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Title: Kepler's Optical Secondary Eclipse Of HAT-P-7b And Probable Detection Of Planet-Induced Stellar Gravity Darkening
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Abstract: We present observations spanning 355 orbital phases of HAT-P-7 observed by Kepler from May 2009 to March 2011 (Q1-9). We find a shallower secondary eclipse depth than initially announced, consistent with a low optical albedo and detection of nearly exclusively thermal emission, without a reflected light component. We find an approximately 10 ppm perturbation to the average transit light curve near phase -0.02 that we attribute to a temperature decrease on the surface of the star, phased to the orbit of the planet. This cooler spot is consistent with planet-induced gravity darkening, slightly lagging the sub-planet position due to the finite response time of the stellar atmosphere. The brightness temperature of HAT-P-7b in the Kepler bandpass is $T_B = 2733 \pm 21$ K and the amplitude of the deviation in stellar surface temperature due to gravity darkening is approximately -0.18 K. The detection of the spot is not statistically unequivocal due its small amplitude, though additional Kepler observations should be able to verify the astrophysical nature of the anomaly.