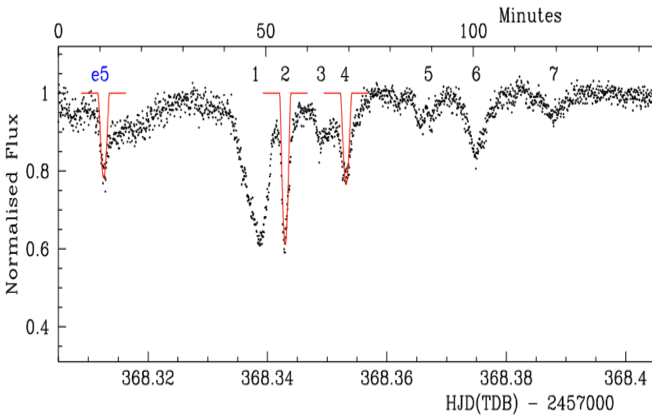
Asteroid disruption simulations to explain variability of a white dwarf

Fig. 1: Photometric transit curve of white dwarf WD 1145+017 from Gänsicke et al. (2016, ApJL, 818, L7)



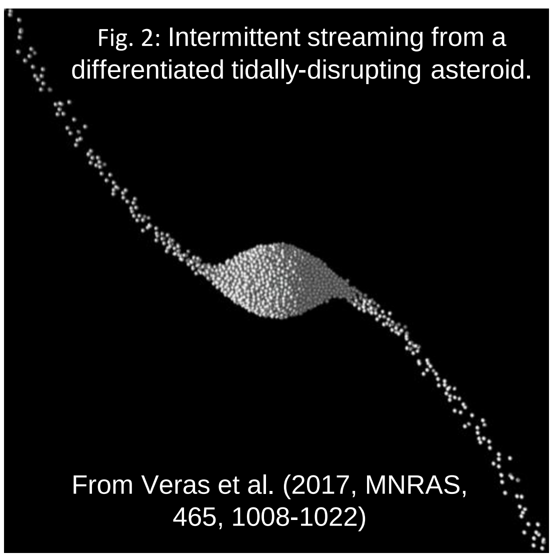


Fig. 2: Intermittent streaming from a differentiated tidally-disrupting asteroid.

From Veras et al. (2017, MNRAS, 465, 1008-1022)

- White dwarfs host planetary systems, and the white dwarf WD 1145+017 showcases remarkable photometric transit curves (Fig. 1) with depths of up to 60%, shallow and steep ingresses and egresses, and specific features which gradually appear and disappear over days.
- We sought to explain this variability.
- We performed tidal disruption simulations of asteroids as rubble piles of different densities and masses and with different orbital eccentricities (Fig. 2).
- We were able to provide a first-order match to the variability with a disrupting asteroid is differentiated, has a bulk density greater than about 3 g/cm^3, and an orbital eccentricity of < 0.1.
- These findings help constrain the origin of this asteroid within that planetary system, by analogy with Solar System asteroid families.
- Further work would entail achieving an even better match to observations by modelling asteroids of different shapes and internal strengths.

Dimitri Veras[1], Philip J. Carter[2], Zoë M. Leinhardt[2], & Boris T. Gänsicke[1], “*Explaining the variability of WD 1145+017 with simulations of asteroid tidal disruption”, MNRAS, 2017, 465, 1008-1022. Link for movies: http://www.star.bris.ac.uk/pcarter/WD1145_asteroid_disruption/ Link for paper: https://arxiv.org/abs/1610.06926*

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