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Publication date

2021

Document Version

Final published version

Published in

Bulletin - American Astronomical Society

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Citation for published version (APA):

Paragas, K., Vissapragada, S., Knutson, H. A., & Oklopčić, A. (2021). Metastable Helium Reveals Ongoing Mass Loss for the Gas Giant HAT-P-18b. *Bulletin - American Astronomical Society*, 53(1), [543.05]. <https://baas.aas.org/pub/2021n1i543p05/release/1>

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Bulletin of the AAS • Vol. 53, Issue 1

Metastable Helium Reveals Ongoing Mass Loss for the Gas Giant HAT-P-18b

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Published on: Jan 11, 2021

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The helium (He) 1083 nm line offers insight into the atmospheric mass loss of close-in exoplanets, which is likely to be significant in sculpting their population. Most studies of atmospheric escape have been done at UV wavelengths using the hydrogen Lyman-alpha line, but in the last few years the metastable He 1083 nm line has emerged as a more observationally accessible alternative. By measuring the amount of excess absorption in this line during a transit, we can characterize the spatial extent of the planet's exosphere and its corresponding present-day mass loss rate. We used an ultra-narrow band filter to observe two transits of the gas giant HAT-P-18b, using the 200" Hale Telescope at Palomar Observatory, and report the first-ever detection of outflowing gas from its upper atmosphere. With a J-band magnitude of 10.8, this is the faintest system for which such a measurement has been made, demonstrating the effectiveness of this approach for surveying mass loss on a diverse sample of close-in gas giant planets.