University of Zurich UZH

Title

Master Thesis in Physics

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January 3, 2023

Abstract

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Acknowledgements

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Some examples

$$M_Z = (57.9 \pm 7.03) M_\oplus (\frac{M}{M_J})^{(0.61 \pm 0.08)} \tag{1}$$

n	0	1	1.5	2	2.5
τ_{ff}	$\propto M^0$	$\propto M^{1/4}$	$\propto M^{1/2}$	$\propto M$	$\propto M^{5/2}$
τ_{expl}	$\propto M^0$	$\propto M^{1/4}$	$\propto M^{1/2}$	$\propto M$	$\propto M^{5/2}$
τ_{Alfven}	$\propto M^{1/3}$	$\propto M^{1/4}$	$\propto M^{1/6}$	$\propto M^0$	$\propto M^{-1/2}$
τ_{shear}	$\propto M^{-1/3}$	$\propto M^0$	$\propto M^{1/3}$	$\propto M$	$\propto M^3$

Table 1: *Relation of the timescales with planetary mass for different density power-law indexes.*

(a) **free-fall timescale**

(b) **expansion timescale**

(c) **Alfvén timescale**
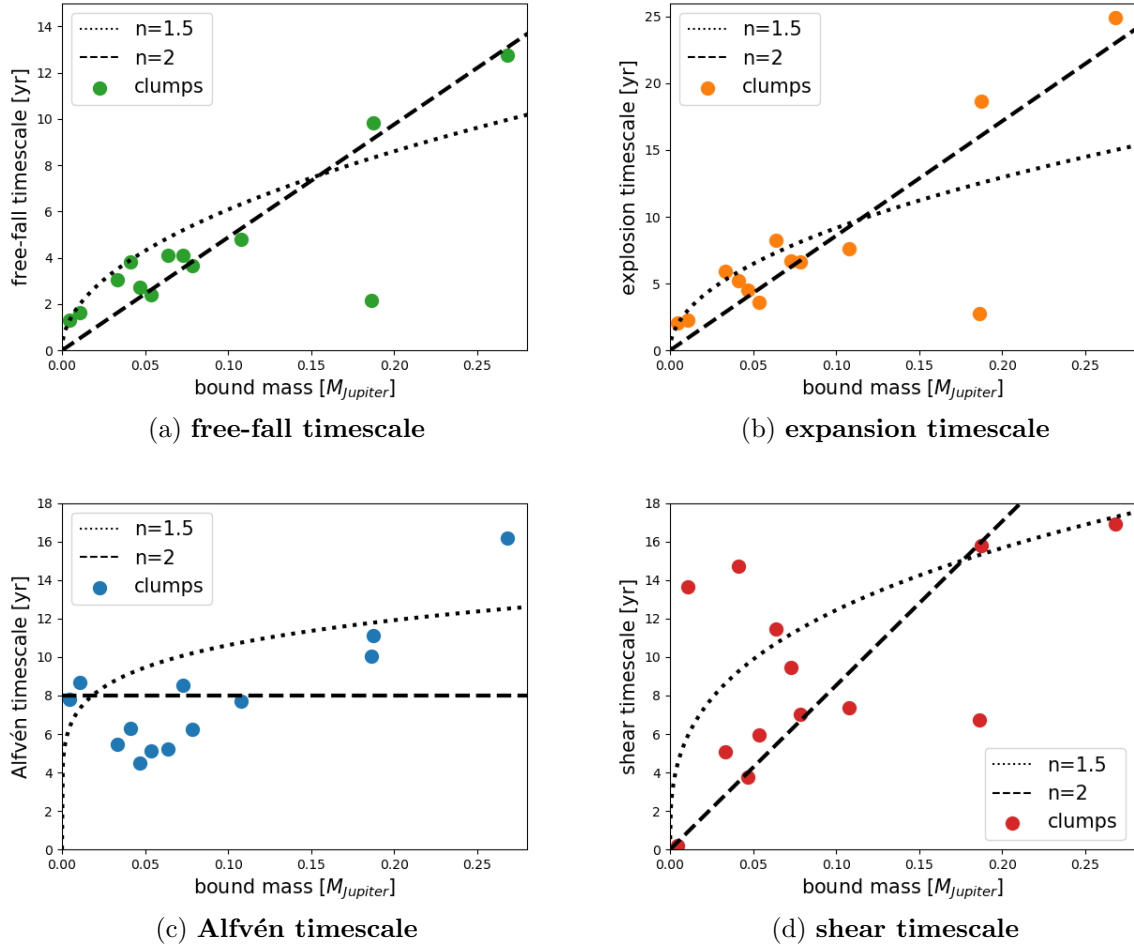

(d) **shear timescale**

Figure 1: *Relation of the 13 MHD clumps bound mass with (a) the free-fall timescale, (b) the expansion timescale, (c) the Alfvén timescale, and (d) the shear timescale. The black dashed and dotted lines correspond to the predicted relation for power-law index n=1.5 and n=2.*

Mass	$0.01 M_{Jupiter}$	$0.1 M_{Jupiter}$	$1 M_{Jupiter}$	$10 M_{Jupiter}$
Vaporization timescale $[10^3 \text{yrs}]$				
Z=0.007	500'000	5'000	50	0.5
Z=0.013	900'000	9'000	90	0.9
Z=0.02	1'300'000	13'000	130	1.3
Z=0.1	4'300'000	43'000	430	4.3
Z=0.2	4'800'000	48'000	480	4.8
Z=0.5	1'100'000	11'000	110	1.1
Z=0.7	130'000	1'300	13	0.1
Z=0.9	660	6.6	0.07	0.001

Table 2: *Vaporization timescales of a micron-sized silicate grain in scenario 1.*

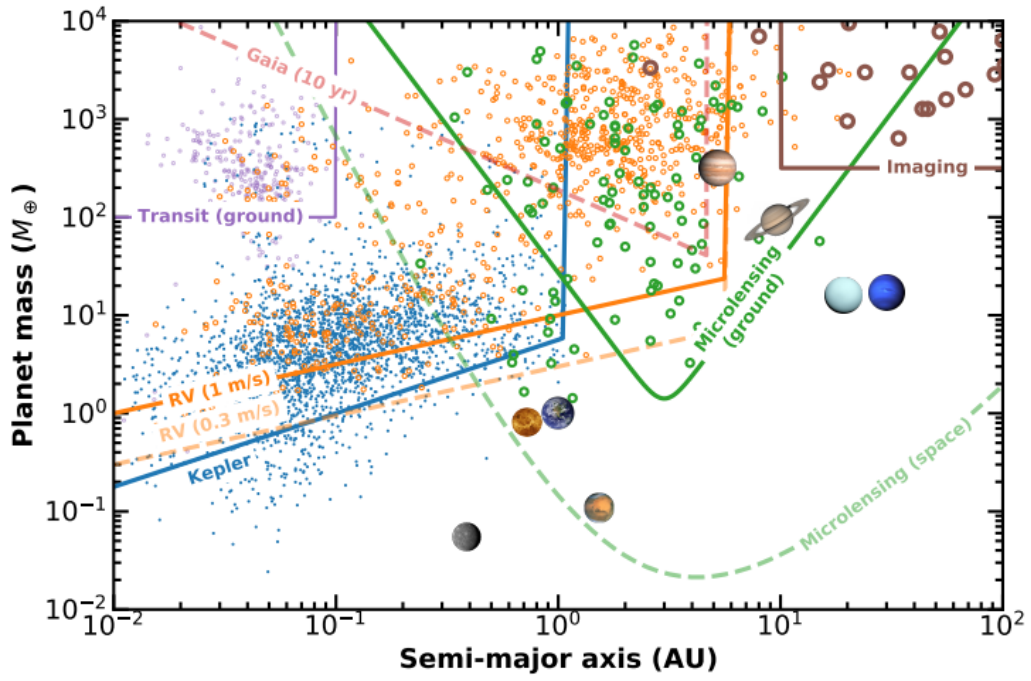Footnote[1]

Figure 2 shows...

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[1]XXX

Figure 2: *Mass to semimajor axis relation of confirmed planets, detected by ground-spaced transit, RV survey, Kepler survey, ground and space microlensing, and direct imaging. The solid lines in different colors mark the sensitivity regions of each detection method. The figure is reprinted from Zhu & Dong (2021) [1].*

Part IV

Conclusions & Outlook

Conclusions

Outlook

Part V
Appendix

References

[1] W. Zhu and S. Dong, "Exoplanet statistics and theoretical implications," *Annual Review of Astronomy and Astrophysics*, vol. 59, no. 1, pp. 291–336, 2021.