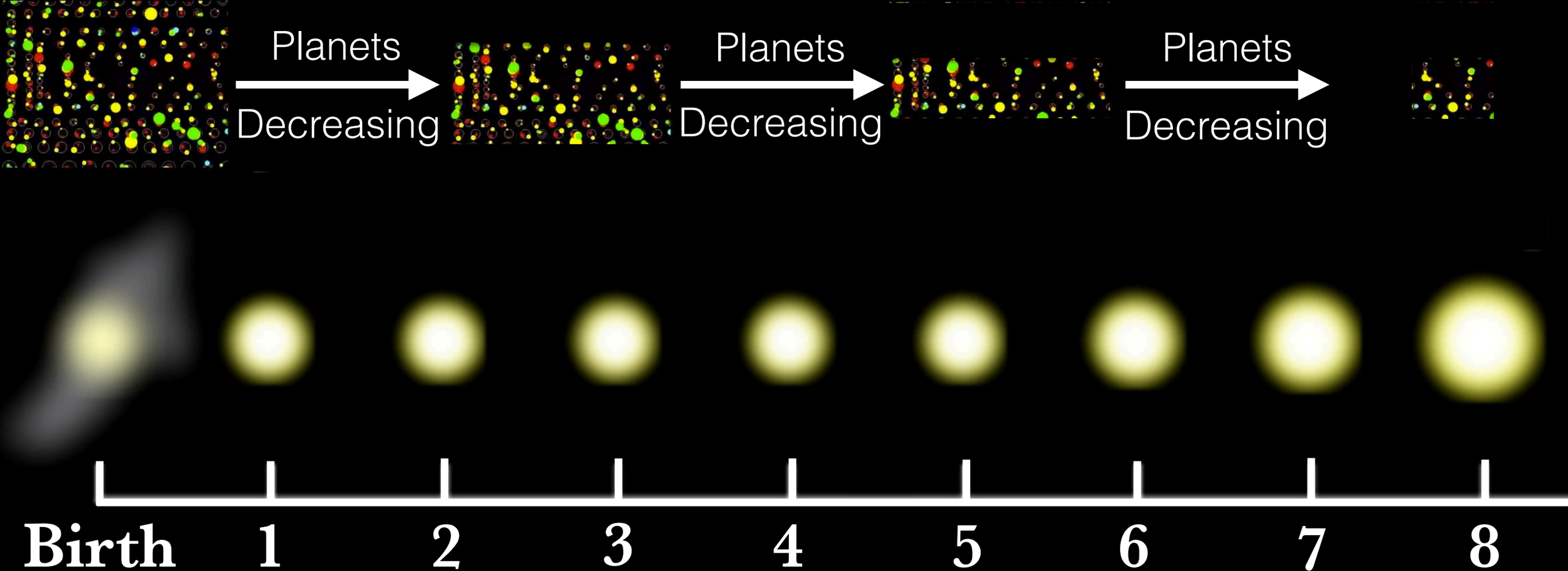
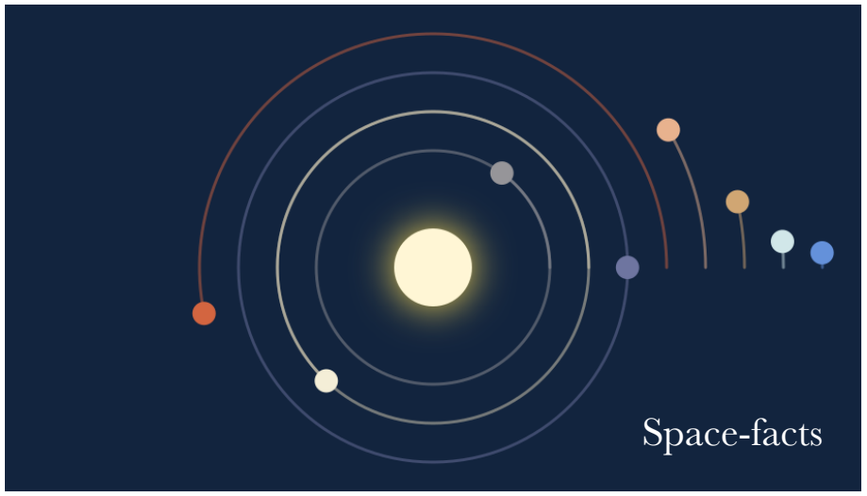


How PLATO's asteroseismic stellar age constraints could track planetary evolution

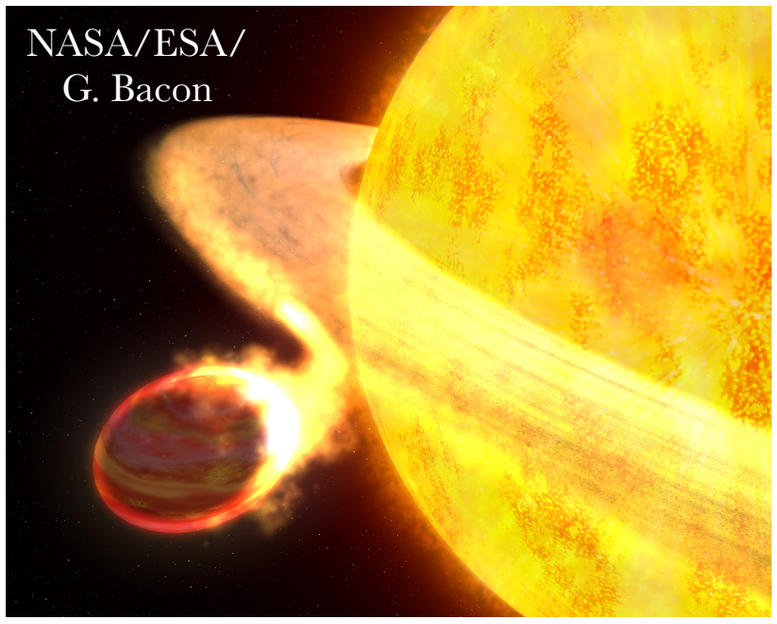
Dimitri Veras
University of Warwick

What can asteroseismology do for planets?

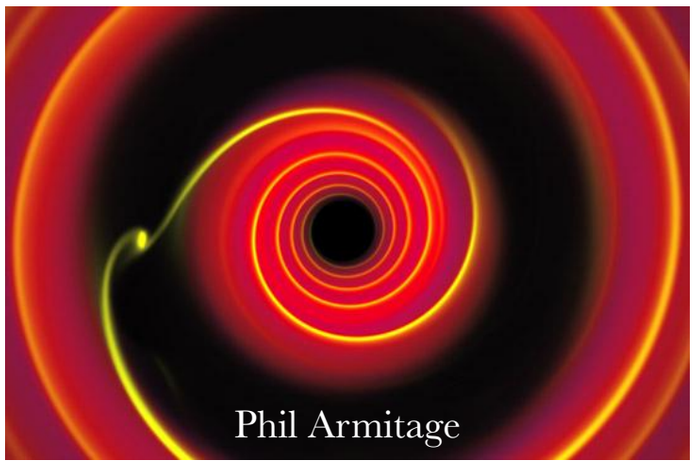
— Tides



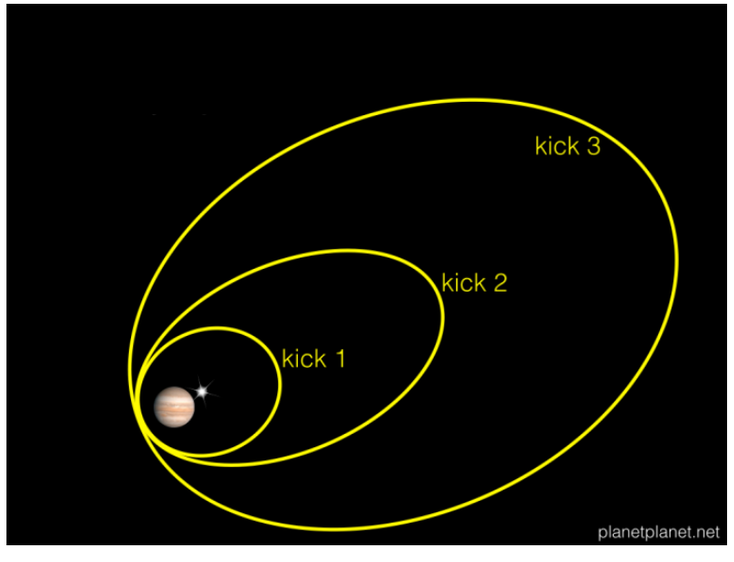
— Planet destruction



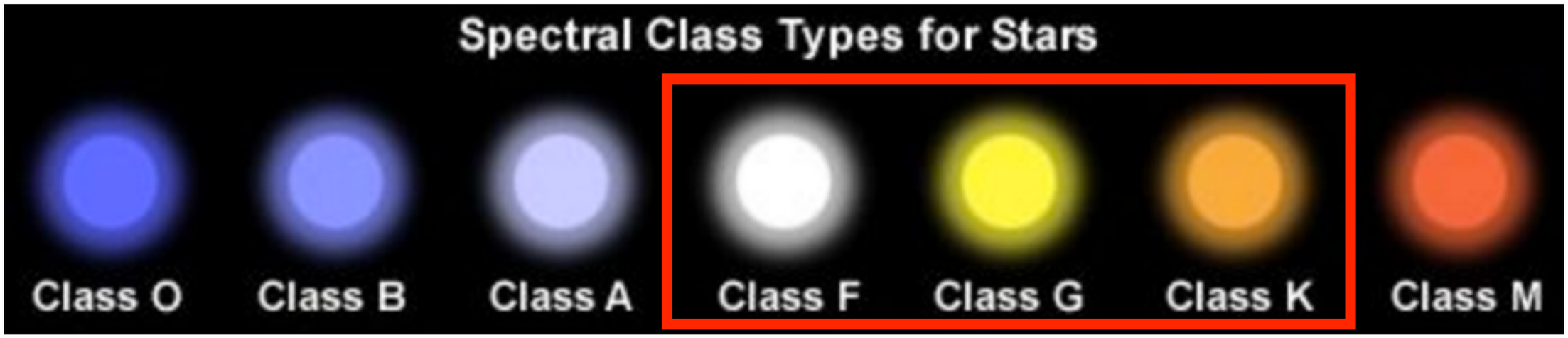
— Formation



— Gravitational scattering



What can PLATO do for asteroseismology?



F5-K7 stars

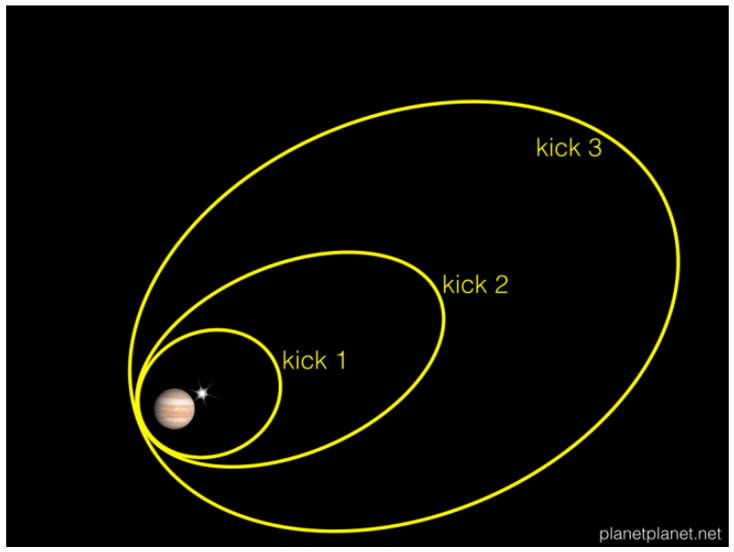
Core sample of ~15,000 stars

Uses *Gaia* radii measurements

10% main sequence age precision

What can asteroseismology do for planets?

— Gravitational scattering



Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

MNRAS **453,** 67–72 (2015) doi:10.1093/mnras/stv1615

Prospects for detecting decreasing exoplanet frequency with main-sequence age using *PLATO*

Dimitri Veras,[1★] David J. A. Brown,[1,2] Alexander J. Mustill[3] and Don Pollacco[1]

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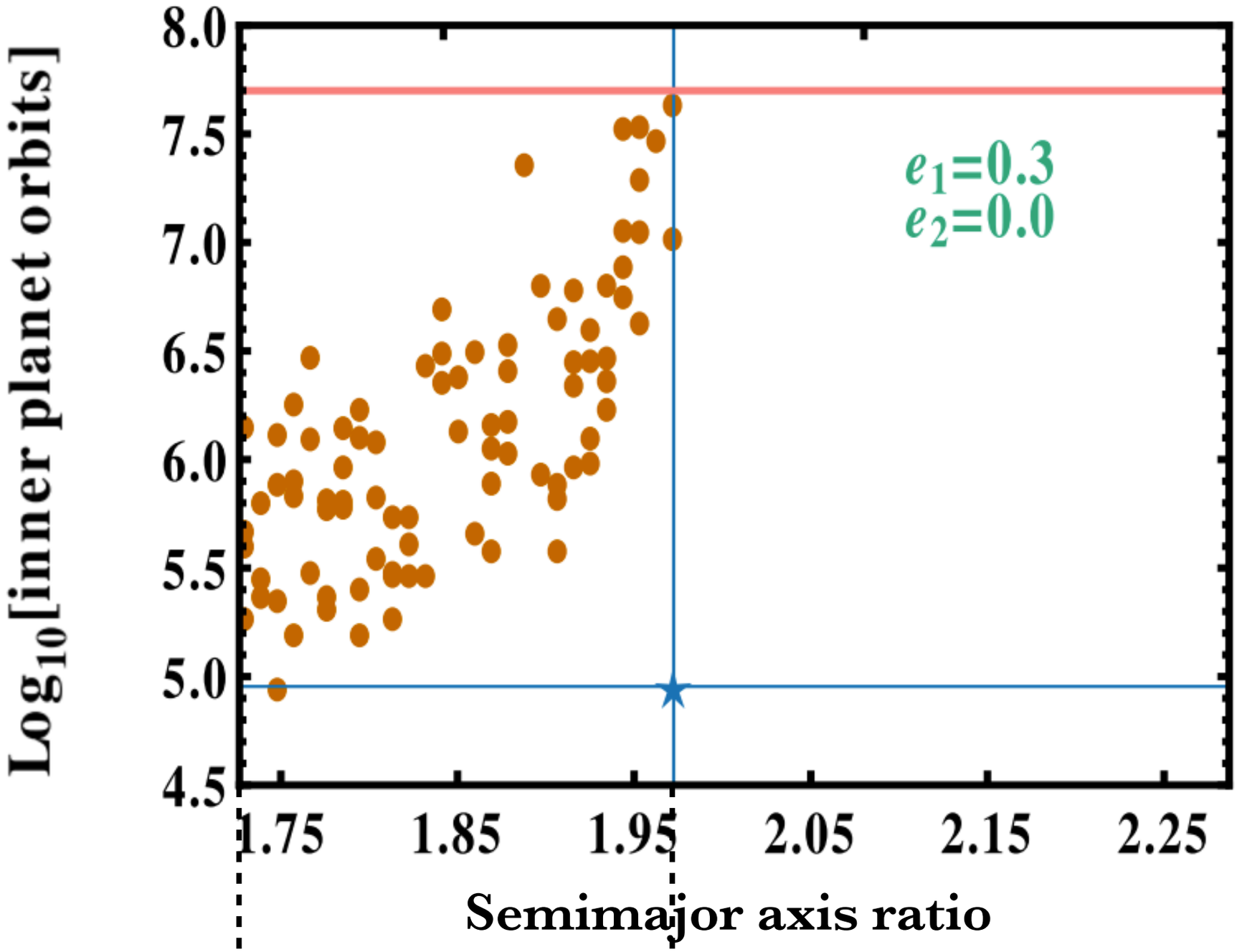
[3]*Lund Observatory, Department of Astronomy and Theoretical Physics, Lund University, Box 43, SE-221 00 Lund, Sweden*

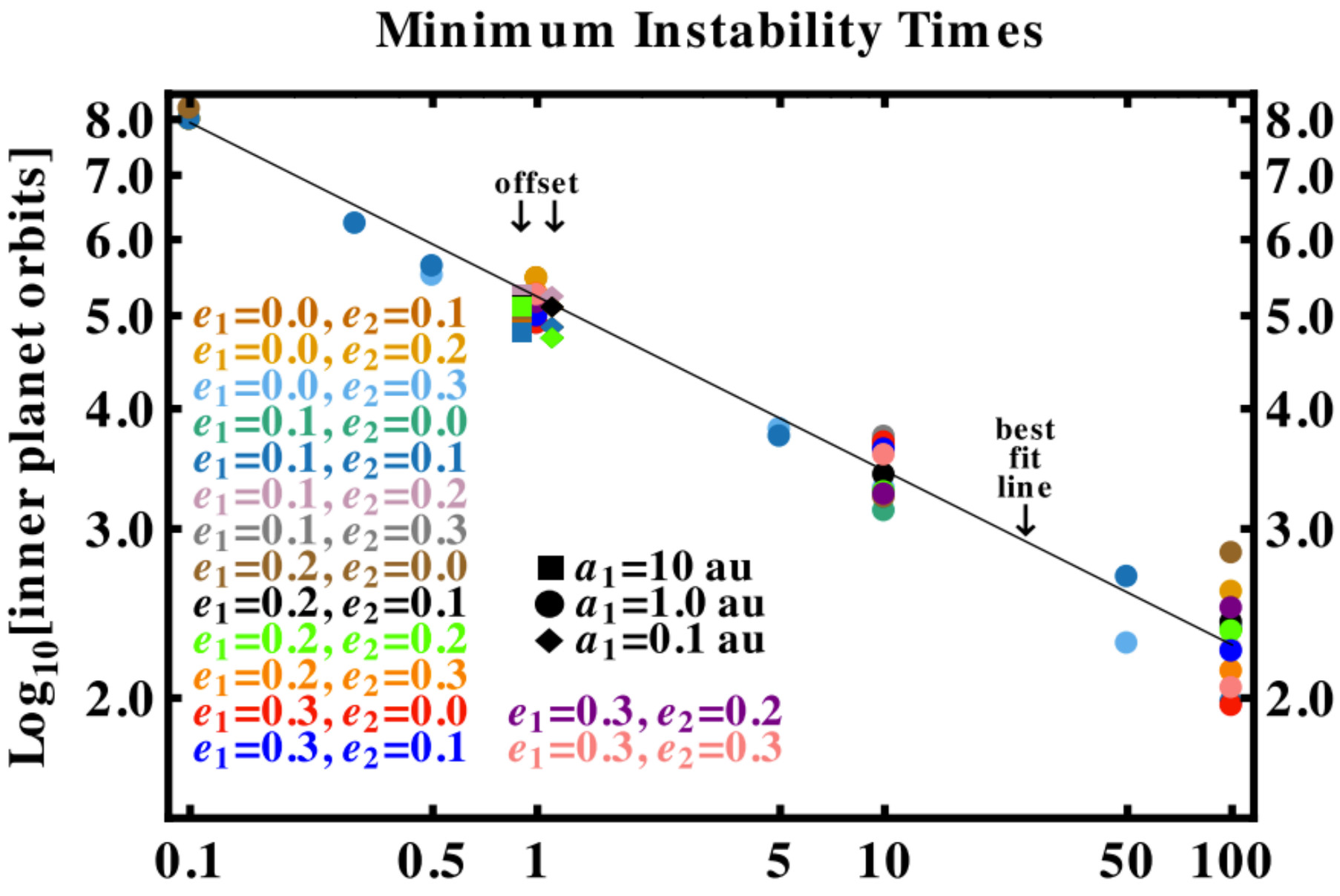
2-planet unstable systems

Veras & Mustill (2013, MNRAS, 434, L11)



2-planet unstable systems

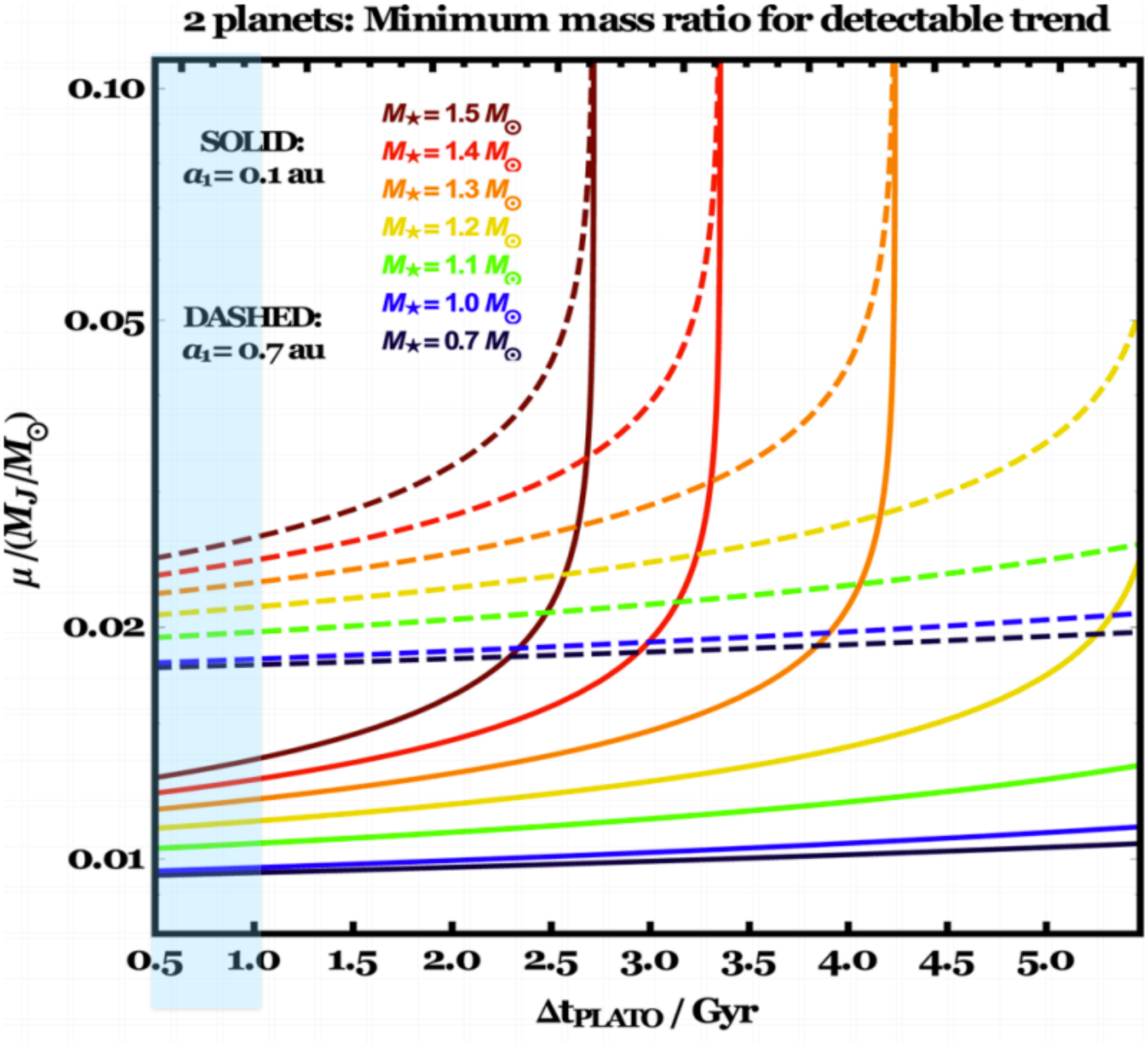
Veras & Mustill (2013, MNRAS, 434, L11)



$$\log_{10} x \sim 5.2 \left(\frac{\mu}{M_J/\mathrm{M}_\odot} \right)^{-0.18}$$

PLATO asteroseismology with 2 planets

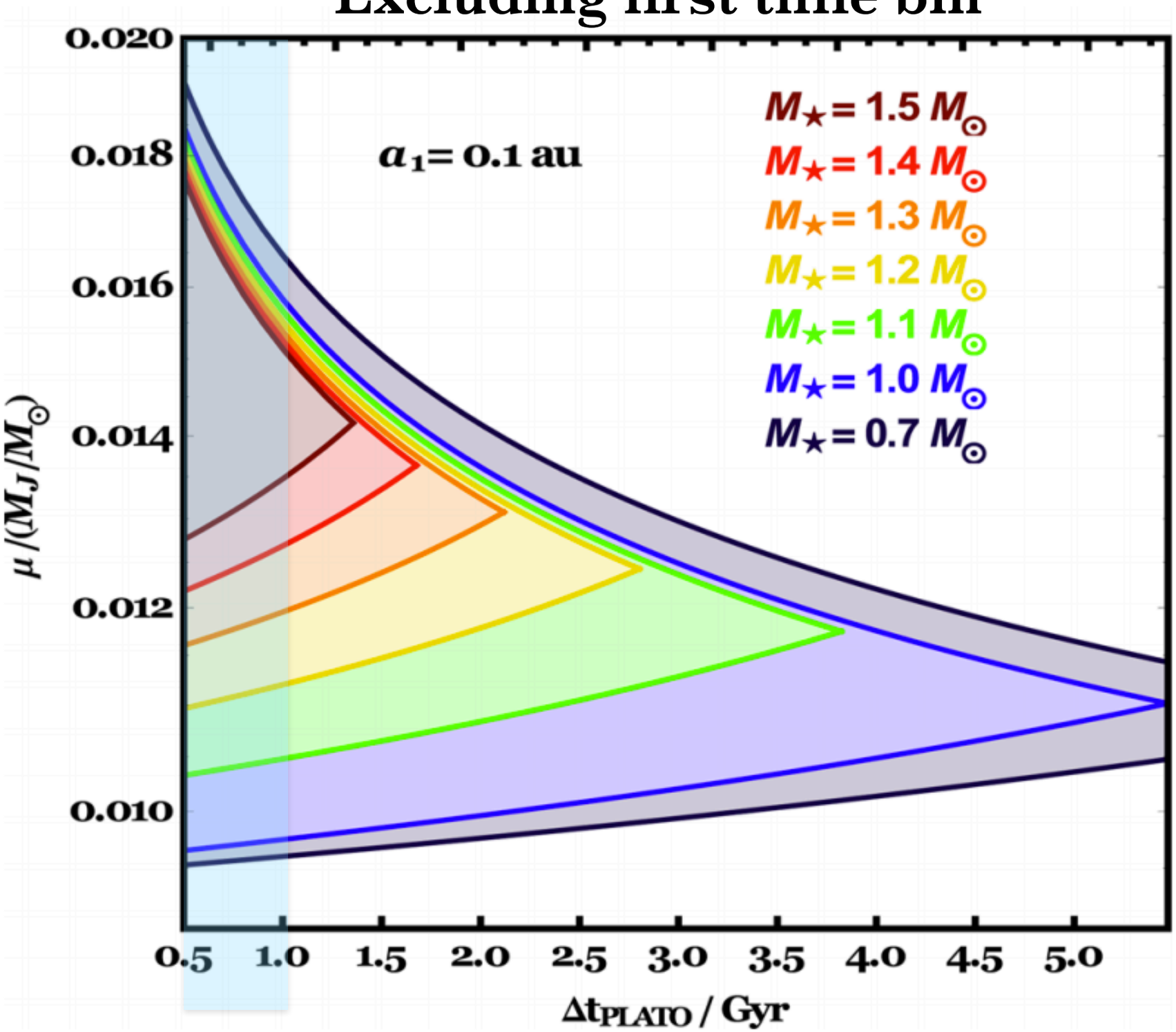
Veras, Brown, Mustill, Pollacco (2015, MNRAS, 453, 67)



PLATO asteroseismology with 2 planets

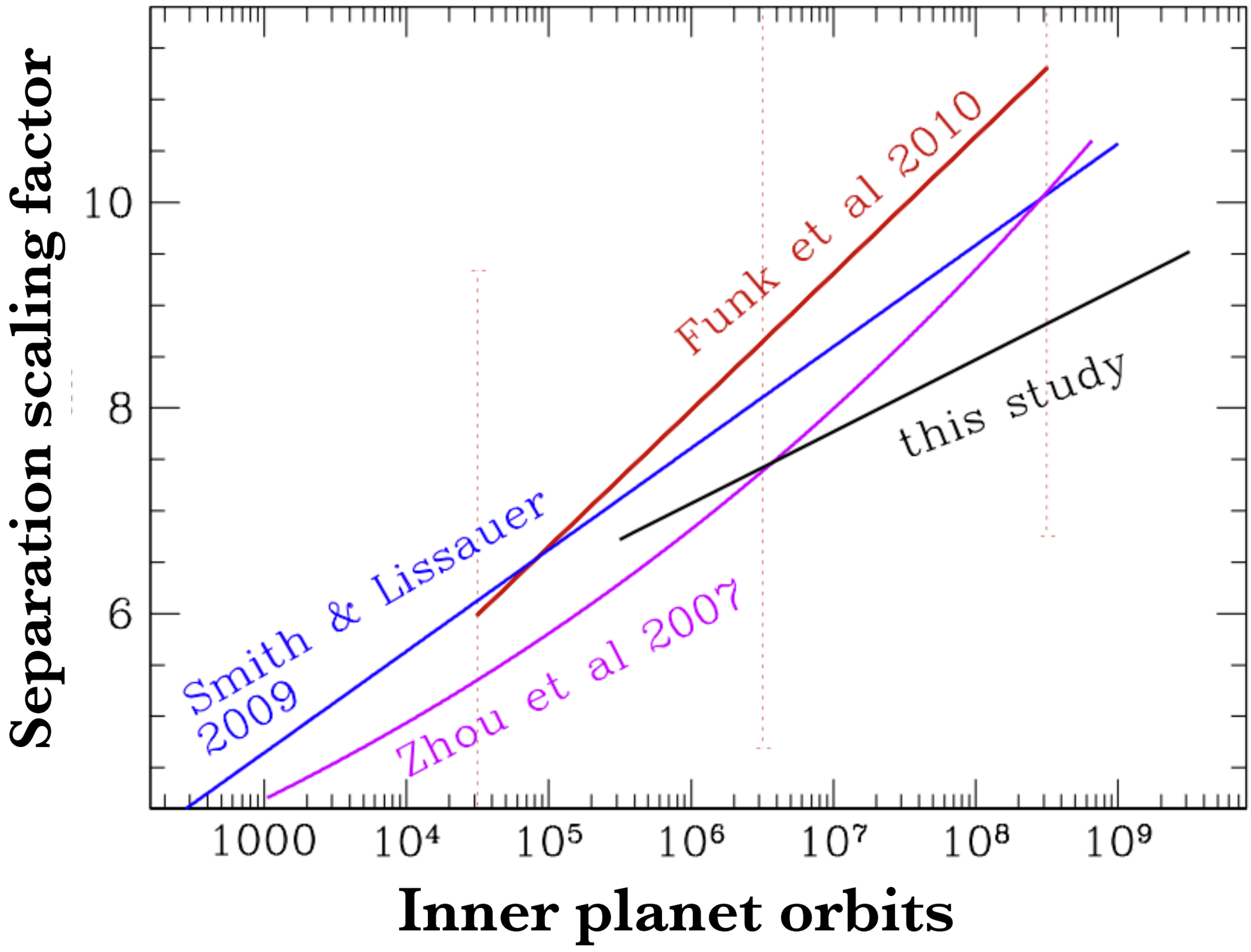
Veras, Brown, Mustill, Pollacco (2015, MNRAS, 453, 67)

Excluding first time bin



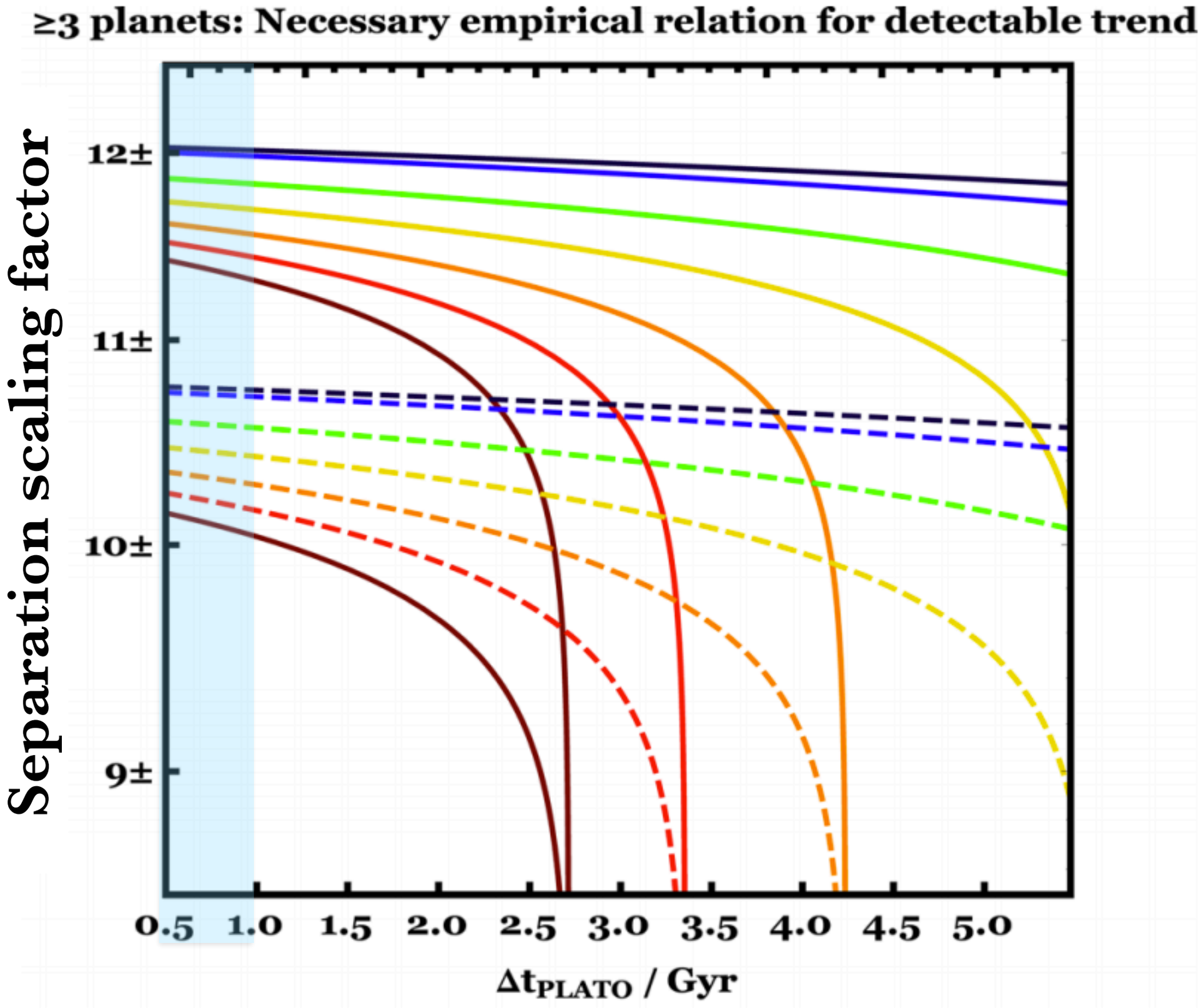
More than 2 planets

Pu & Wu (2015, ApJ, 807, 44)



More than 2 planets

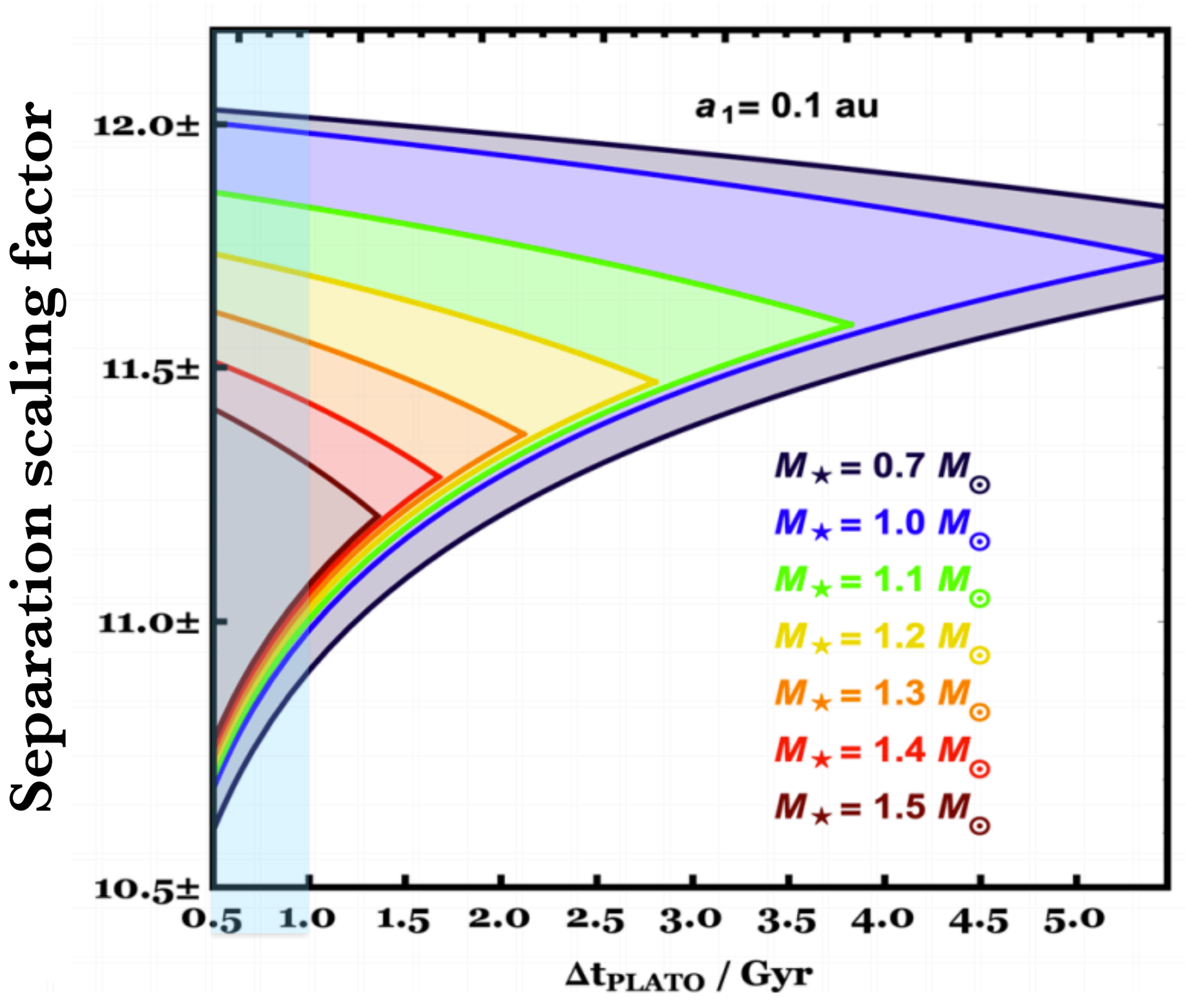
Veras, Brown, Mustill, Pollacco (2015, MNRAS, 453, 67)



More than 2 planets

Veras, Brown, Mustill, Pollacco (2015, MNRAS, 453, 67)

Excluding first time bin



Conclusions

Veras, Brown, Mustill, Pollacco (2015, MNRAS, 453, 67)

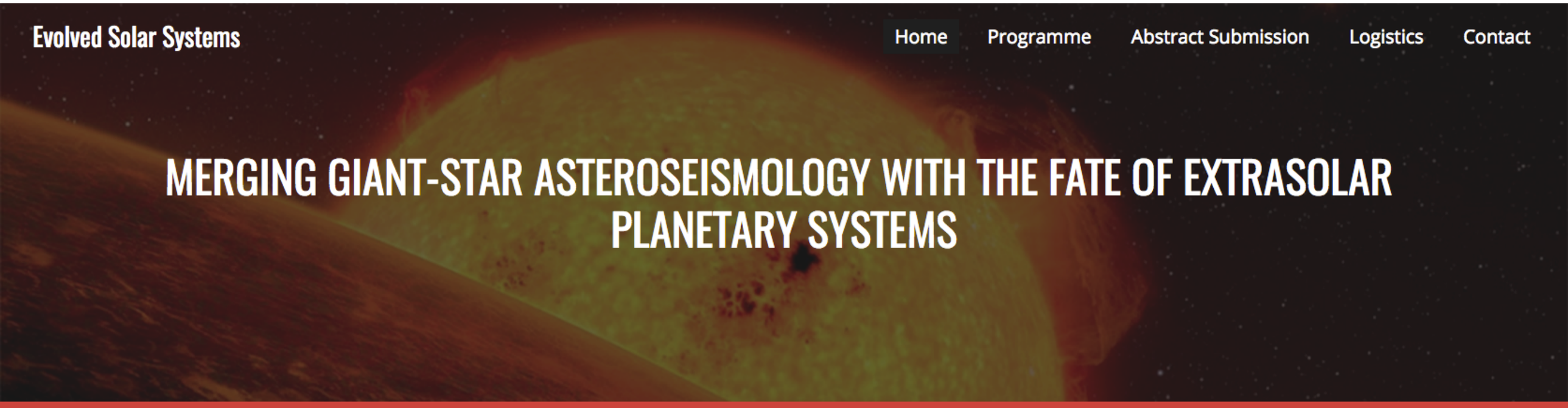
PLATO stellar age constraints can trace planetary system evolution

Predict decreasing frequency with time

Detectable for ice giants and gas giants

What about after main sequence?

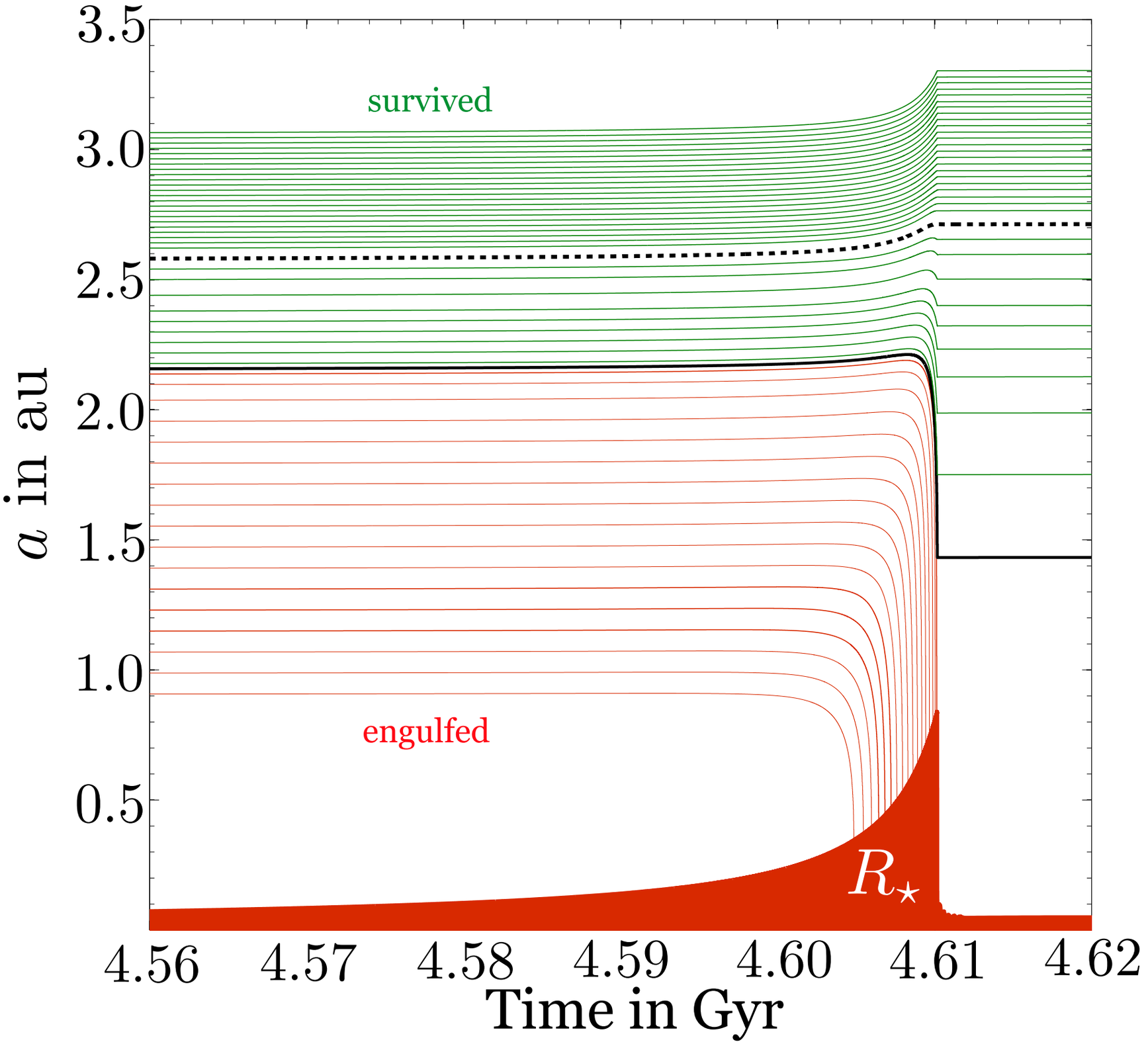
9 March 2018
London



goo.gl/bVLBc9

Fate of planetary systems: red giant branch

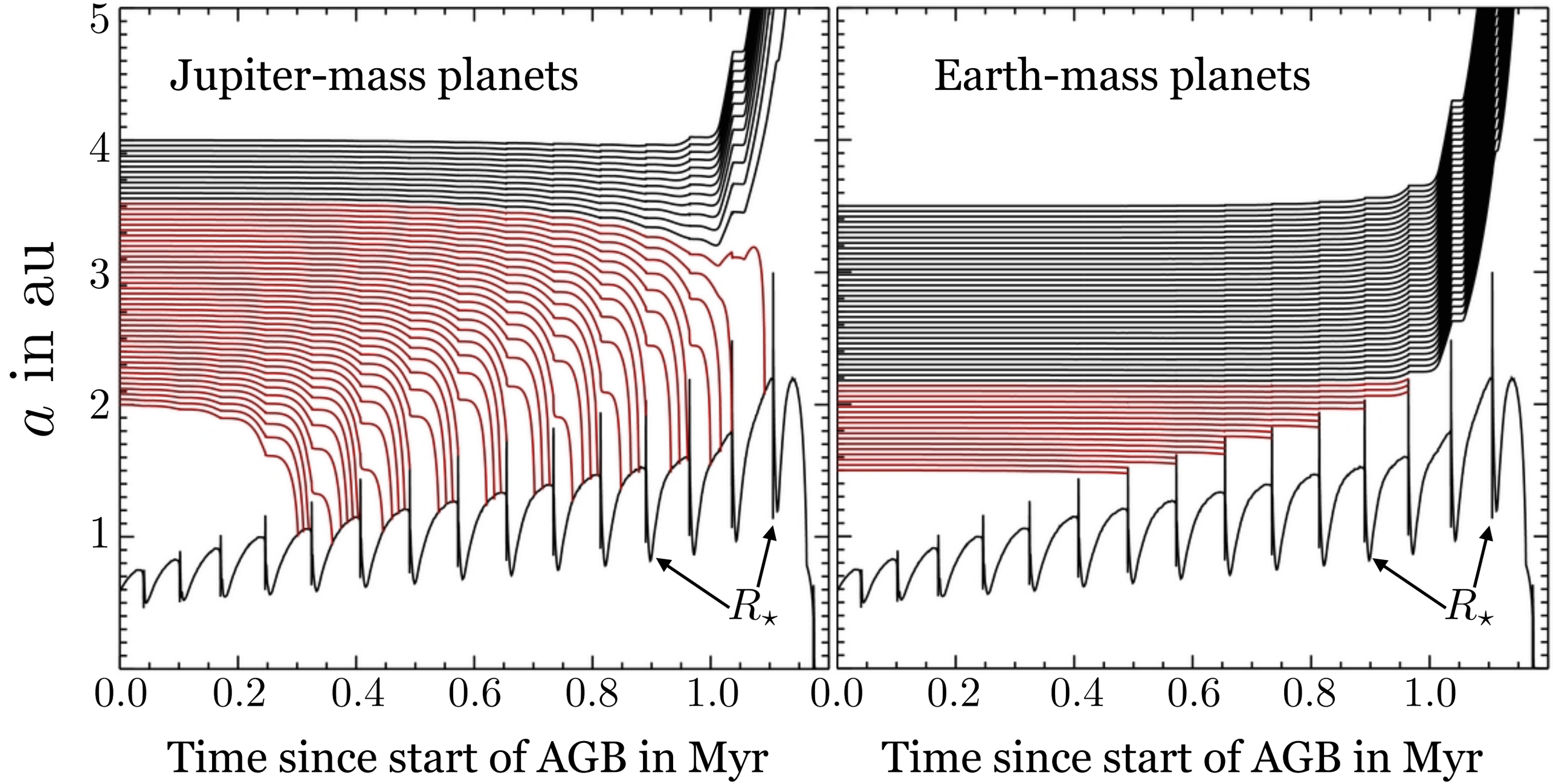
Villaver et al. (2014)



$\mathbf{1.5}M_\odot$

Fate of planetary systems: asymptotic giant branch

Mustill & Villaver (2012)



$2.0 M_\odot$