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Possible case of exoplanetary rings around HIP 41378 f

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Planetary rings are exciting features yet to be detected around exoplanets despite their prevalence around the giant planets and other rocky bodies of the solar system. A number of studies have proposed methods to identify and characterise the signatures of rings mostly from transit light curves. Probing for the presence of rings in transit light curves is very useful as the rings can cause a number of effects both on the light curve shape and the inferred parameters of the planet.

The presence of rings around a transiting planet can cause it to appear larger and lead to an underestimation of its density if the mass is known. Therefore, a class of planets with extremely low densities, called Super puffs, can be planets with yet undetected rings. A Bayesian framework is employed here to show that the anomalously low density (~0.09 g/cm^3) of the transiting long-period planet HIP 41378f might be due to the presence of opaque circum-planetary rings. Analysing the light curve data from the K2 mission, we construct physically motivated model priors and found that the statistical evidence for the ringed planet scenario is comparable to that of the planet-only scenario. The ringed planet solution suggests a larger planetary density of ~1.23 g/cm^3 similar to Uranus. The associated ring extends from 1.05 to 2.59 times the planetary radius and is inclined away from the sky-plane by ~25 degrees. However, the computed ring material density is lower than is expected for a planet with an equilibrium temperature of 294K so future high-precision transit observations of HIP 41378f would be necessary to confirm/dismiss the presence of planetary rings.