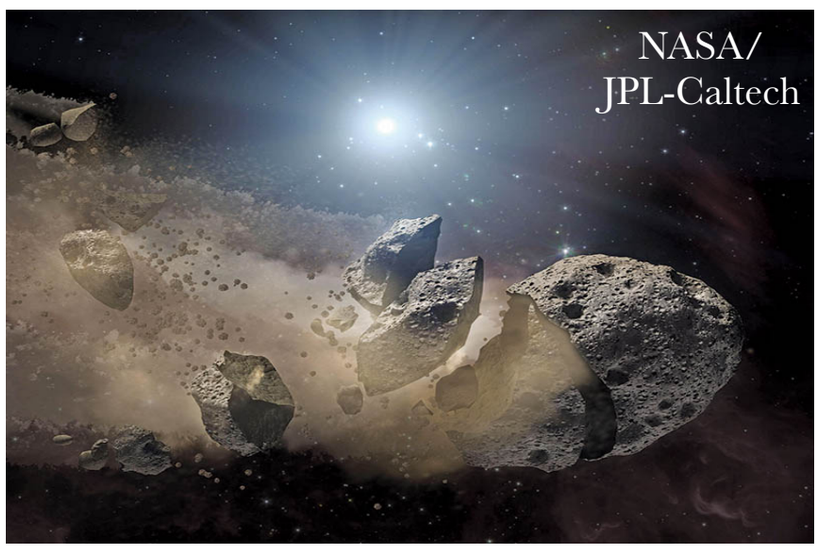
Constraining the properties of the asteroid disintegrating around WD 1145+017

Dimitri Veras (University of Warwick)

break-up → **form disc** → **pollute star**



↑

Missing Link **(before WD 1145+017)**

WD 1145+017 papers (so far)

Observational

Vanderburg et al. (2015, Nature, 526, 546-549)	2015
Alonso et al. (2016, A&A, 589, L6) Gänsicke et al. (2016, ApJL, 818, L7) Rappaport et al. (2016, MNRAS, 458, 3904) Xu et al. (2016, ApJL, 816, L22) Zhou et al. (2016, MNRAS, 463, 4422)	2016
Croll et al. (2017, ApJ, 836, 82) Gary et al. (2017, MNRAS, 465, 3267) Hallakoun et al. (2017, Submitted to MNRAS) Redfield et al. (2017, Submitted to ApJ)	2017

Theoretical

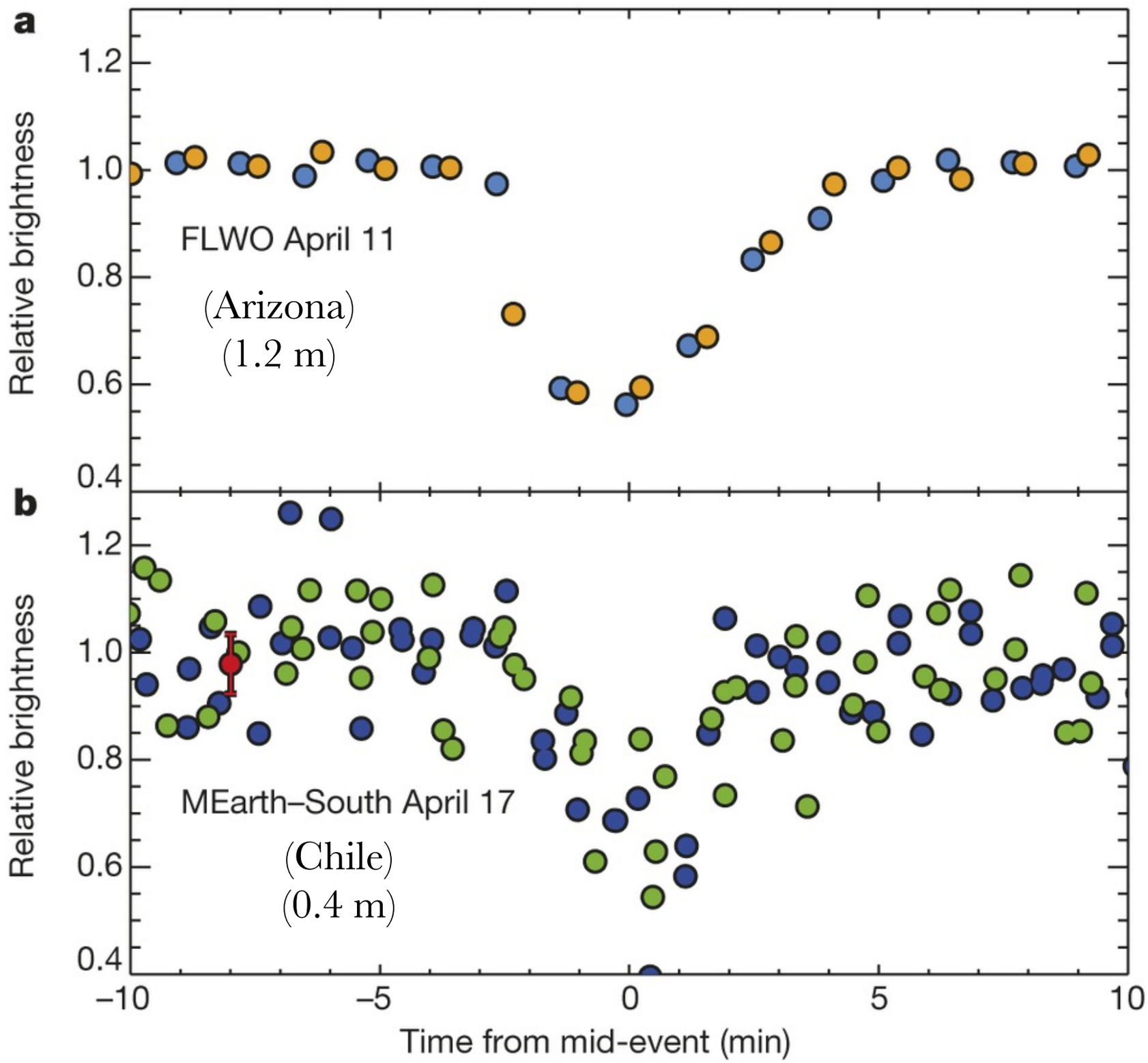
Gurri et al. (2017, MNRAS, 464, 321)
Veras et al. (2017, MNRAS, 465, 1008)

WD 1145+017: other talks

Tuesday 11:10	**Rik van Lieshout**
Tuesday 12:00	**Mark Wyatt**
Thursday 16:40	**Na'ama Hallakoun**
Friday 9:20	**John Lewis**

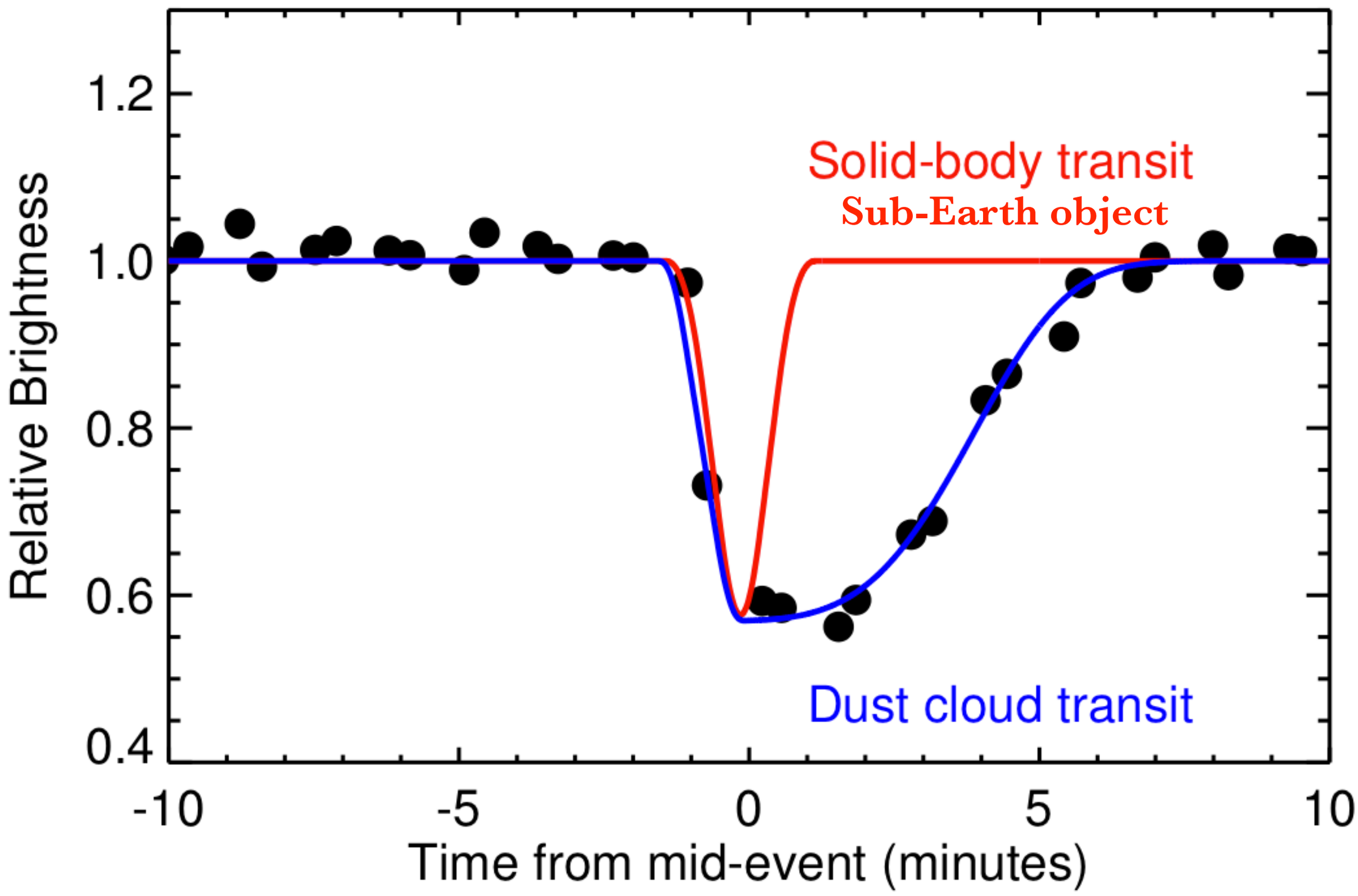
Basic observational background

Vanderburg et al. (2015, Nature, 526, 546-549)



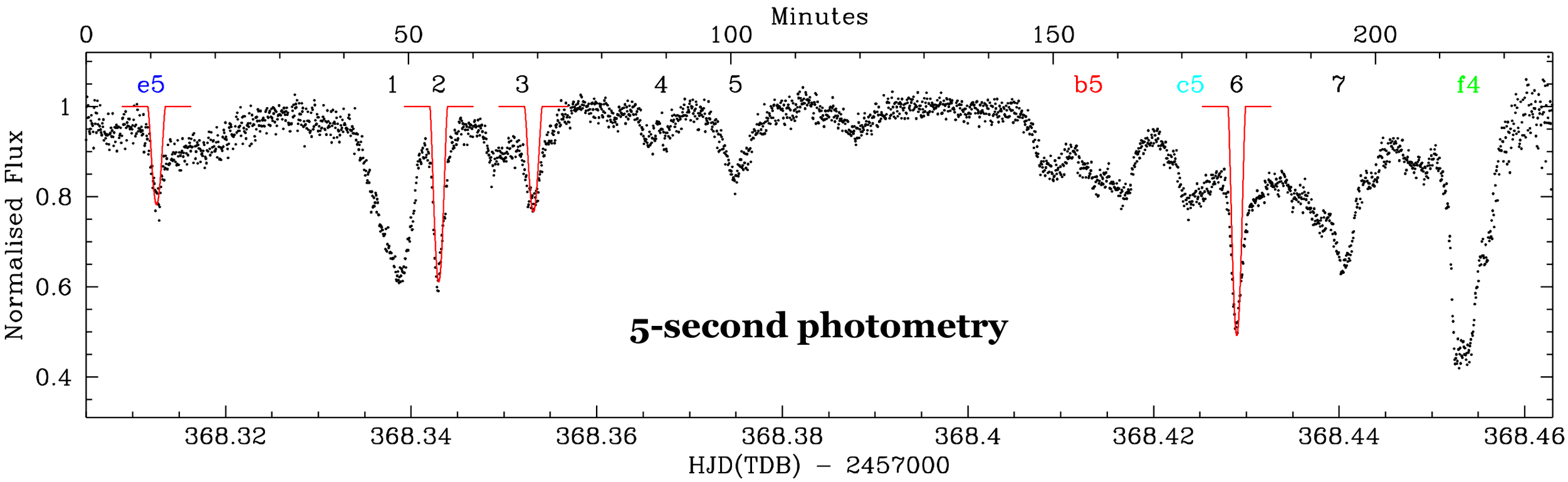
Basic observational background

Vanderburg et al. (2015, Nature, 526, 546-549)



Basic observational background

Gänsicke et al. (2016, ApJL, 818, L7)

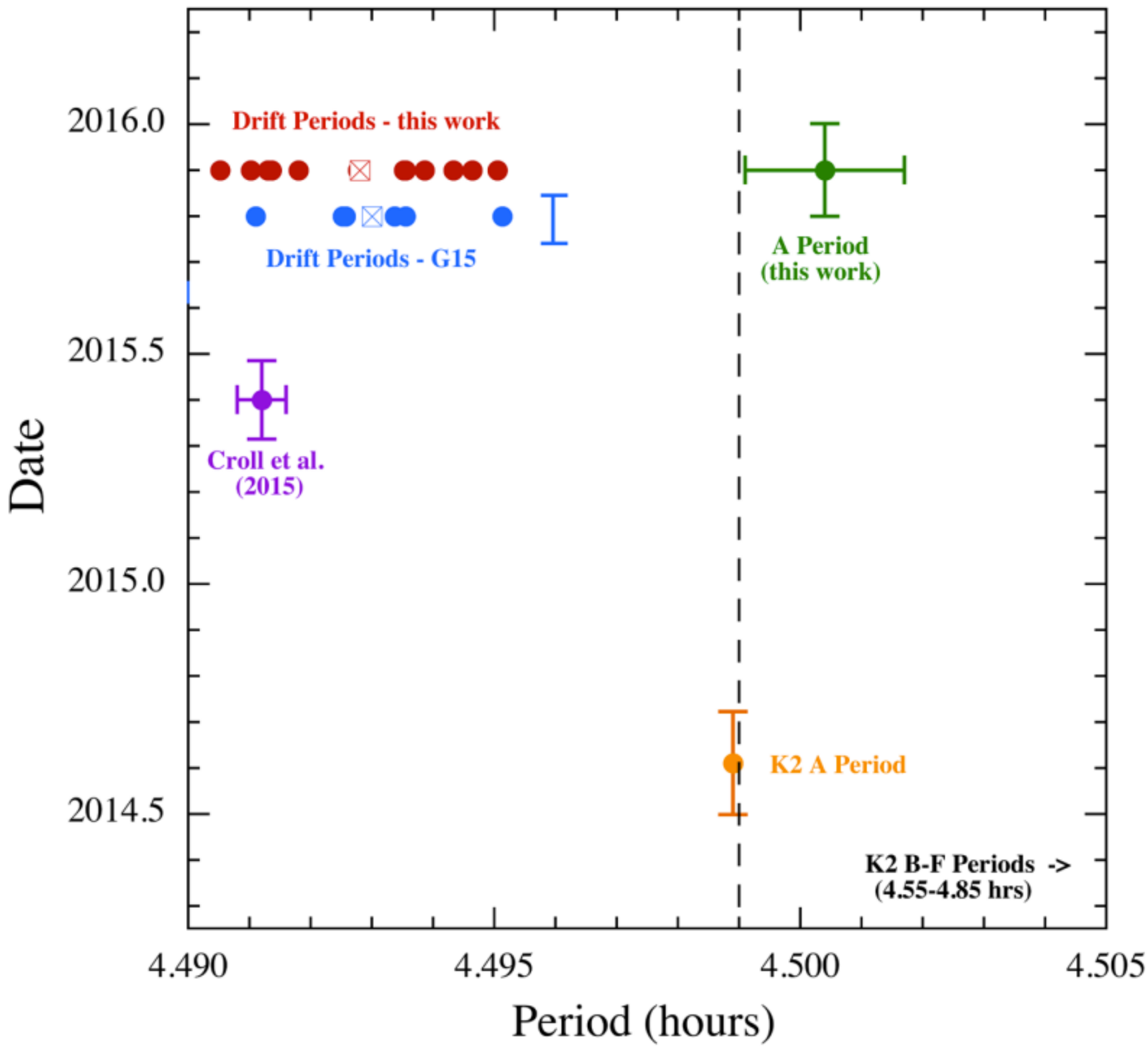


(Thailand)
(2.4 m)

(Spain)
(1.0 m)

Basic observational background

Rappaport et al. (2016, MNRAS, 458, 3904)



Explaining observables

Veras et al. (2017, MNRAS, 465, 1008)

Collaborators

Philip J. Carter

Zoë M. Leinhardt

Boris T. Gänsicke

Constraints

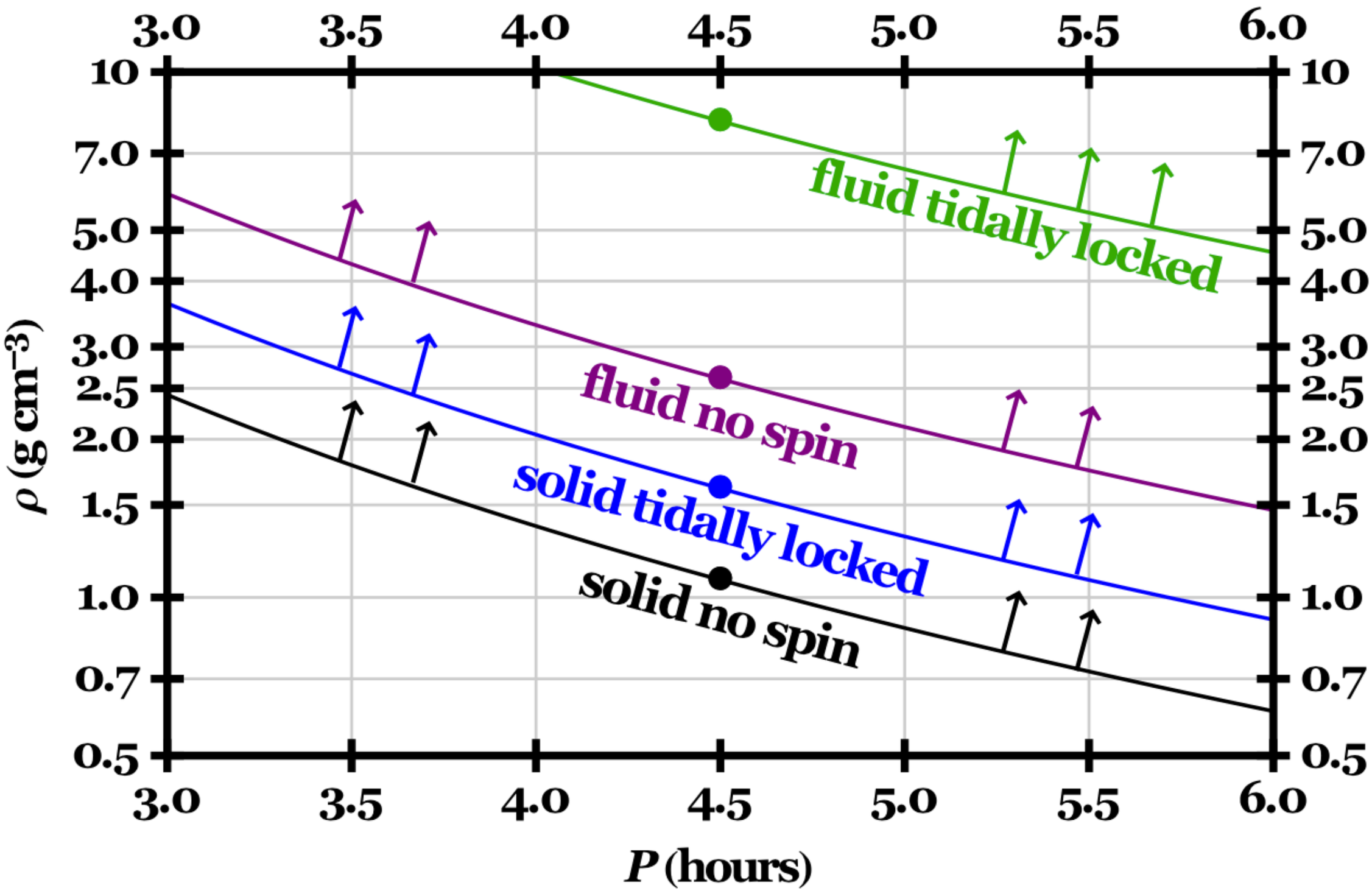
Disruption persists for 2 years

Disruption intermittent

Orbital period of ~4.499 hours

Stable to disruption

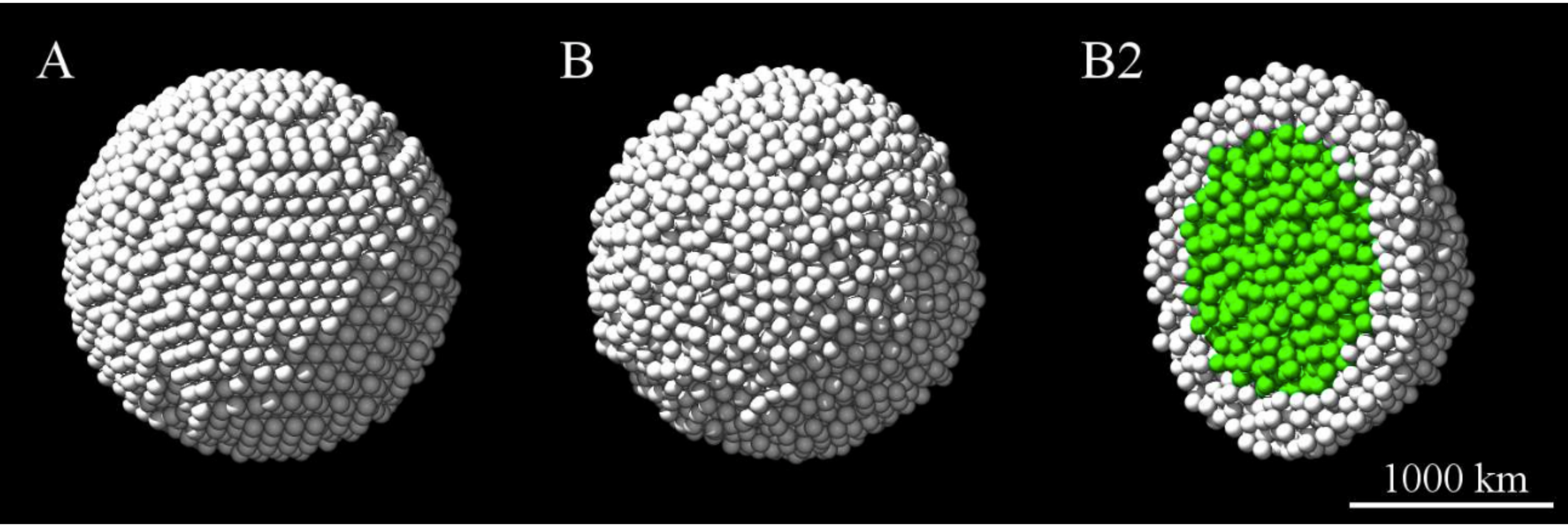
Veras et al. (2017, MNRAS, 465, 1008)



Rubble pile representations

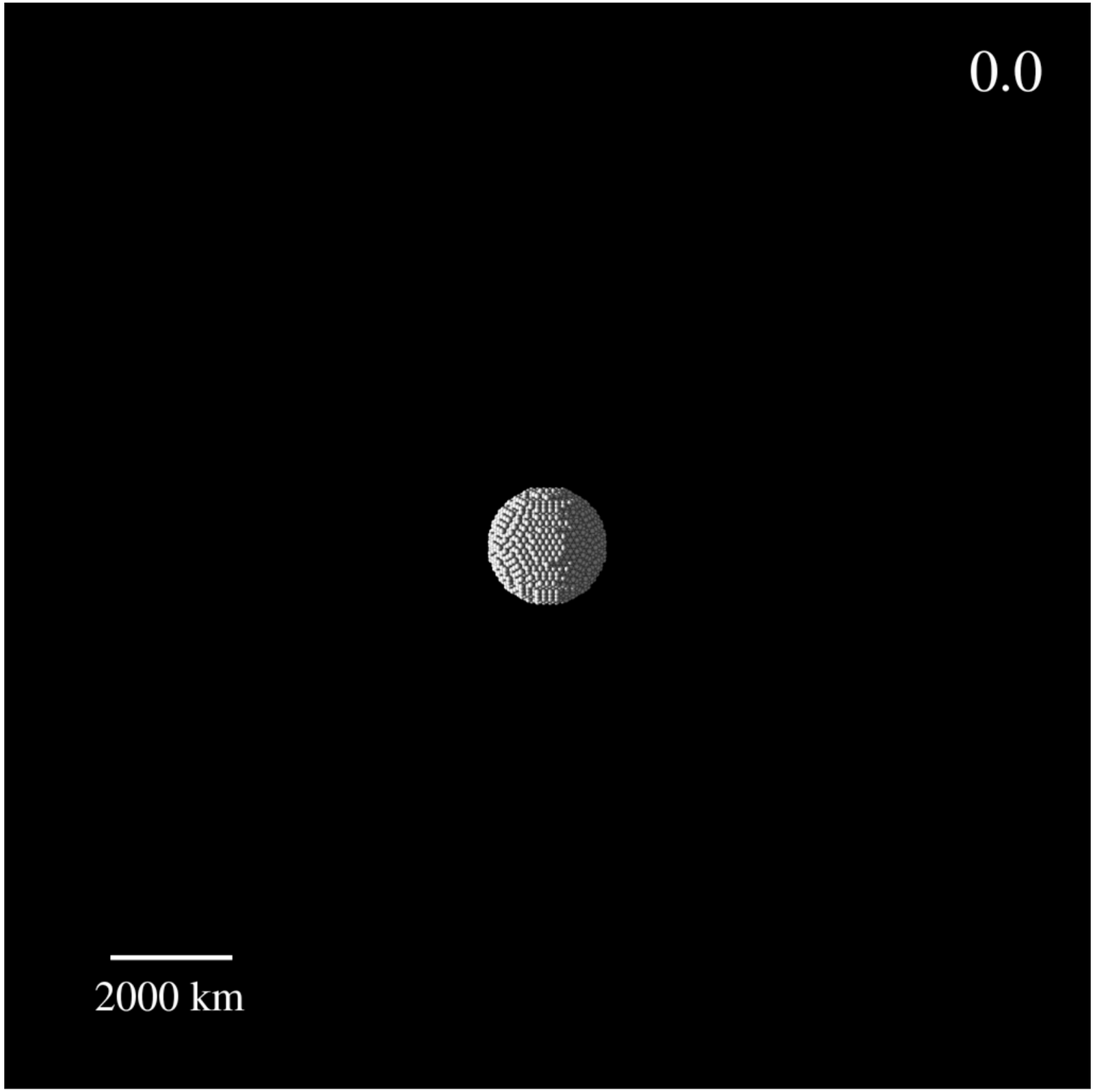
Veras et al. (2017, MNRAS, 465, 1008)

Homogeneous	**Homogeneous**	**Differentiated**
Hexagonal Closest Packing	Random Packing	Core + Mantle



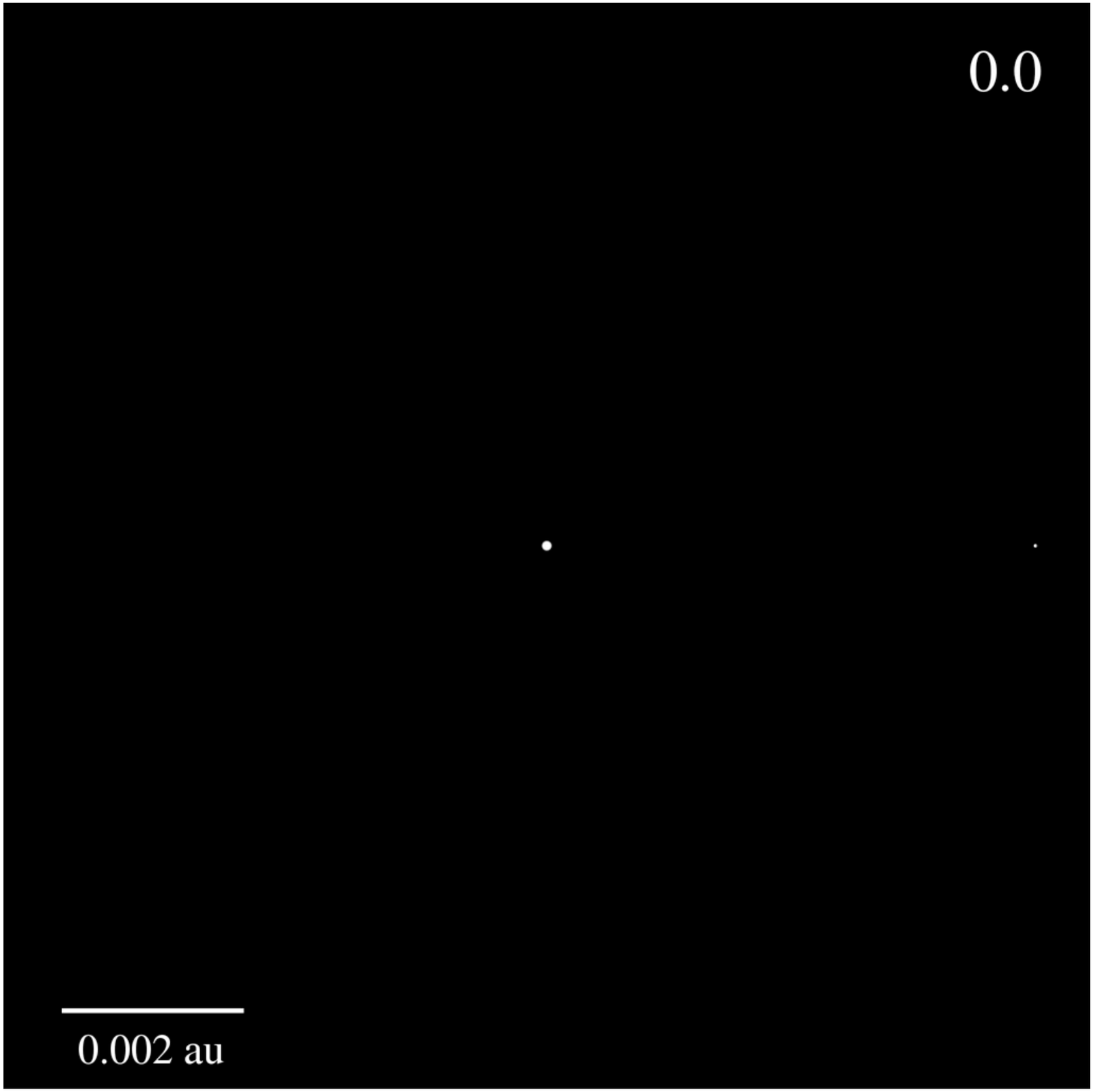
Total disruption

Veras et al. (2017, MNRAS, 465, 1008)



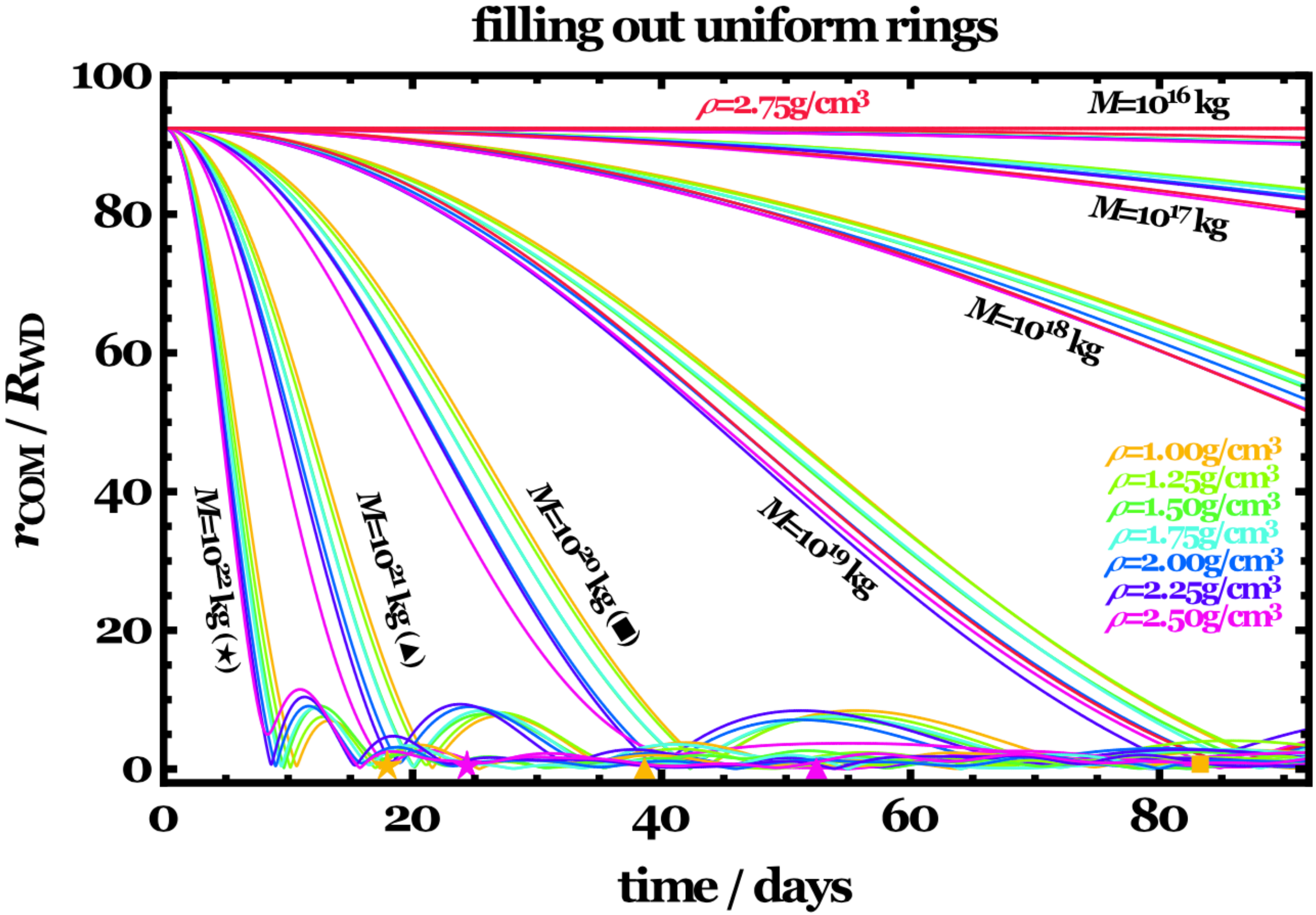
Ring / disc formation

Veras et al. (2017, MNRAS, 465, 1008)



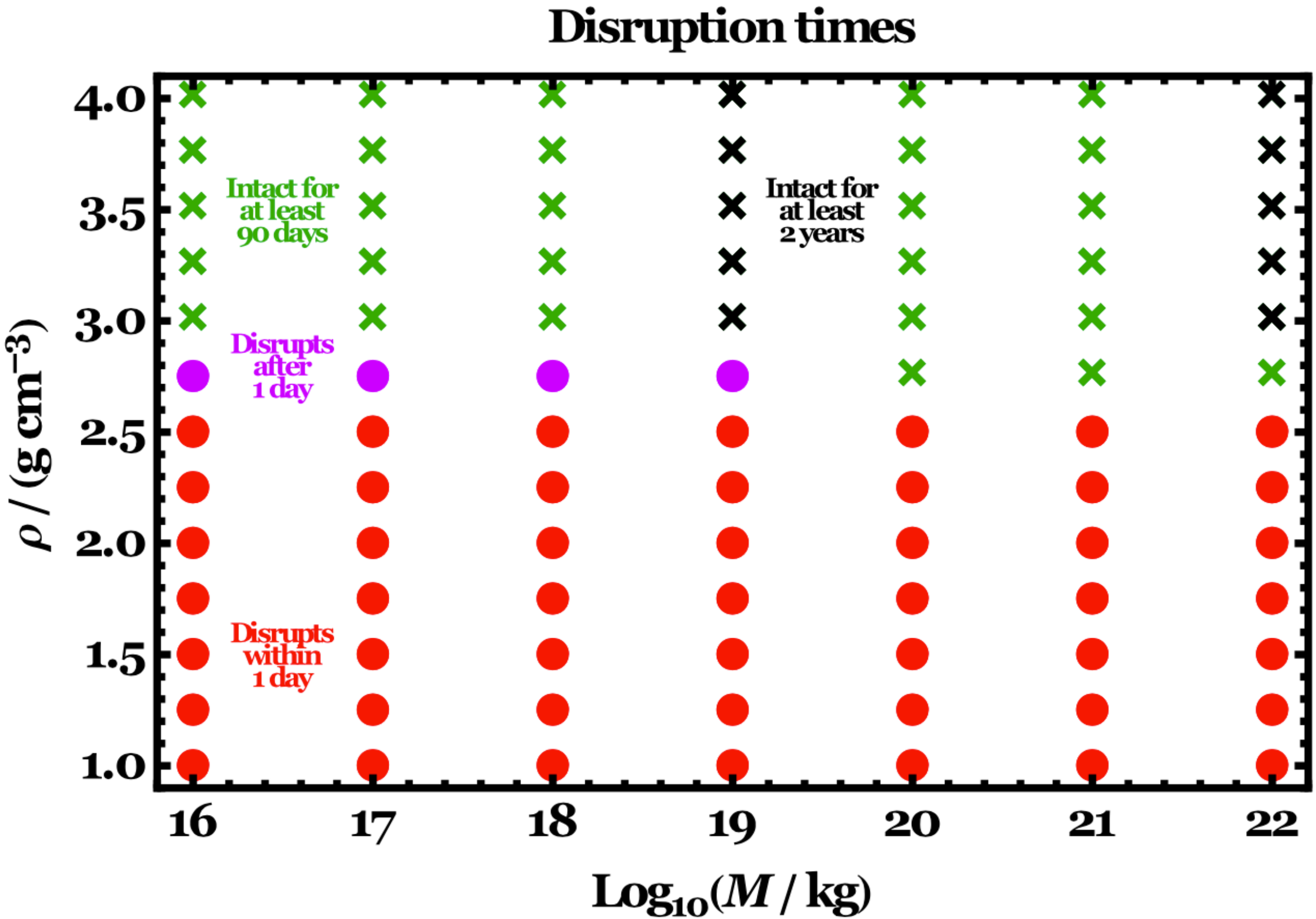
Ring / disc formation timescales

Veras et al. (2017, MNRAS, 465, 1008)



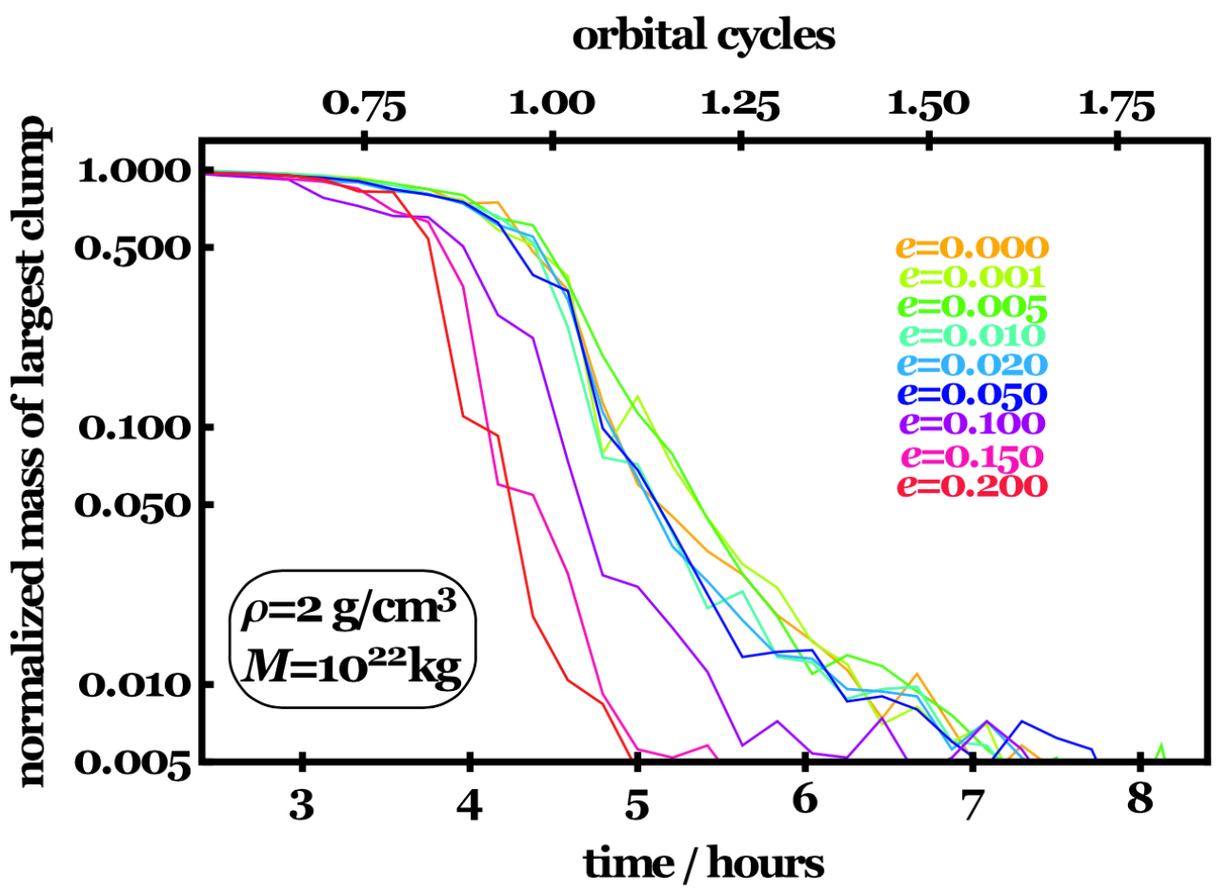
Disruption timescales

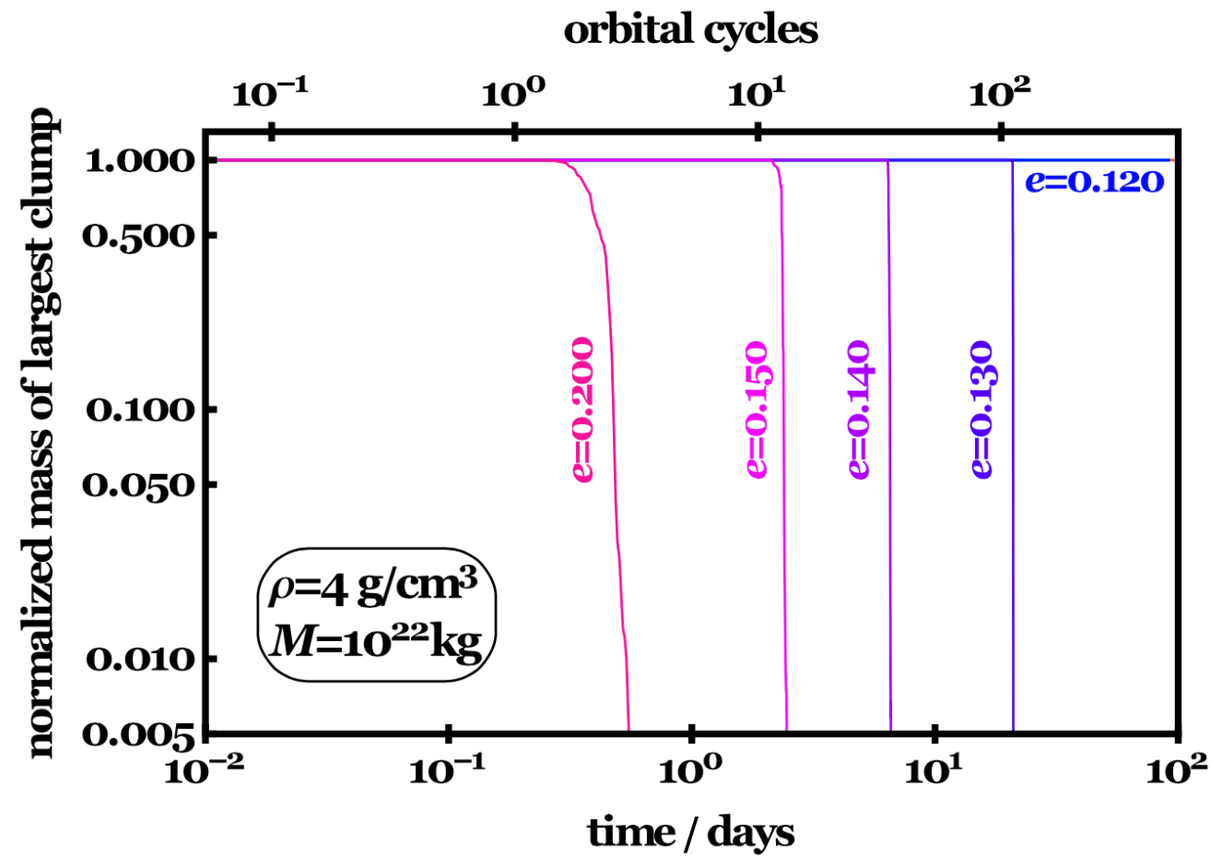
Veras et al. (2017, MNRAS, 465, 1008)



Disruption timescales

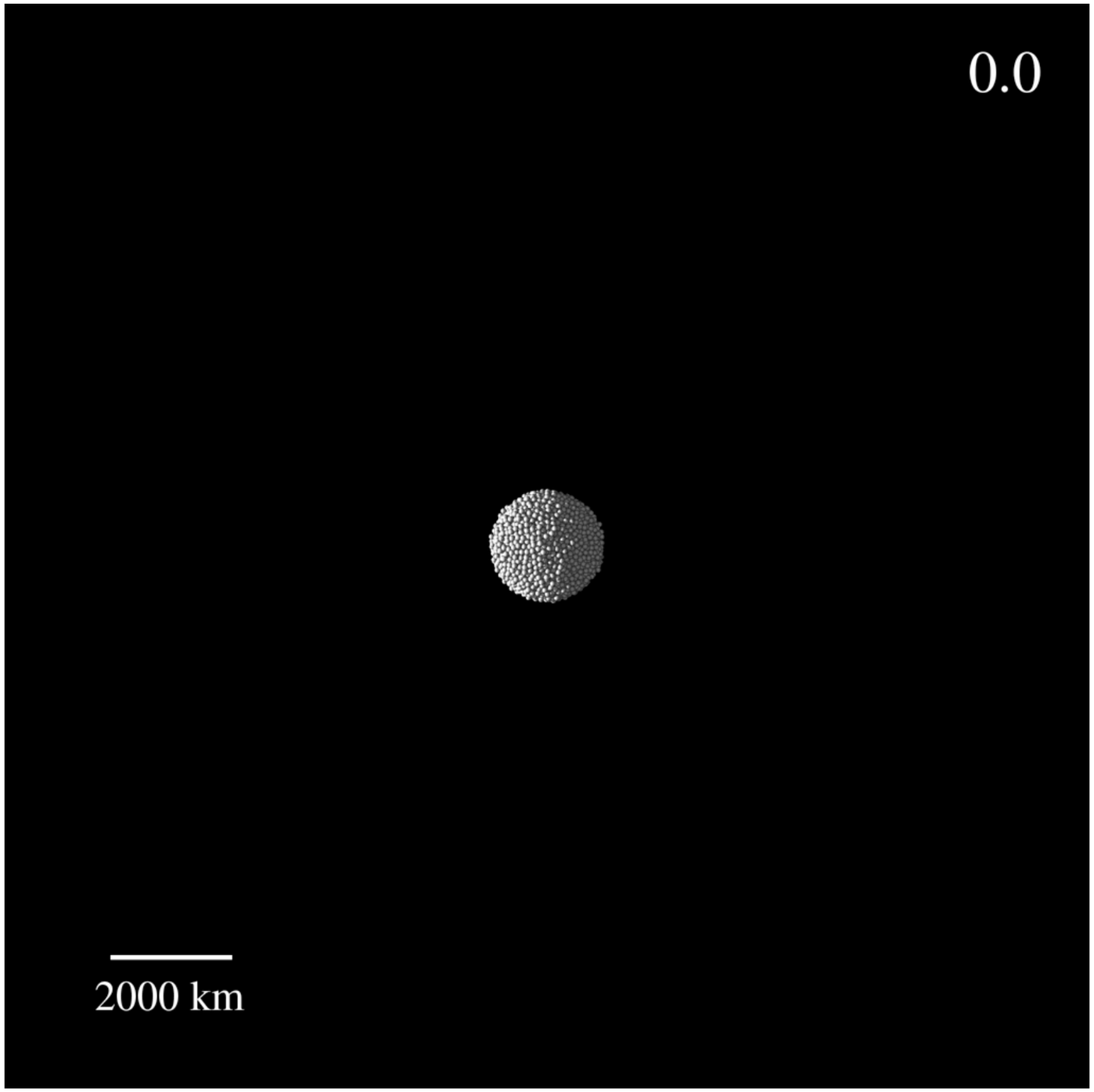
Veras et al. (2017, MNRAS, 465, 1008)





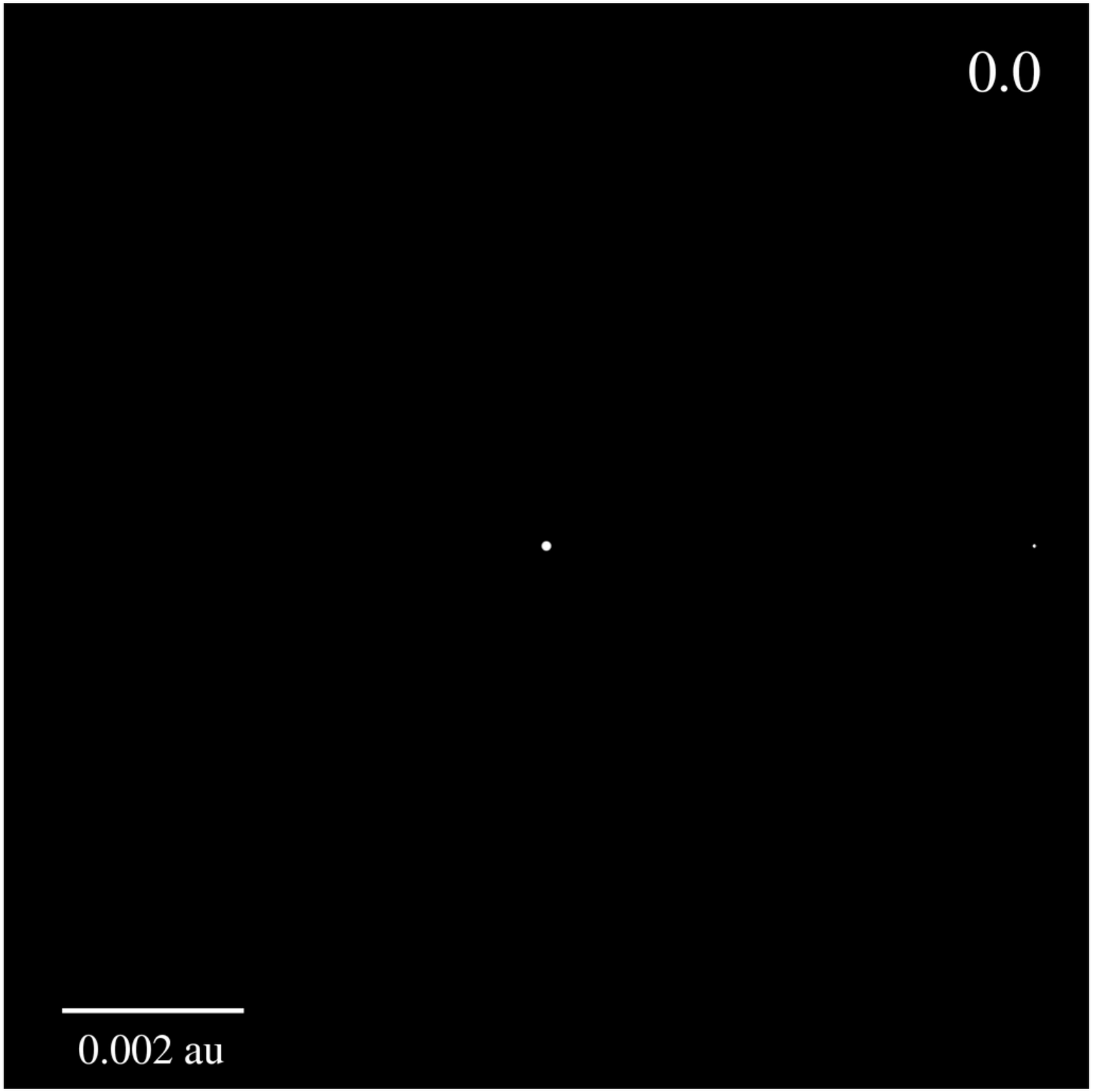
Differentiated: Total disruption

Veras et al. (2017, MNRAS, 465, 1008)



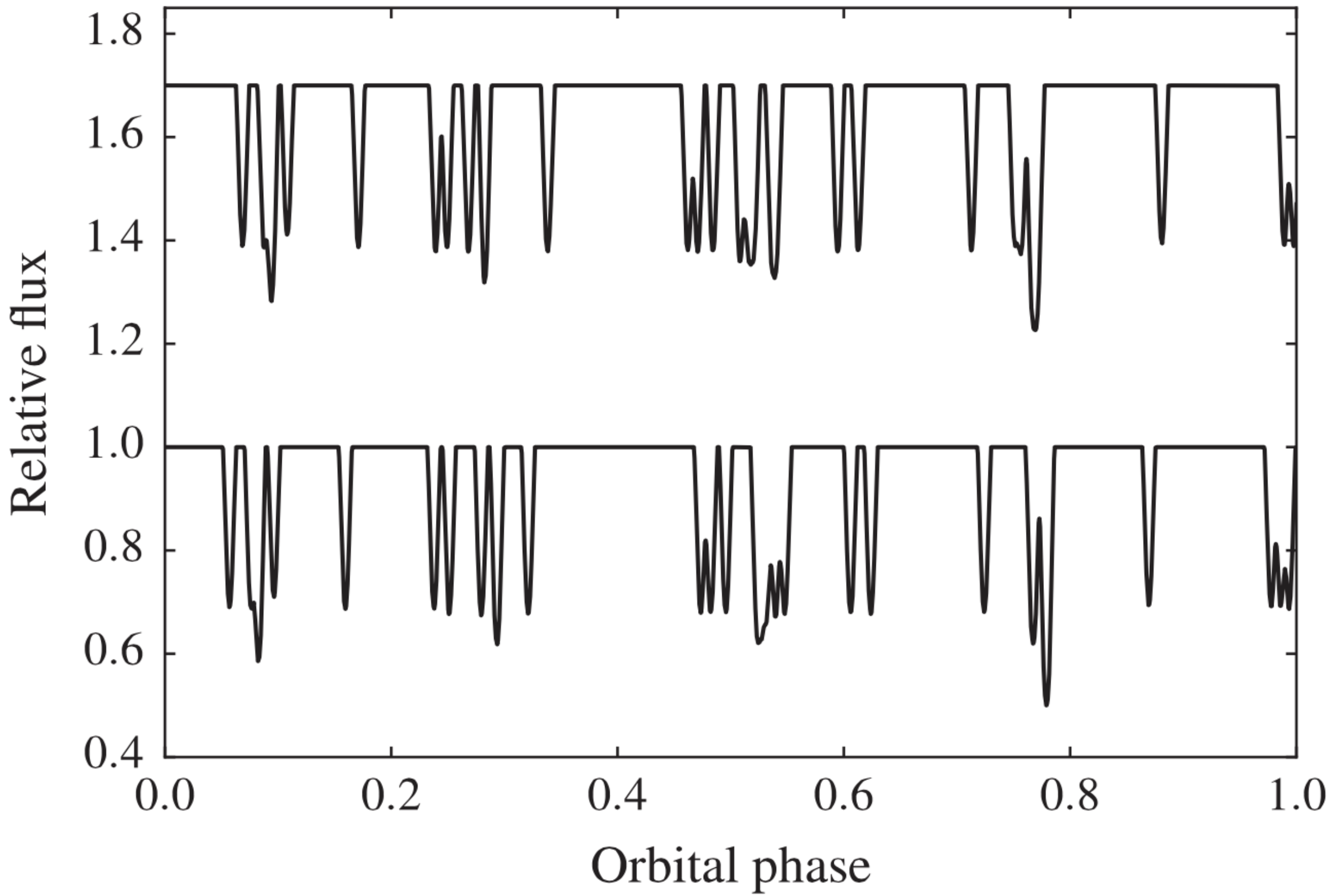
Differentiated: Partial disruption

Veras et al. (2017, MNRAS, 465, 1008)



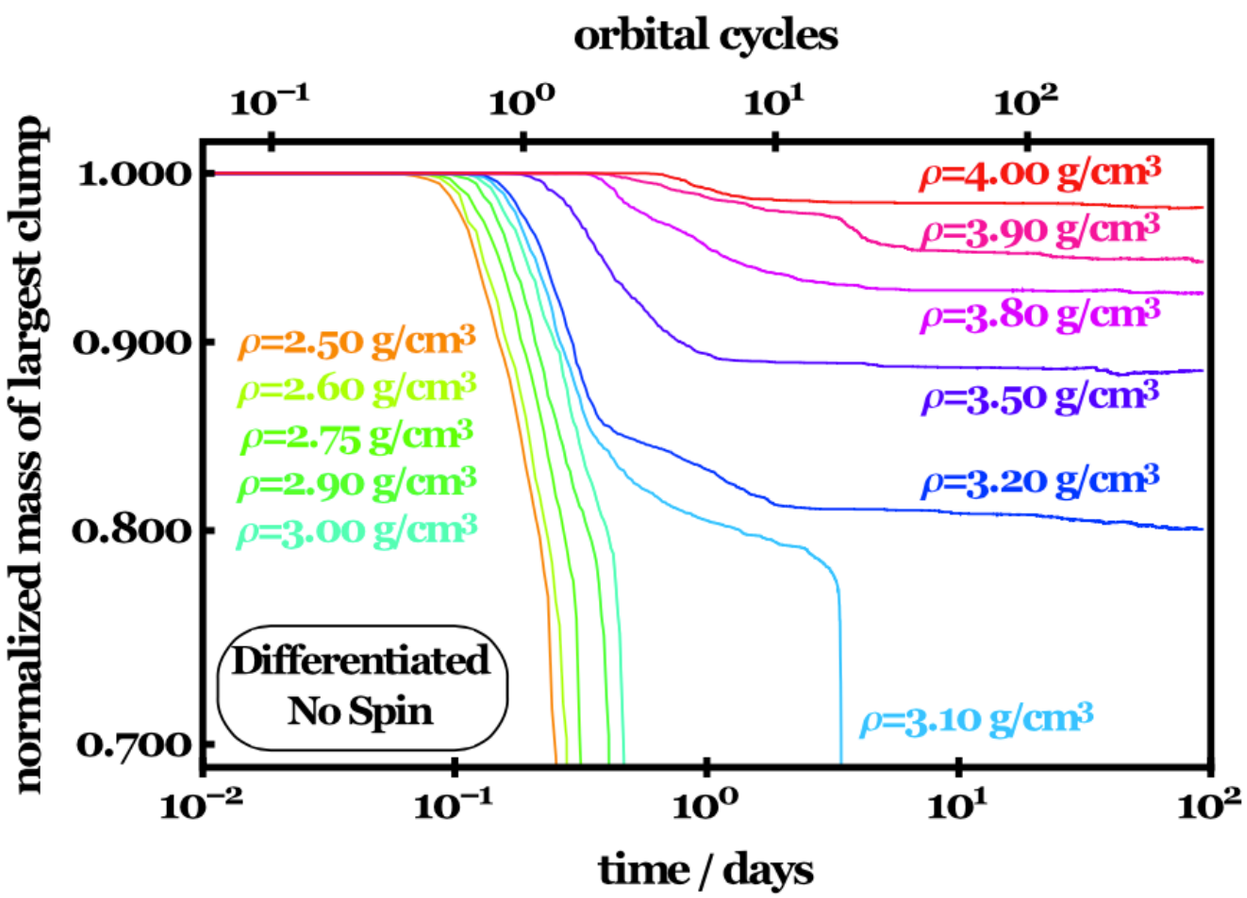
Resulting transit curves

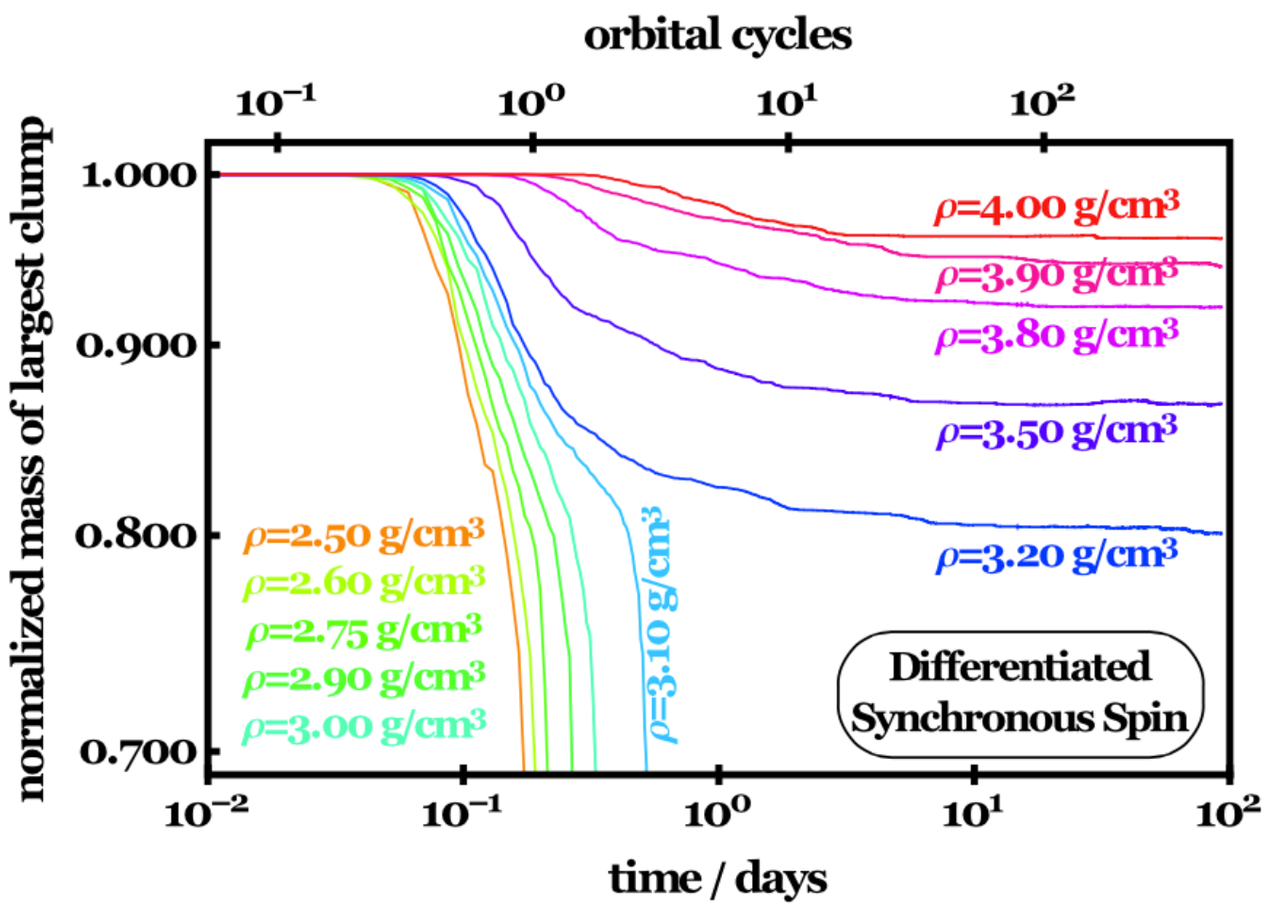
Veras et al. (2017, MNRAS, 465, 1008)



Partial disruption characteristics

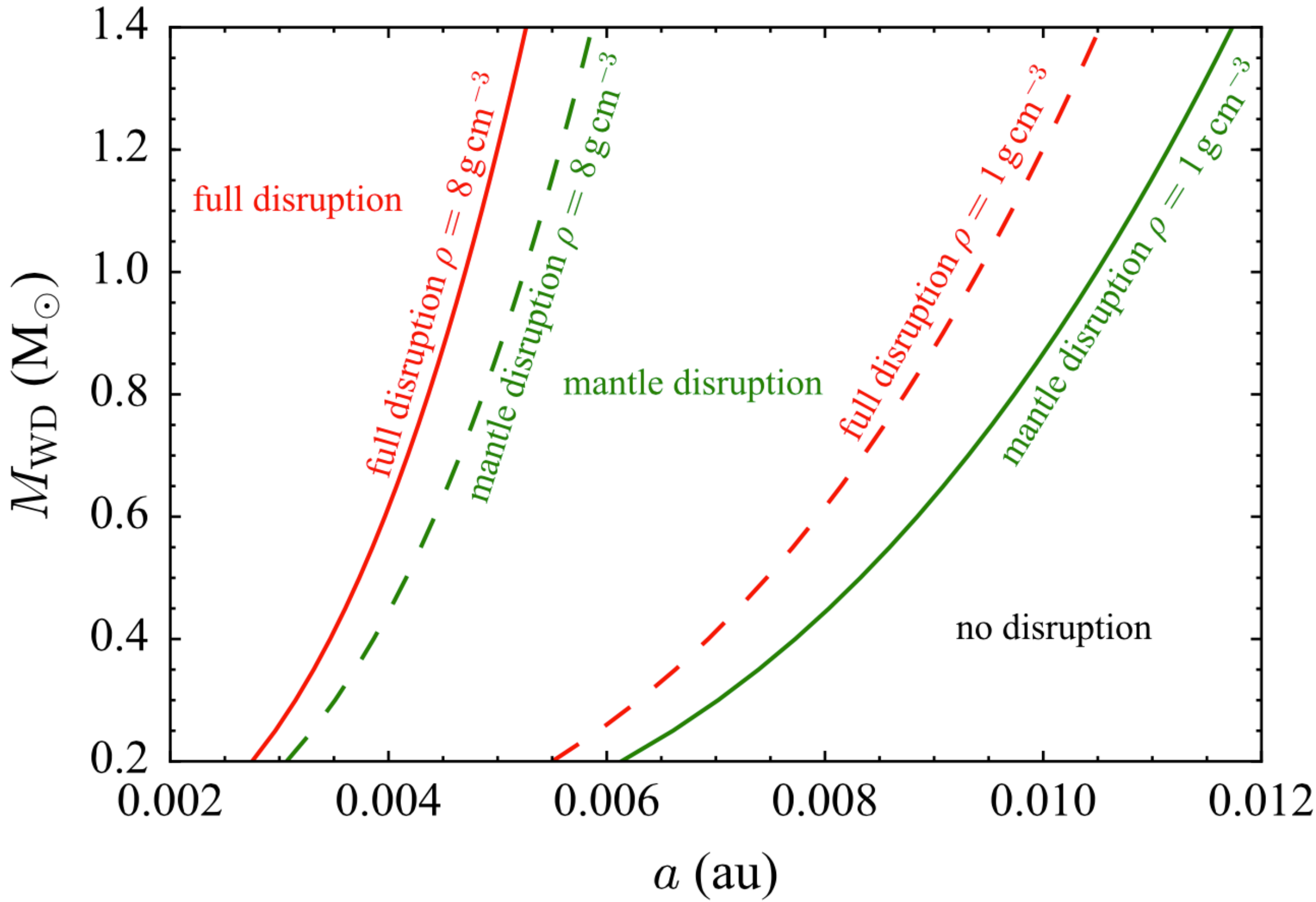
Veras et al. (2017, MNRAS, 465, 1008)





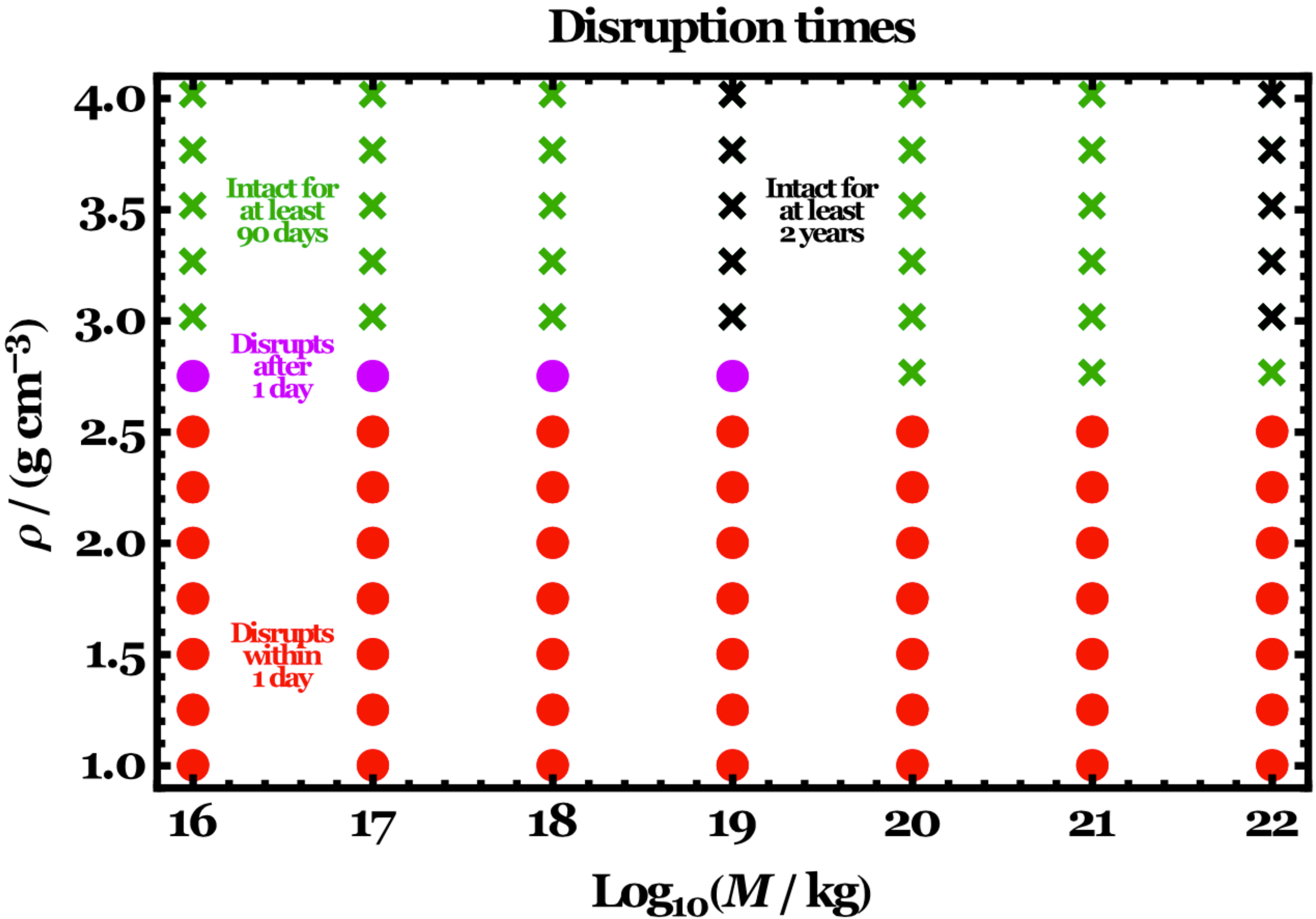
Partial disruption characteristics

Veras et al. (2017, MNRAS, 465, 1008)



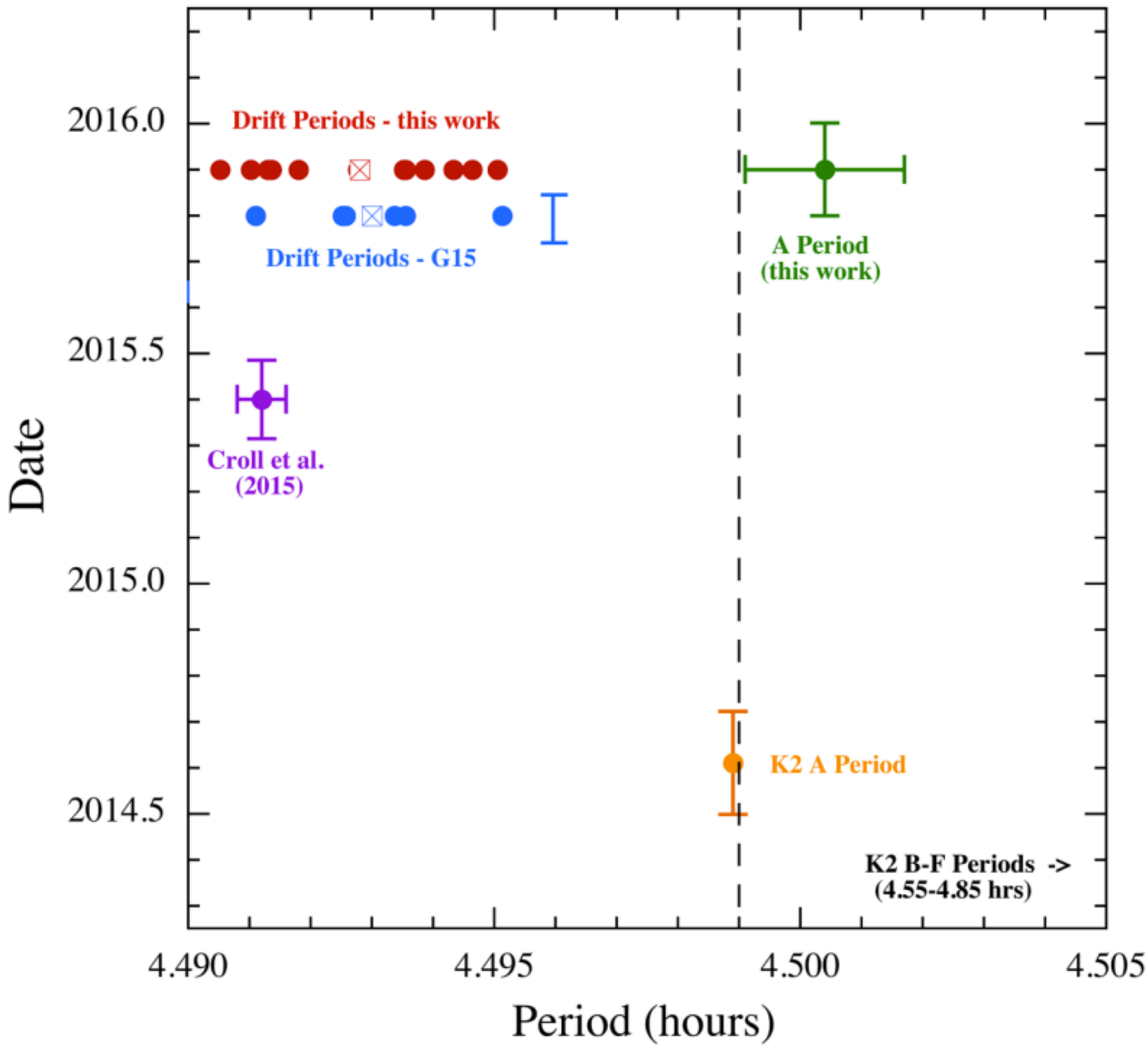
Poor constraint on mass

Veras et al. (2017, MNRAS, 465, 1008)



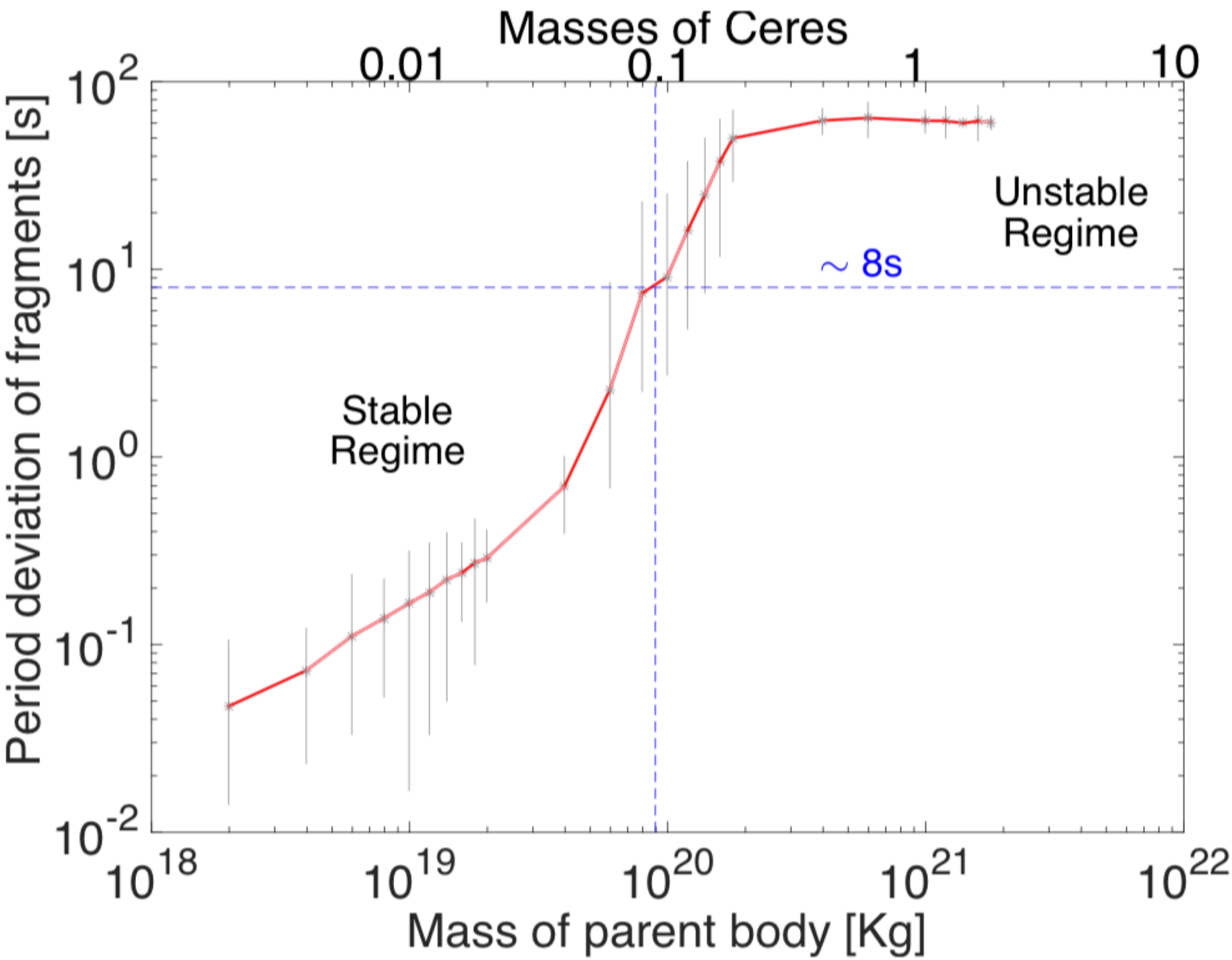
Use other repeating features

Rappaport et al. (2016, MNRAS, 458, 3904)



Constraining mass

Gurri et al. (2017, MNRAS, 464, 321)



Conclusions

Asteroid disintegrating around WD 1145+017:

- **Differentiated, not homogeneous**
- **Eccentricity < 0.01**
- **Bulk density 3-4 g/cm^3**
- **Mass no greater than 10^{20} kg**