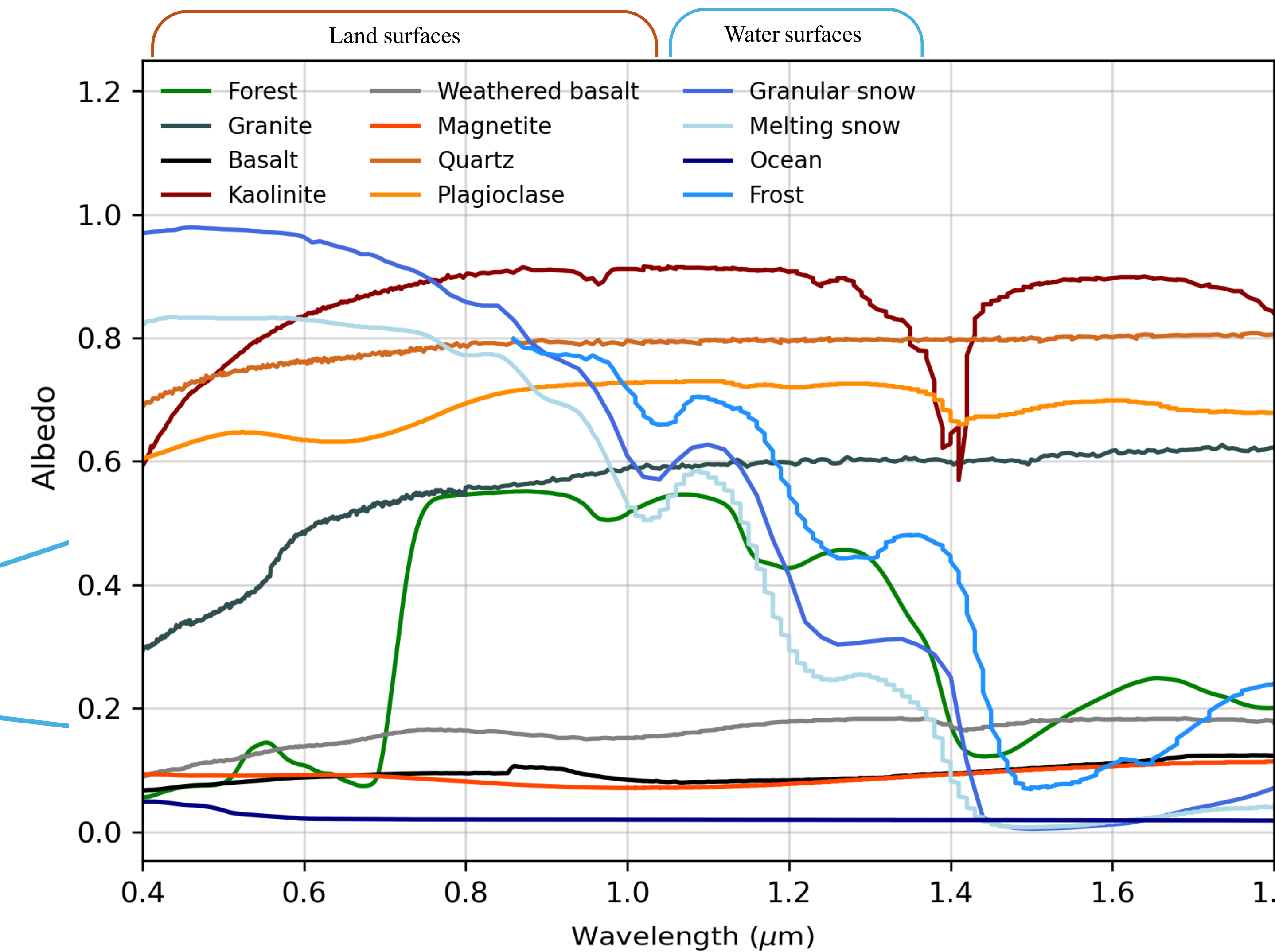
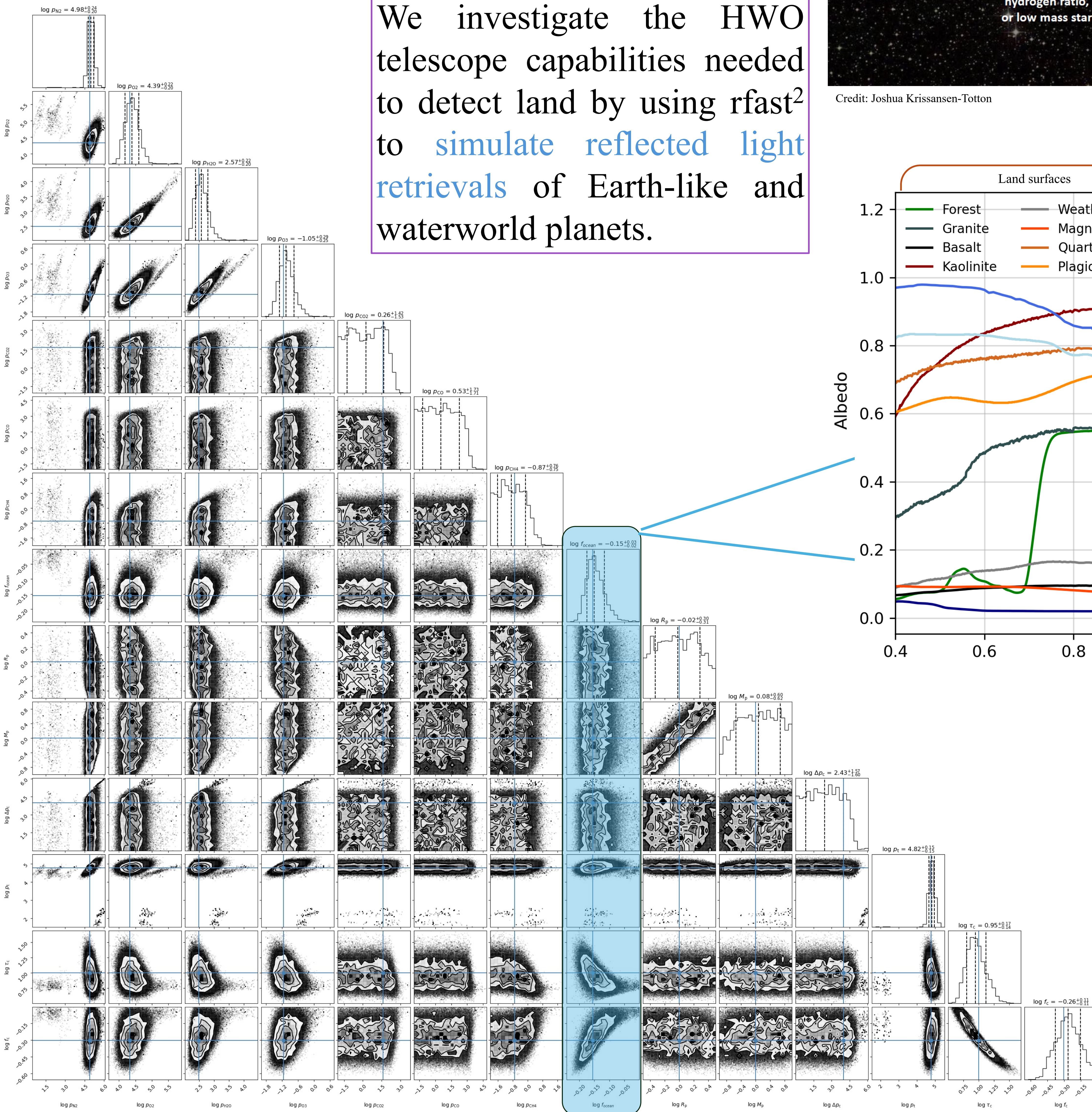


Credit: Joshua Krissansen-Totton

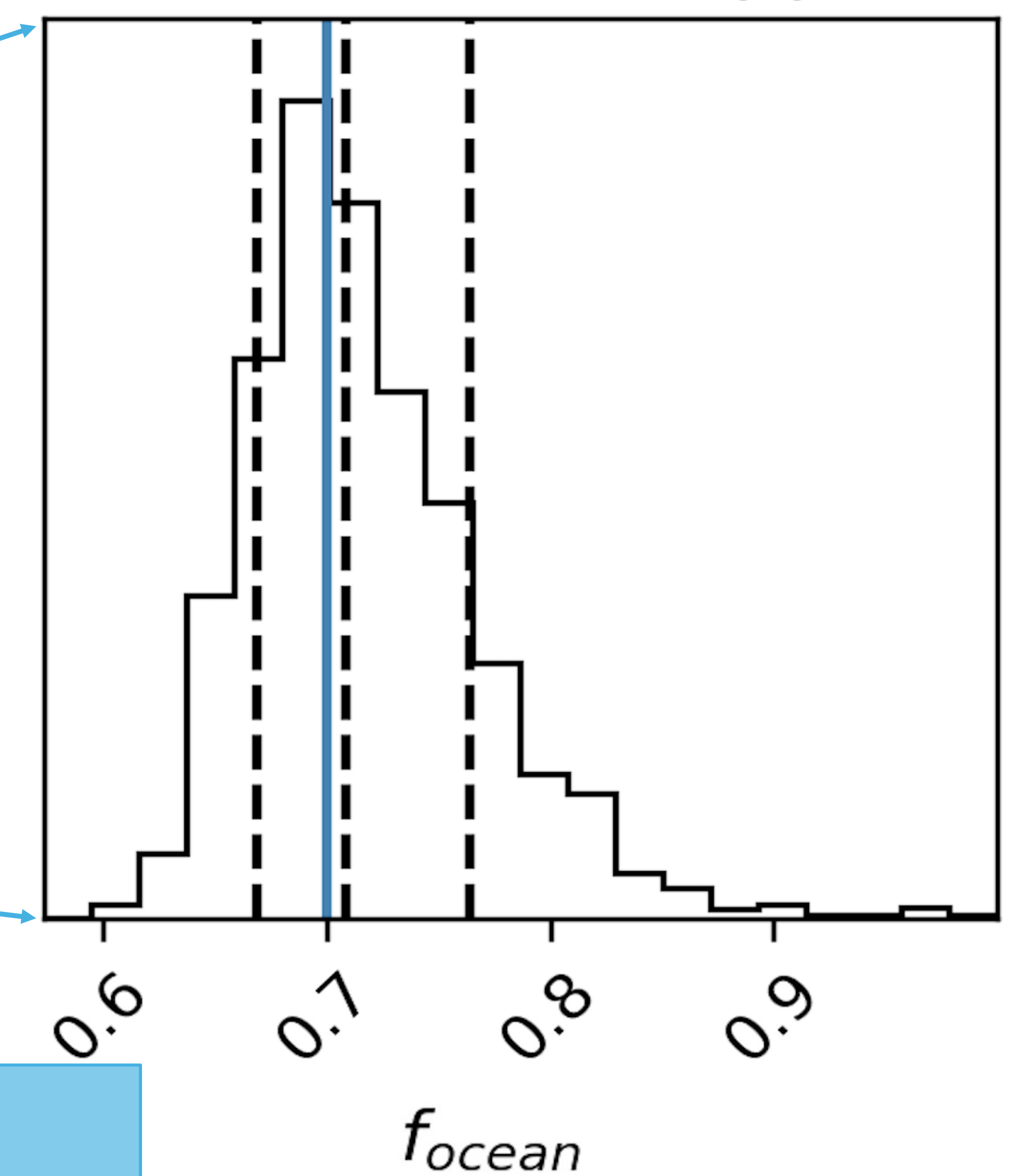
Waterworlds

Waterworlds are the evolutionary outcome of planets with initial water inventories $> \sim 50$ Earth oceans¹. The large ocean pressure removes oxygen sinks and O₂ builds up via diffusion-limited escape of H¹.

Waterworld false positives would be excluded by the detection of exposed land features



$$f_{ocean} = 0.71^{+0.06}_{-0.04}$$



Conclusions

Land has been detected with high confidence.

HWO is probably capable of land detections to rule out waterworld oxygen biosignature false positives.

Acknowledgments:

This work was supported by a NASA Astrophysics Decadal Survey Precursor Science grant 80NSSC23K147L, as well as funding from the Virtual Planetary Laboratory at the University of Washington.

References: [1] Krissansen-Totton et al (2021) Oxygen False Positives on Habitable Zone Planets Around Sun-Like Stars [2] Robinson, Tyler D. and Salvador, Arnaud (2023), Exploring and Validating Exoplanet Atmospheric Retrievals with Solar System Analog Observations