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

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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.