Detectability of Rings Around Transiting Extrasolar Giant Planets

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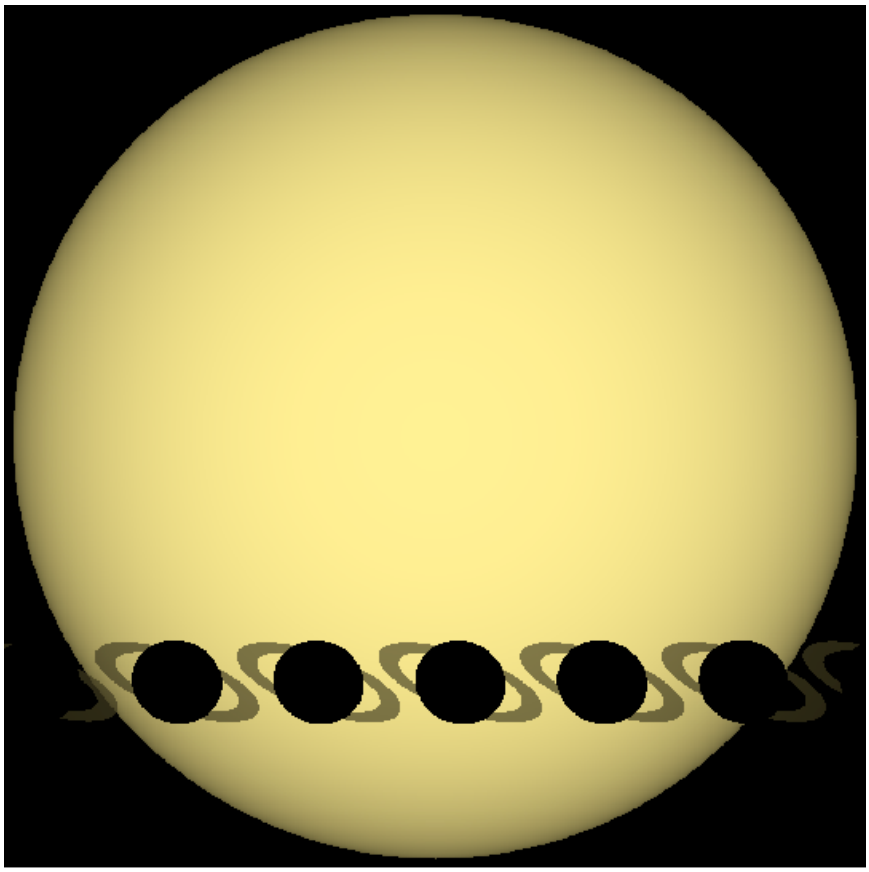
ABSTRACT

Transits, in addition to offering the capability to detect planets, also provide an opportunity to characterize them with follow-up high precision photometry. We investigated whether or not a ring system around a transiting planet could be detected, under what conditions, and what scientifically useful information could be inferred from such a detection. With a huge cross-sectional area, as much as the planet itself for a Saturn-like ring system, one might expect that the transit signal would be unmistakable. However, when comparing the lightcurve of a tansiting ringed planet to a best-fit spherical planet as would be done under actual observing conditions, the residual ring signature is much weaker. Detection of a ring system requires photometric precision of the order a few $x10^{-4}$, and is localized in time to while the planet is crossing the limb, and so requires high time resolution as well. The Kepler mission should have the capability to detect large, Saturn-like ring systems. Scattering from the rings may allow measurement of the typical size of the ring particles, providing insight into the conditions and consequences of the formation of ring systems and planets themselves.



Simulated transit of a 1.0 R_{Jup} extrasolar planet with τ=1 ring system from 1.5-2.0 R_{Jup}. Scattering is exaggerated by a factor of 18 in order to make the off-limb scattering visible.