Radius Cliff across Stellar Type Anne Dattilo PhD Candidate, UC Santa Cruz

Know Thy Star, Know Thy Planet 2 — February 2025







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Observed Planets



Contours/Features/Shapes have Meaning



Yosemite Valley; USGS; 1897





Observed != Intrinsic



Occurrence



Dattilo et al. (2023)







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Dattilo et al. (2023)

The Radius Cliff



Occurrence







Models of the radius valley also produce the cliff!

Atmospheric mass loss (Photoevaporation)





Rogers & Owen 2021

Gas-Poor Formation

The Radius cliff changes in period space





The Radius cliff changes across stellar type





The Radius cliff changes across stellar type





The Radius cliff changes across stellar type



How is the cliff changing?

Occurrence gradient in each period bin



FLAT

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There is a clear trend in period for different stellar types

- The steepest slope of the cliff moves to longer orbital periods with increasing stellar temperatures
- This tracks a rise in both the Neptune and sub-Neptune populations

FLAT





What about insolation?



0.056 - 0.048 (%) - 0.040 - 0.032 - 0.032 - 0.024 ح اعبور 800.0 0.000

We Do Not see a clear trend in insolation

- The cliff is relatively similar across insolation
- i.e., bolometric flux is not a main driver of the radius cliff



So what causes the cliff?

- XUV-dependent processes, such as photoevaporation
- More massive stars host larger (but not more massive) planets.... Possibly due to more massive disks (see Lozovsky+ 2021)







The Radius Cliff is not flat!

- We quantify the shape of the radius cliff as a function of orbital period, insolation flux, and stellar type.
- It varies as a function of orbital period and stellar type, but is relatively constant across insolation flux
- The cliff has a strong dependence on stellar type when looked at across period





- The models of the radius valley not not reproduce the intrinsic shape of the radius cliff in period or insolation.
- This feature is NOT just a secondary feature of the radius valley!









$$- 10^{-2}$$

$$- 10^{-4}$$

$$- 10^{-6}$$

$$- 10^{-10}$$

$$- 10^{-12}$$

$$- 10^{-14}$$

Dattilo+ 2023







The Radius cliff changes in period space



