Initial Results from the First Mass Loss Survey of Gas Giants Orbiting F Stars

Morgan Saidel

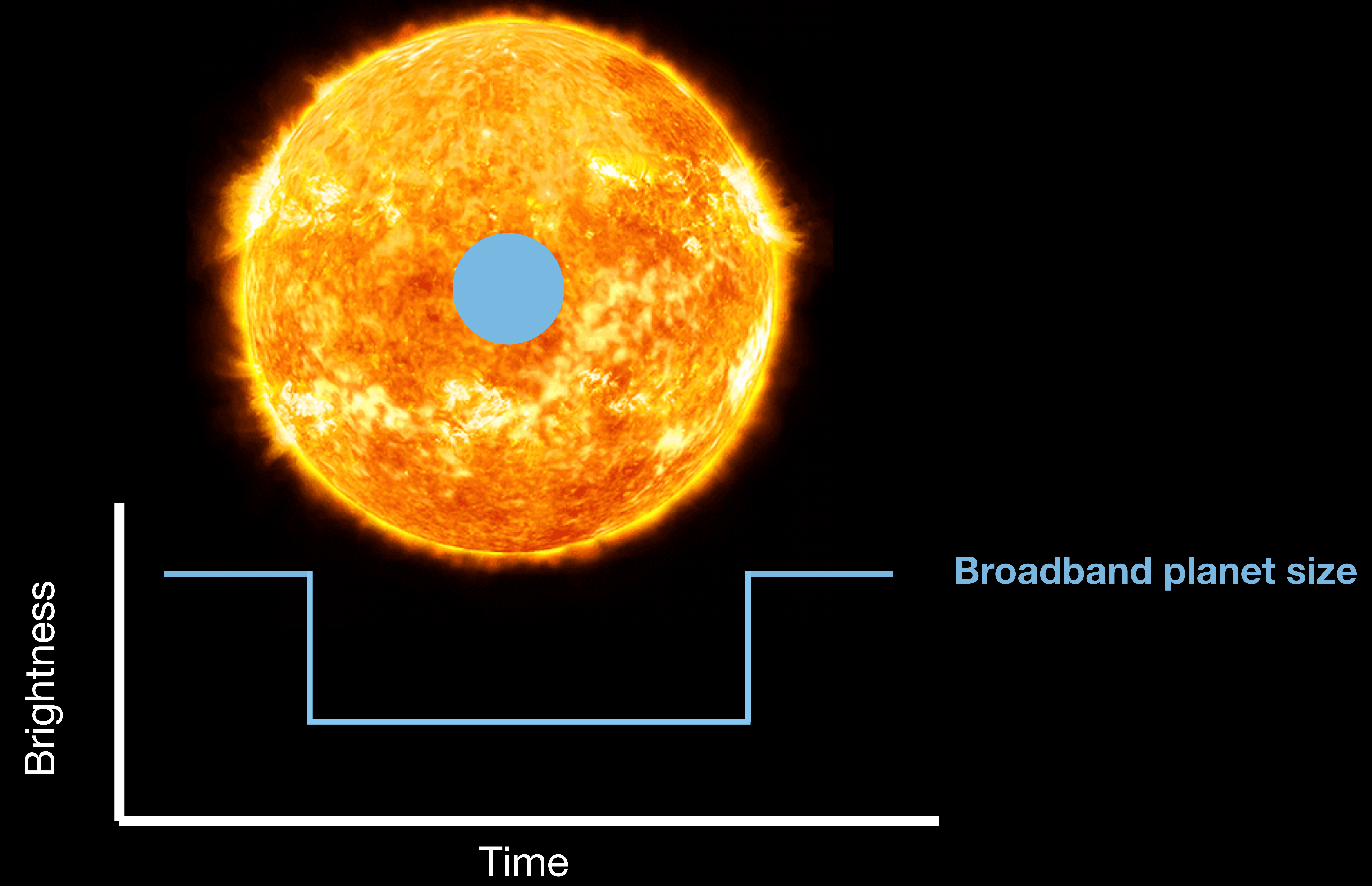
In collaboration with: Shreyas Vissapragada (Carnegie), Heather Knutson (Caltech), Mike Greklek-McKeon (Caltech), Jonathan Gomez-Barrientos (Caltech), Garrett Levine (Yale)

Close-in Planets Can Undergo Extreme Photoevaporation

Image Credit: NASA/CXC/M.Weiss

Close-in Planets Can Undergo Extreme Photoevaporation

An escaping atmos. should increase transit depth



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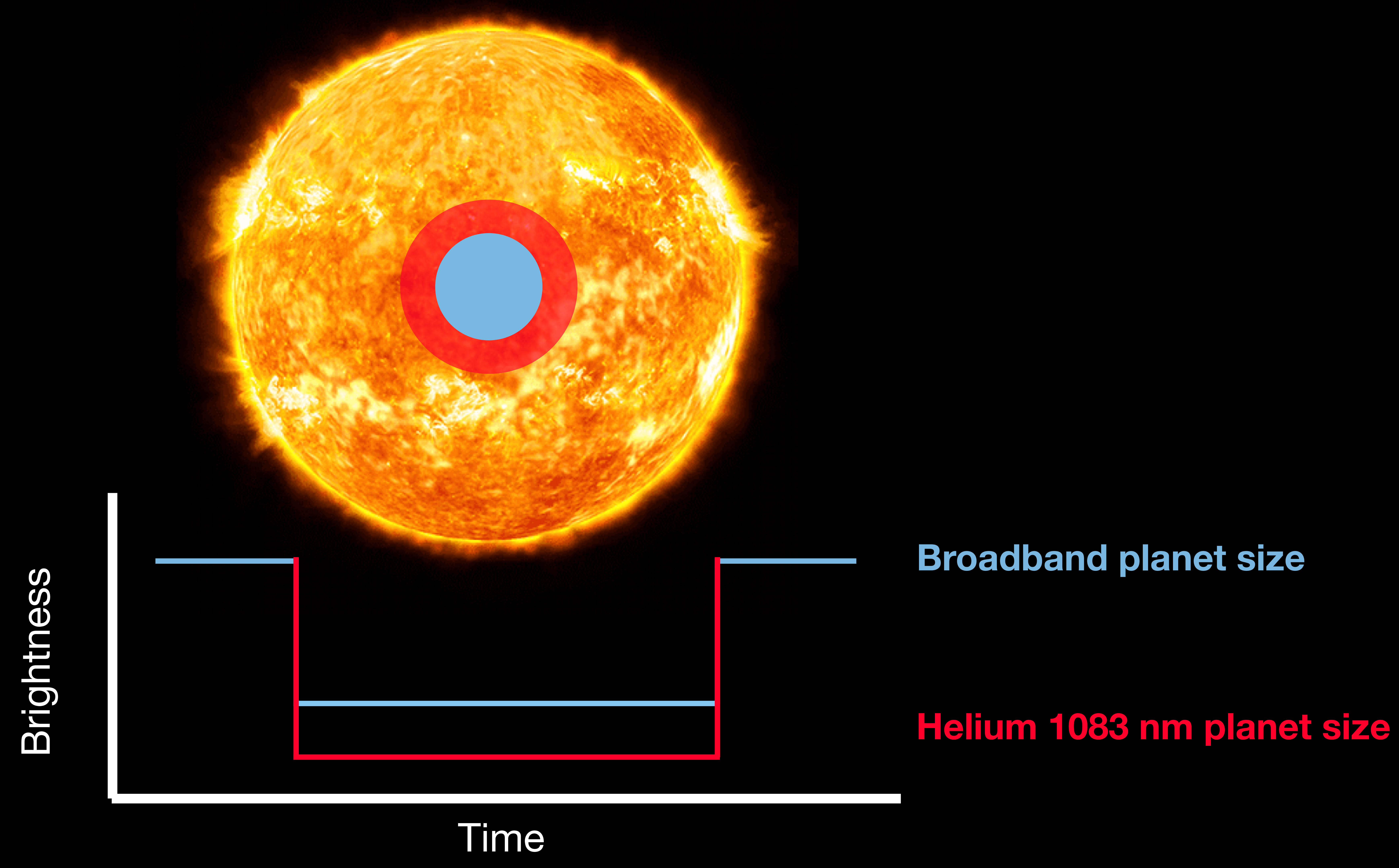

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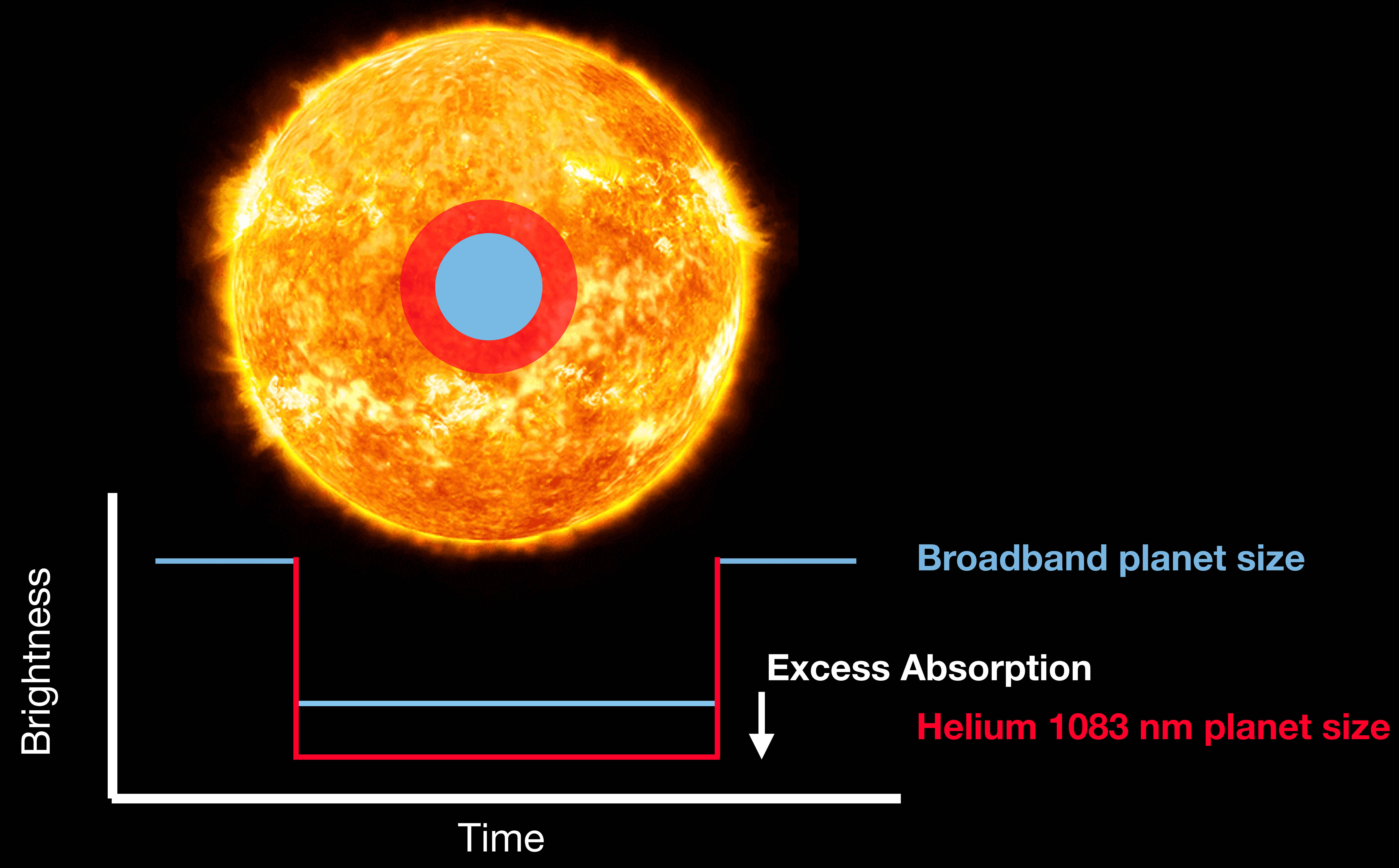
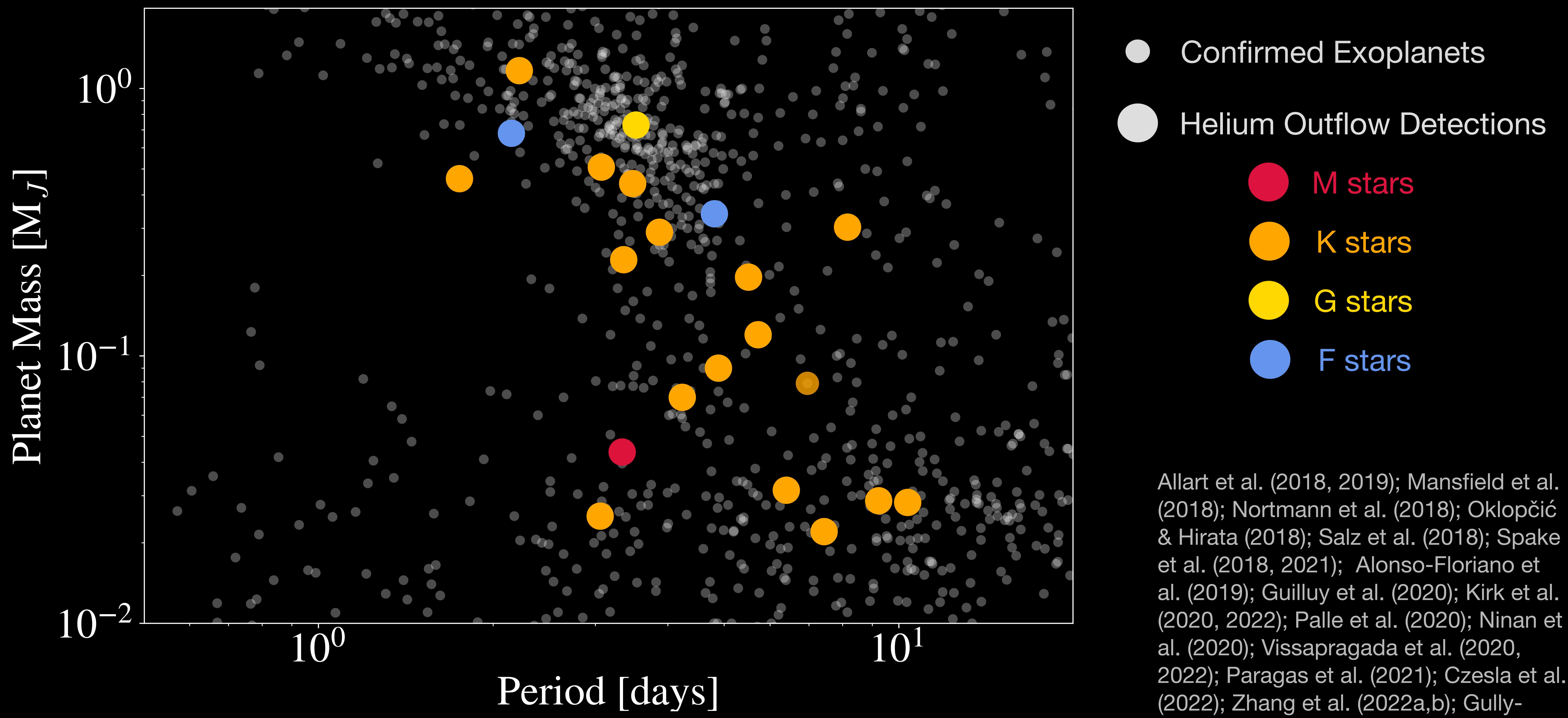
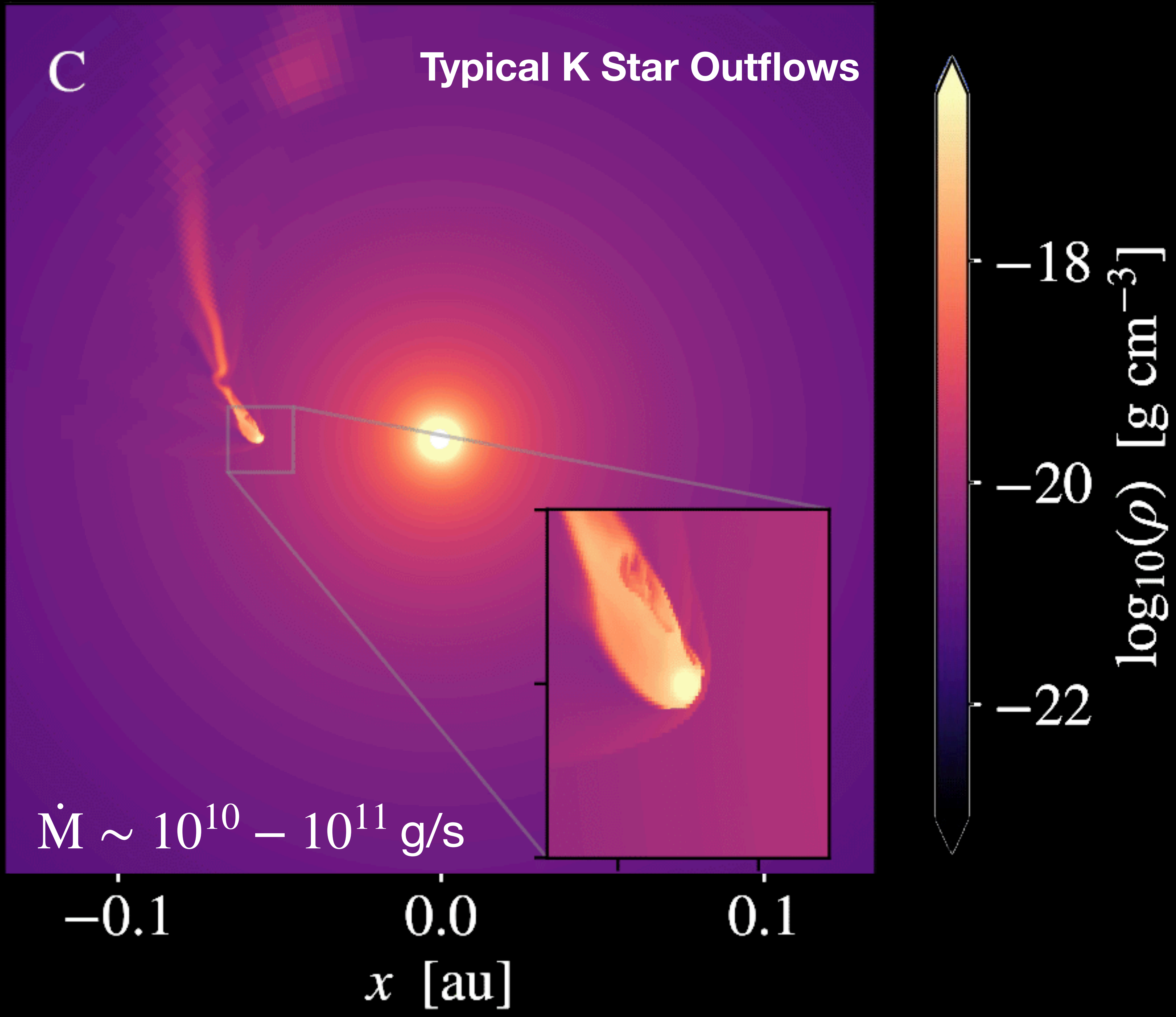


Metastable Helium outflow detections are widely successful but preferential to cooler stars



Allart et al. (2018, 2019); Mansfield et al. (2018); Nortmann et al. (2018); Oklopčić & Hirata (2018); Salz et al. (2018); Spake et al. (2018, 2021); Alonso-Floriano et al. (2019); Guilluy et al. (2020); Kirk et al. (2020, 2022); Palle et al. (2020); Ninan et al. (2020); Vissapragada et al. (2020, 2022); Paragas et al. (2021); Czesla et al. (2022); Zhang et al. (2022a,b); Gully-Santiago et al. (2023); Orell-Miquel et al. (2023); Pérez González et al. (2023); Zhang et al. (2023); Saidel et al. (2025)

First Two F star Detections Reveal Fastest Outflows



MacLeod & Oklopčić (2022); Zhang et al. (2023); Gully-Santiago et al. (2023)

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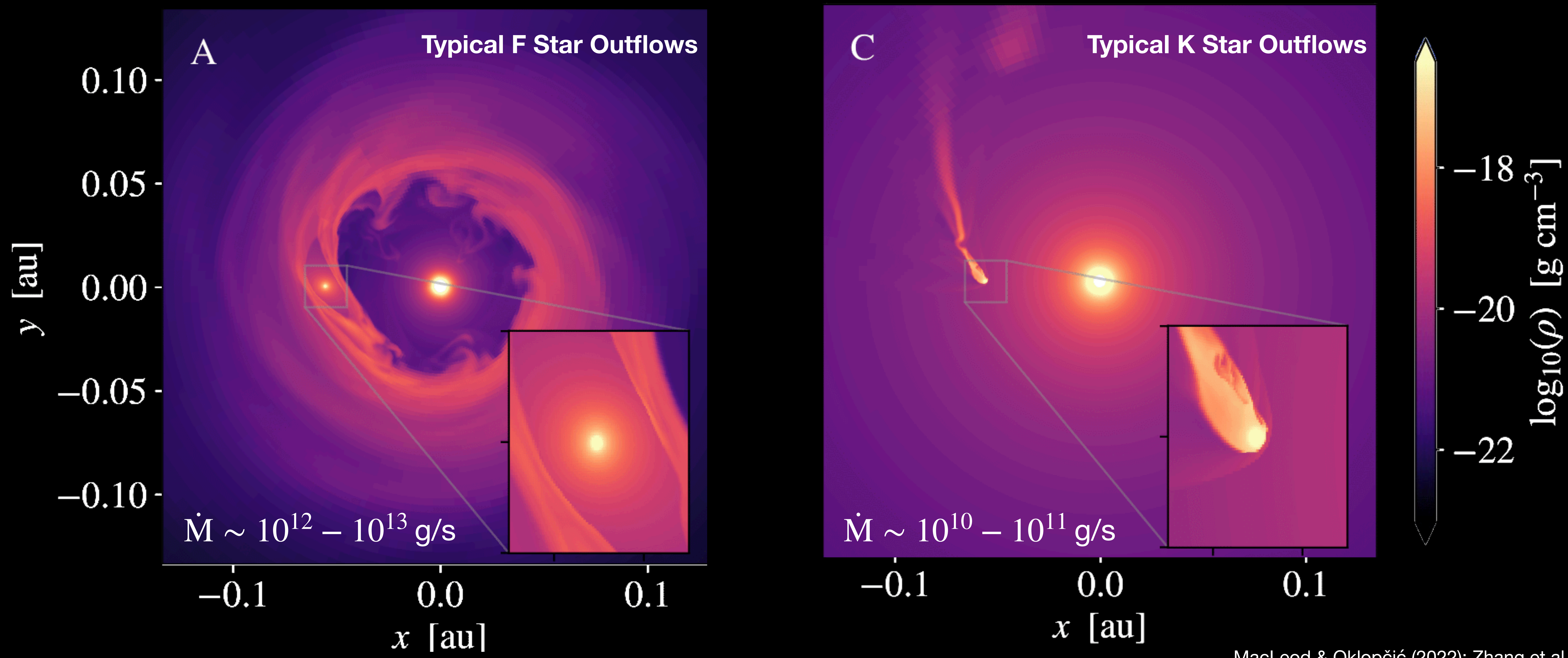
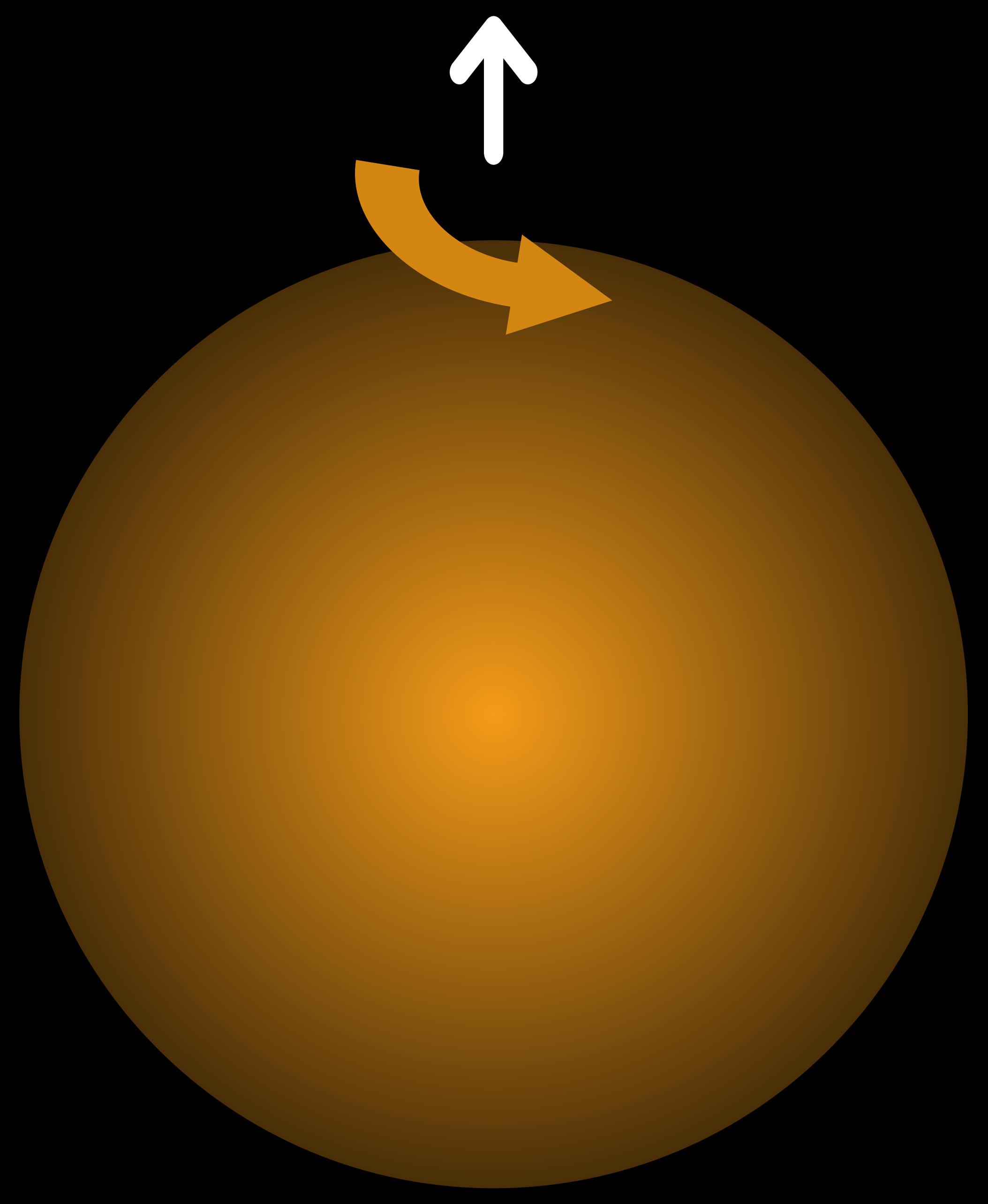


MacLeod & Oklopčić (2022); Zhang et al. (2023); Gully-Santiago et al. (2023)

Three potential drivers for the large outflows



High stellar rotational velocities

e.g. Johnstone et al. (2021)

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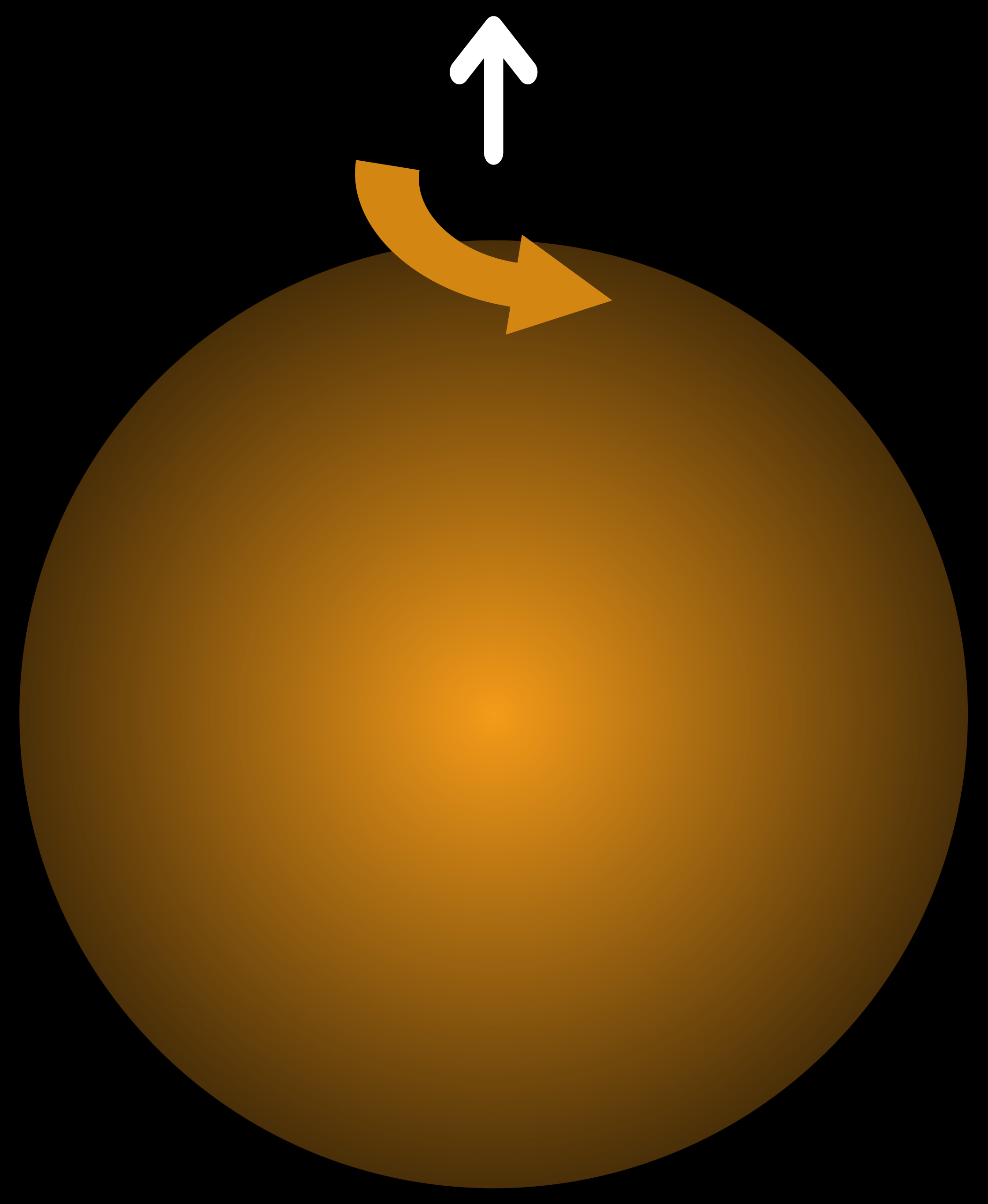

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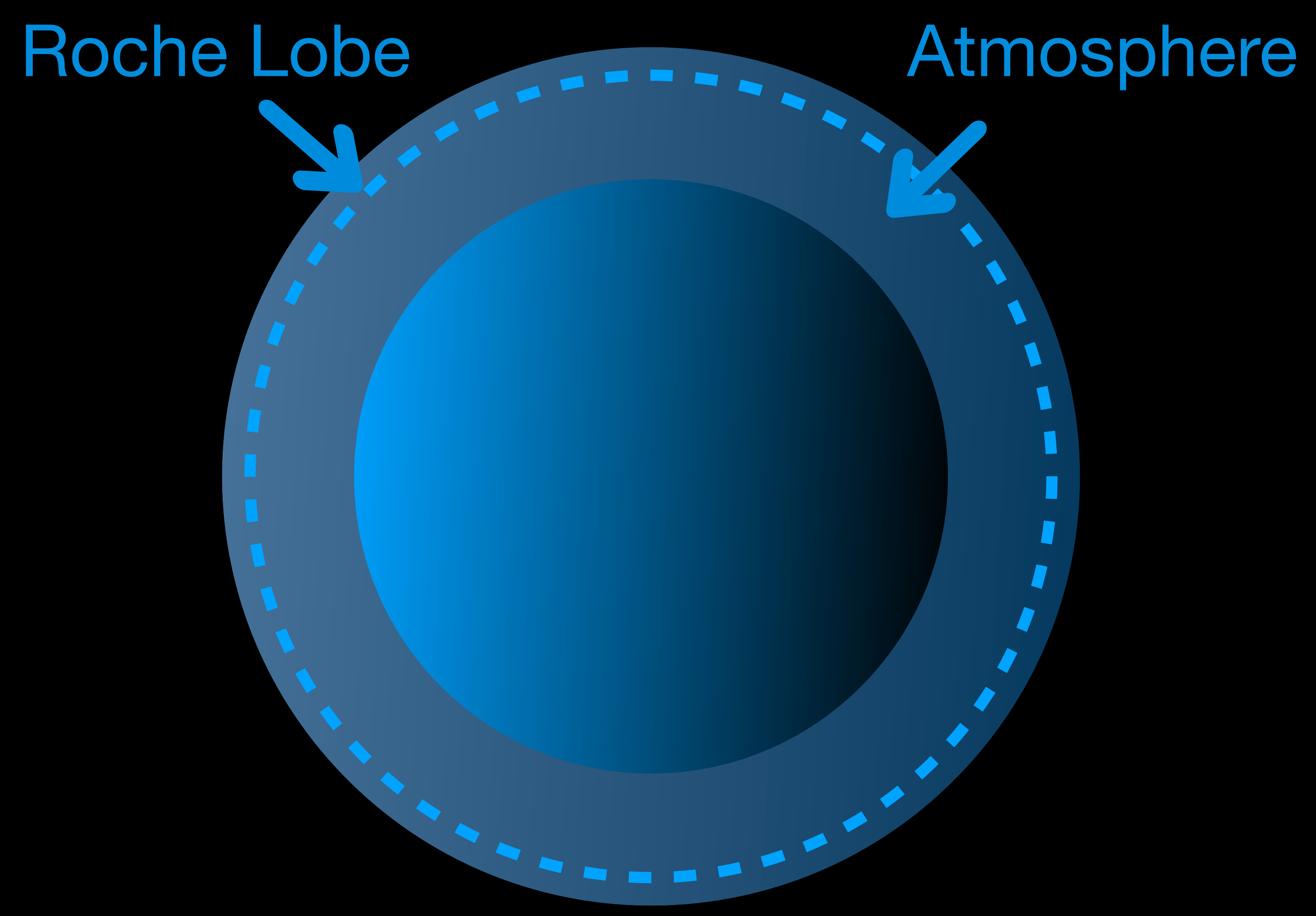

Planet fills large fraction of Roche lobe

Zhang et al. (2023); Gully-Santiago et al. (2023)

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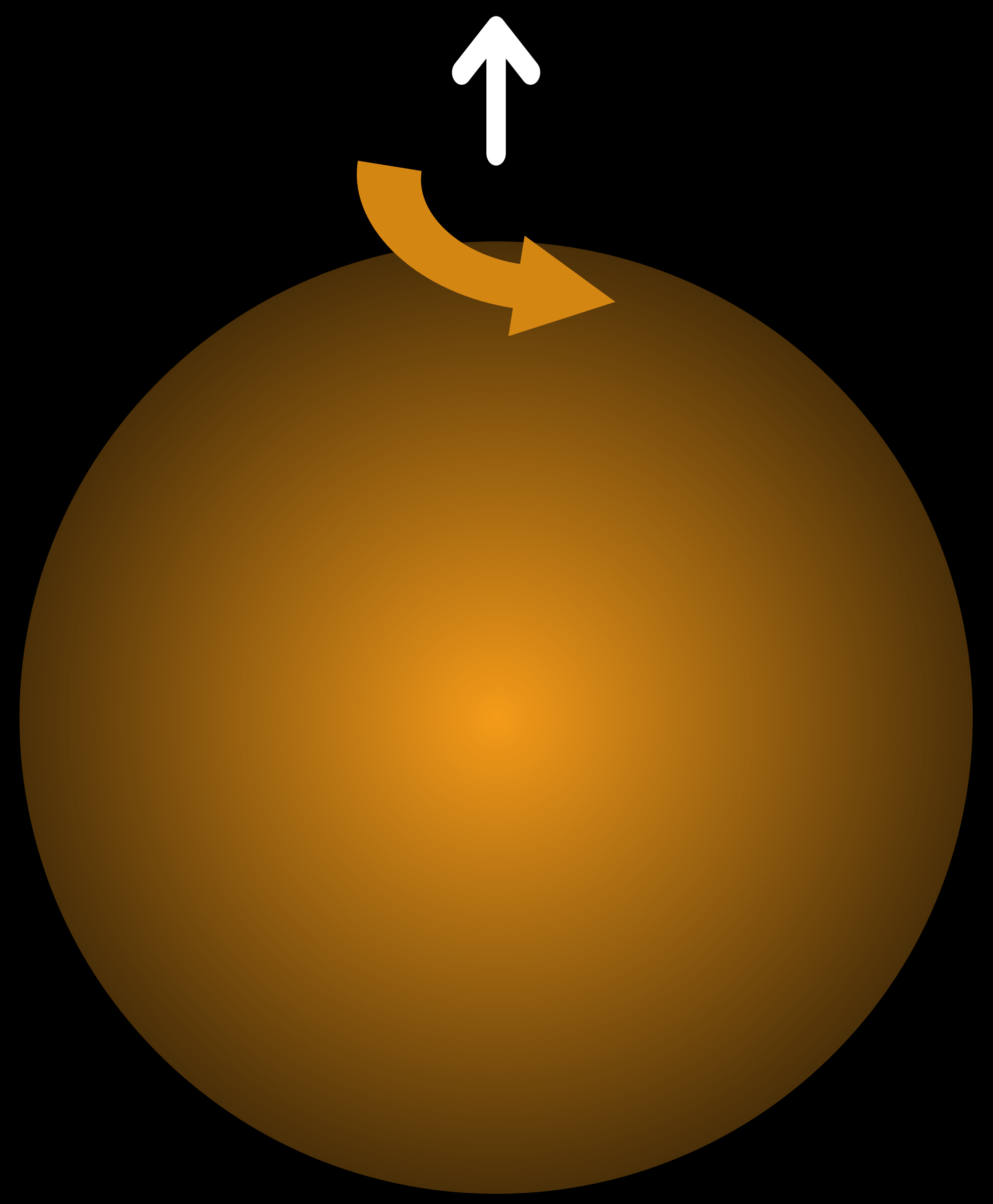

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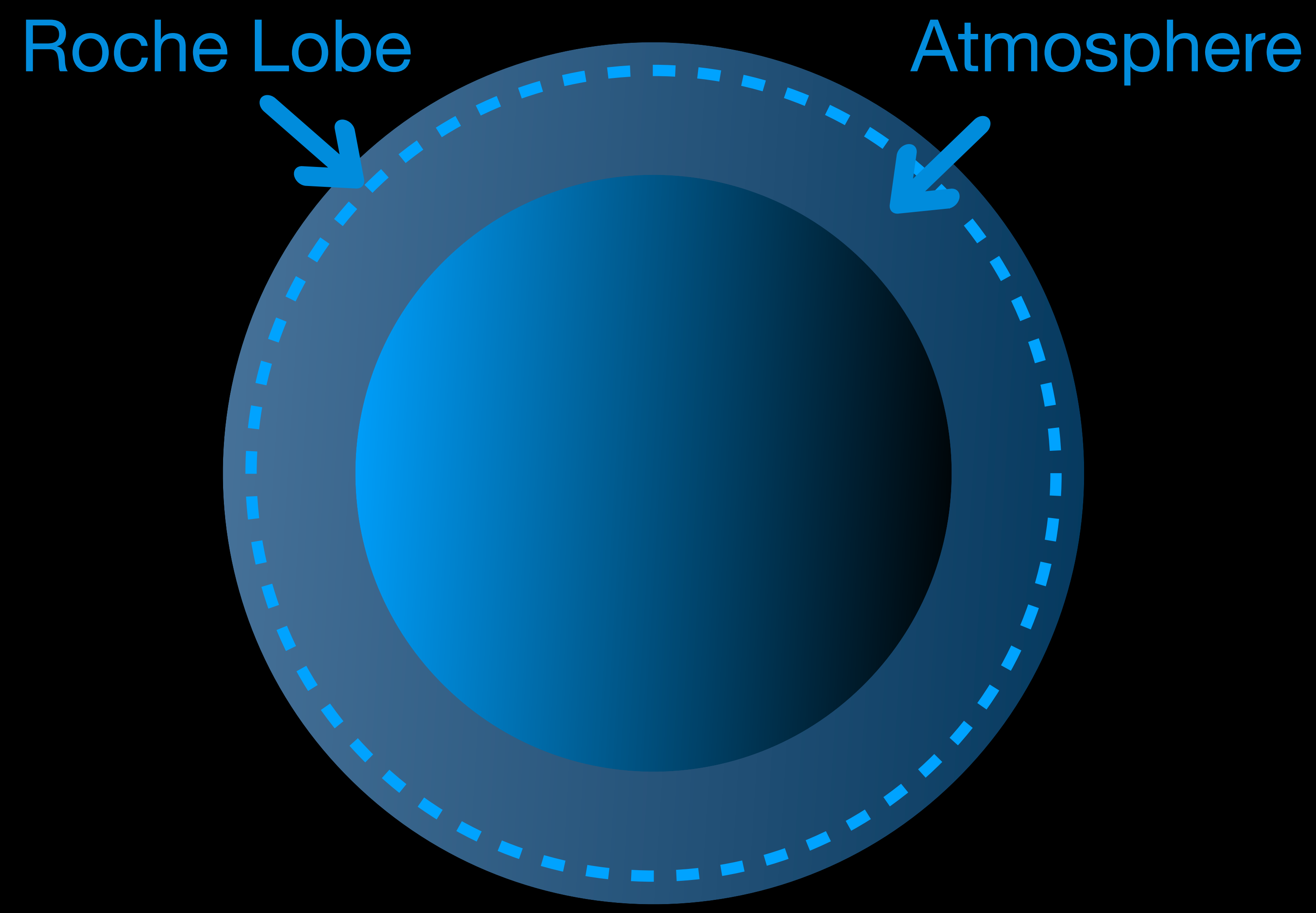

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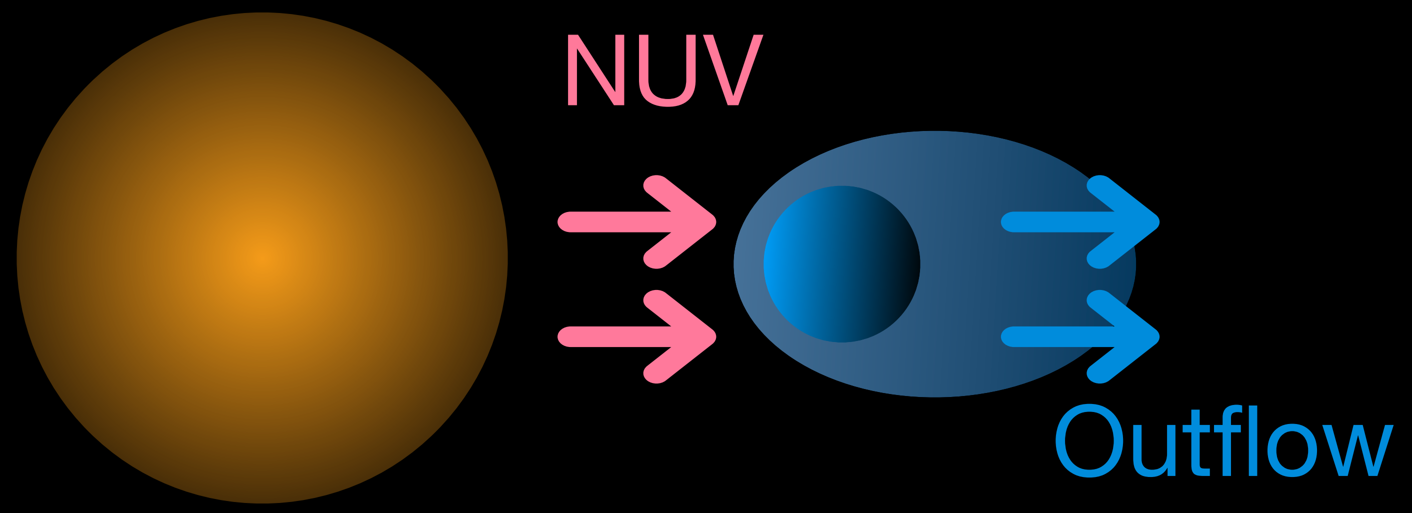


Additional Energy Sources (Balmer Escape?)*

*and/or different outflow geometries

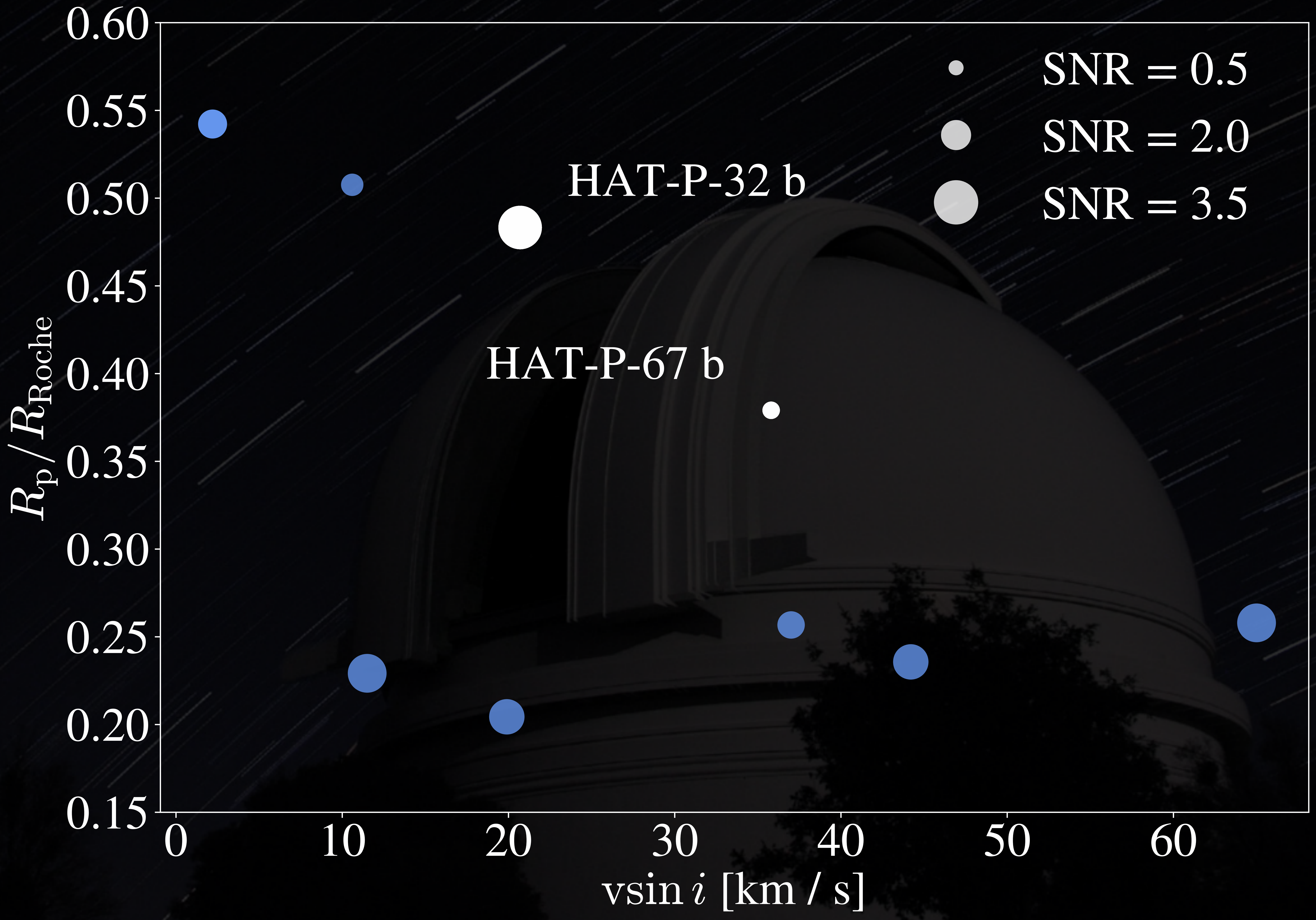
García Muñoz & Schneider (2019)

Survey F star worlds with 1083 nm Helium Filter on Palomar

Vissapragada et al. (2020)

Image Credit: Caltech/Palomar

Seven targets in Palomar survey



Predicted based on 1D EUV-driven outflow models

Image Credit: Caltech/Palomar

Vissapragada et al. (2020); Dos Santos et al. (2022)

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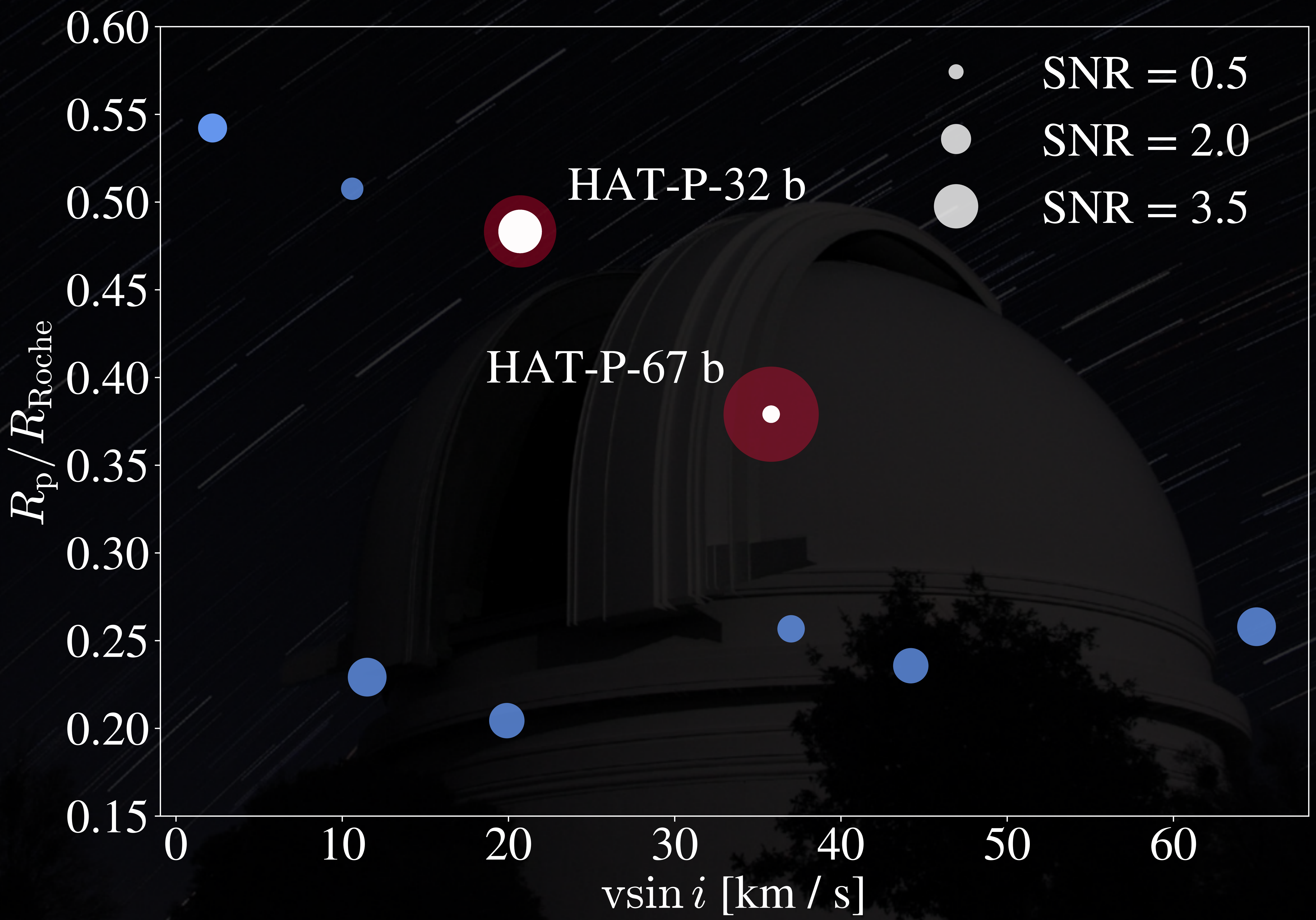

Dos Santos et al. (2022)

Image Credit: Caltech/Palomar

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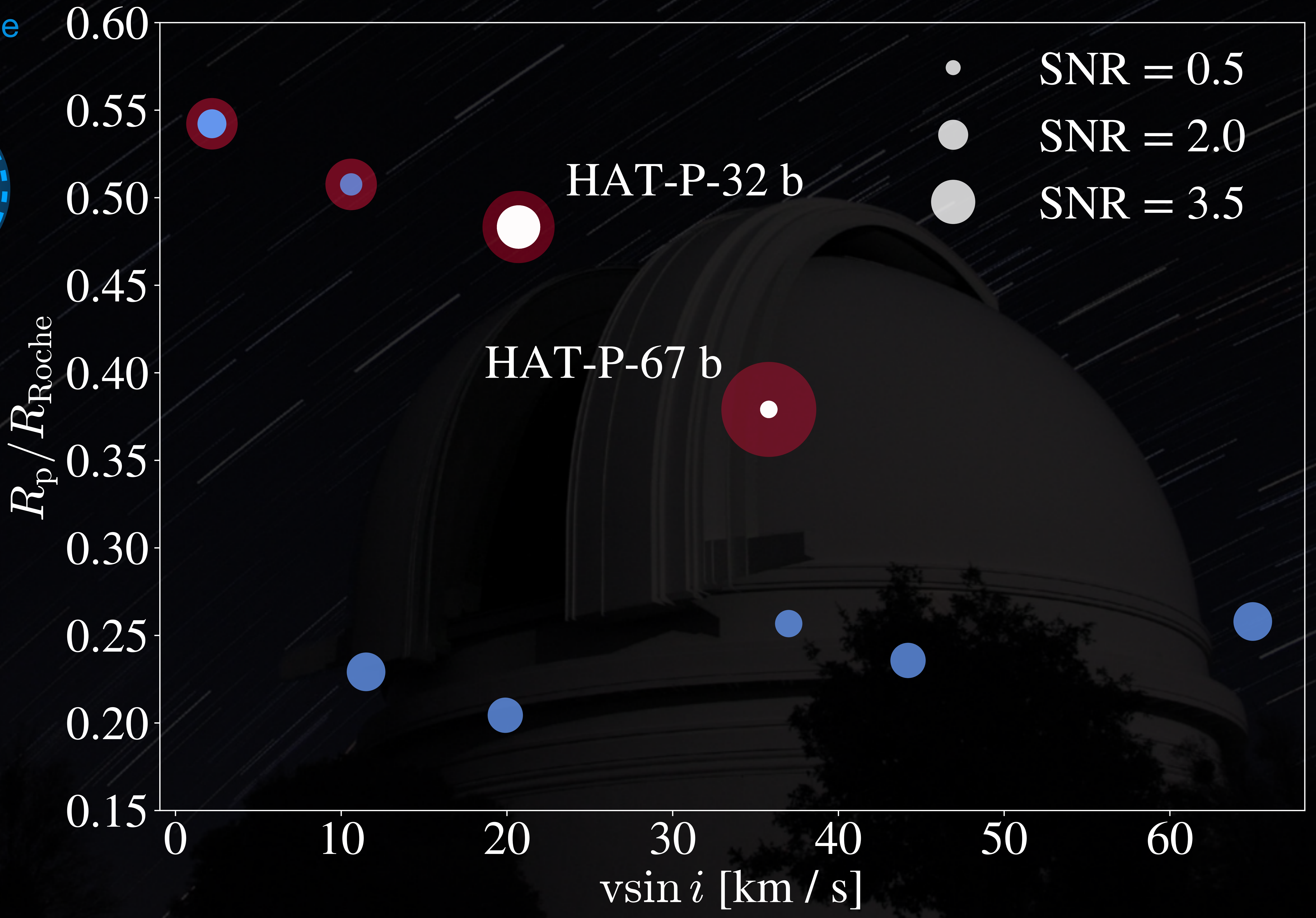

Dos Santos et al. (2022)

Image Credit: Caltech/Palomar

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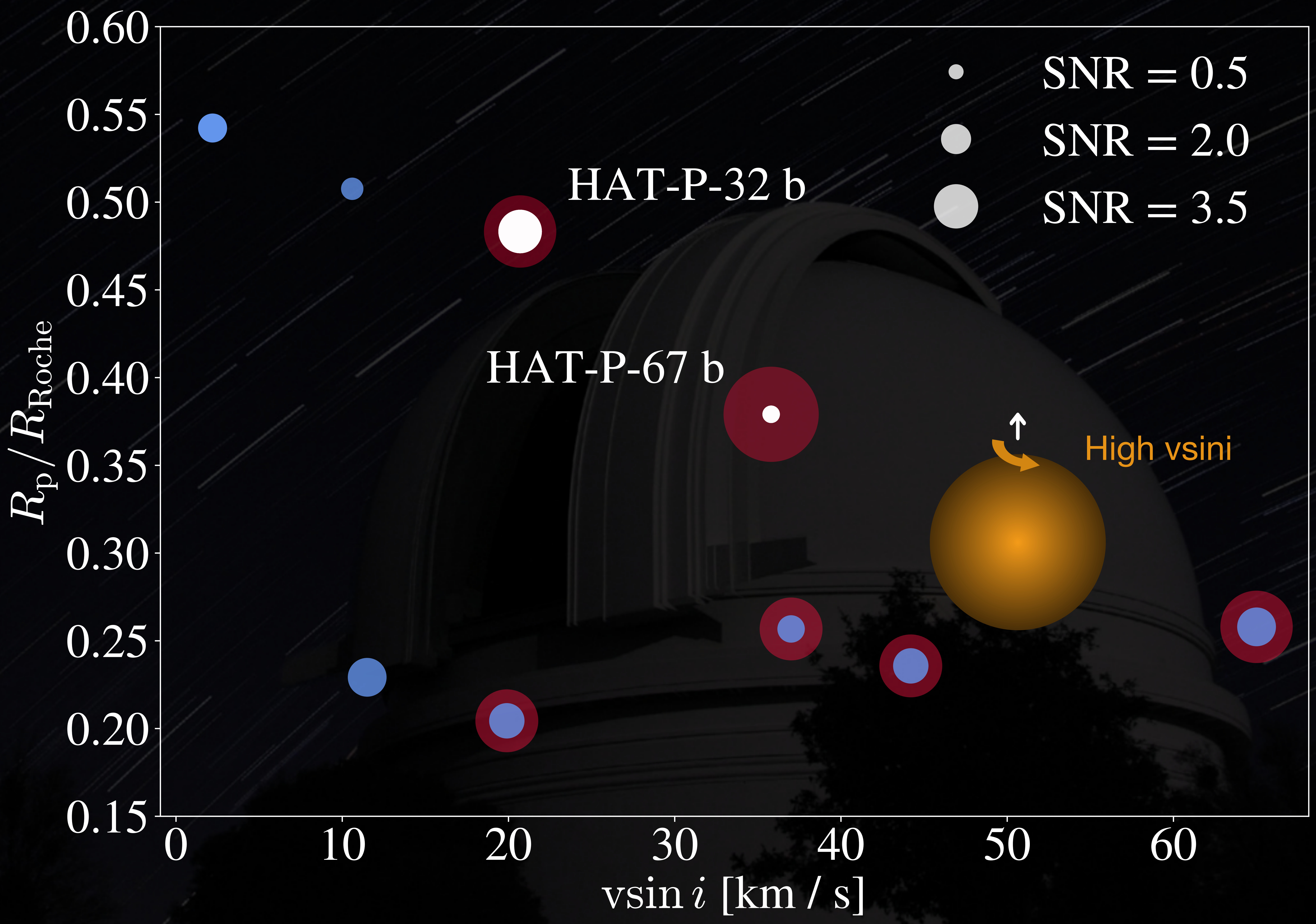
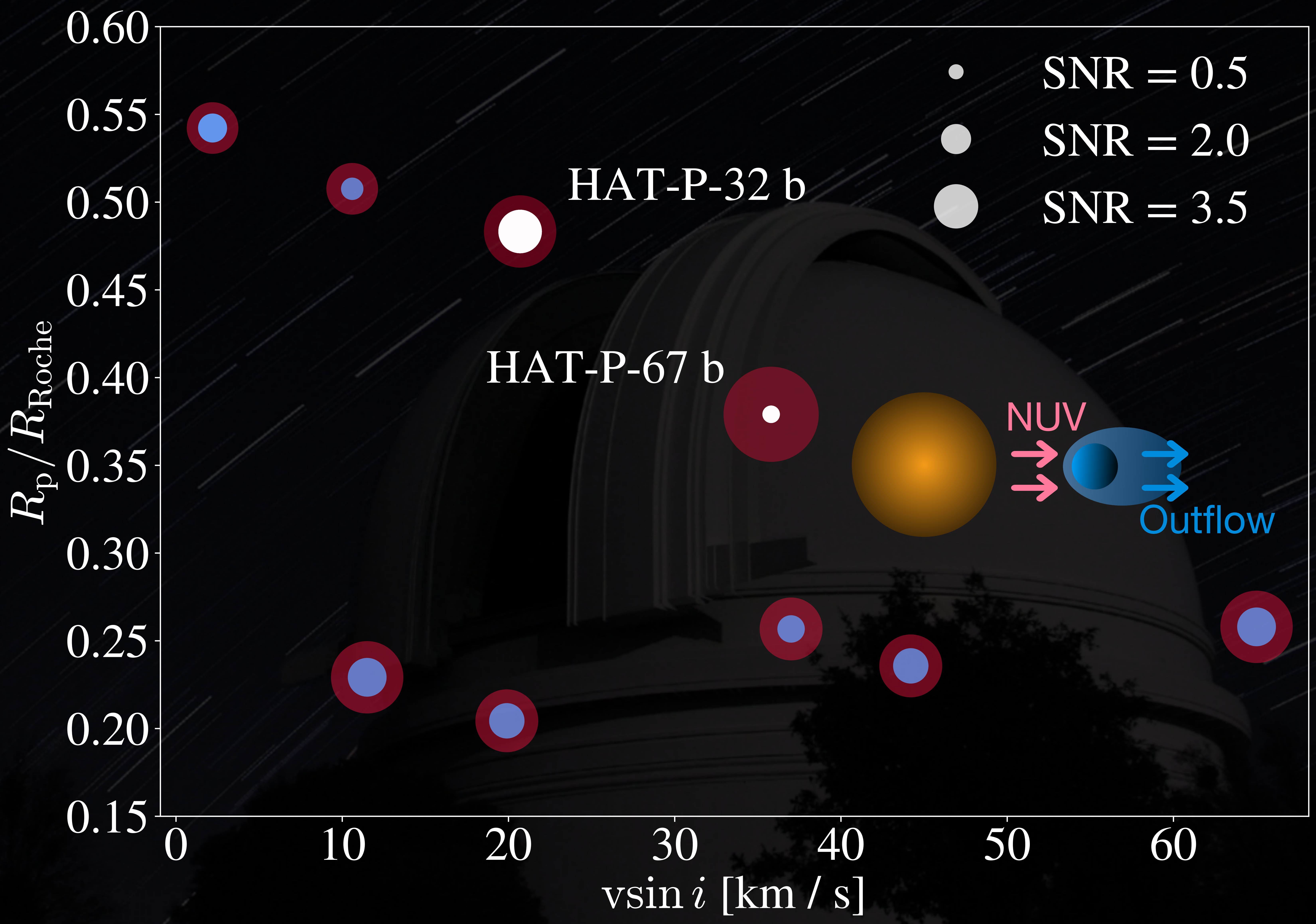


Dos Santos et al. (2022)

Image Credit: Caltech/Palomar

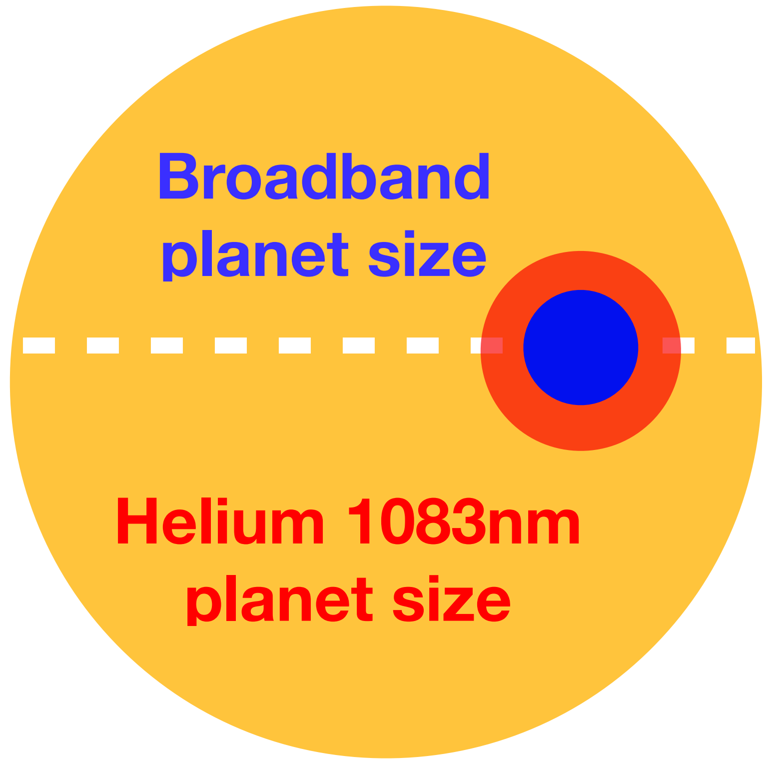
Seven targets in Palomar survey



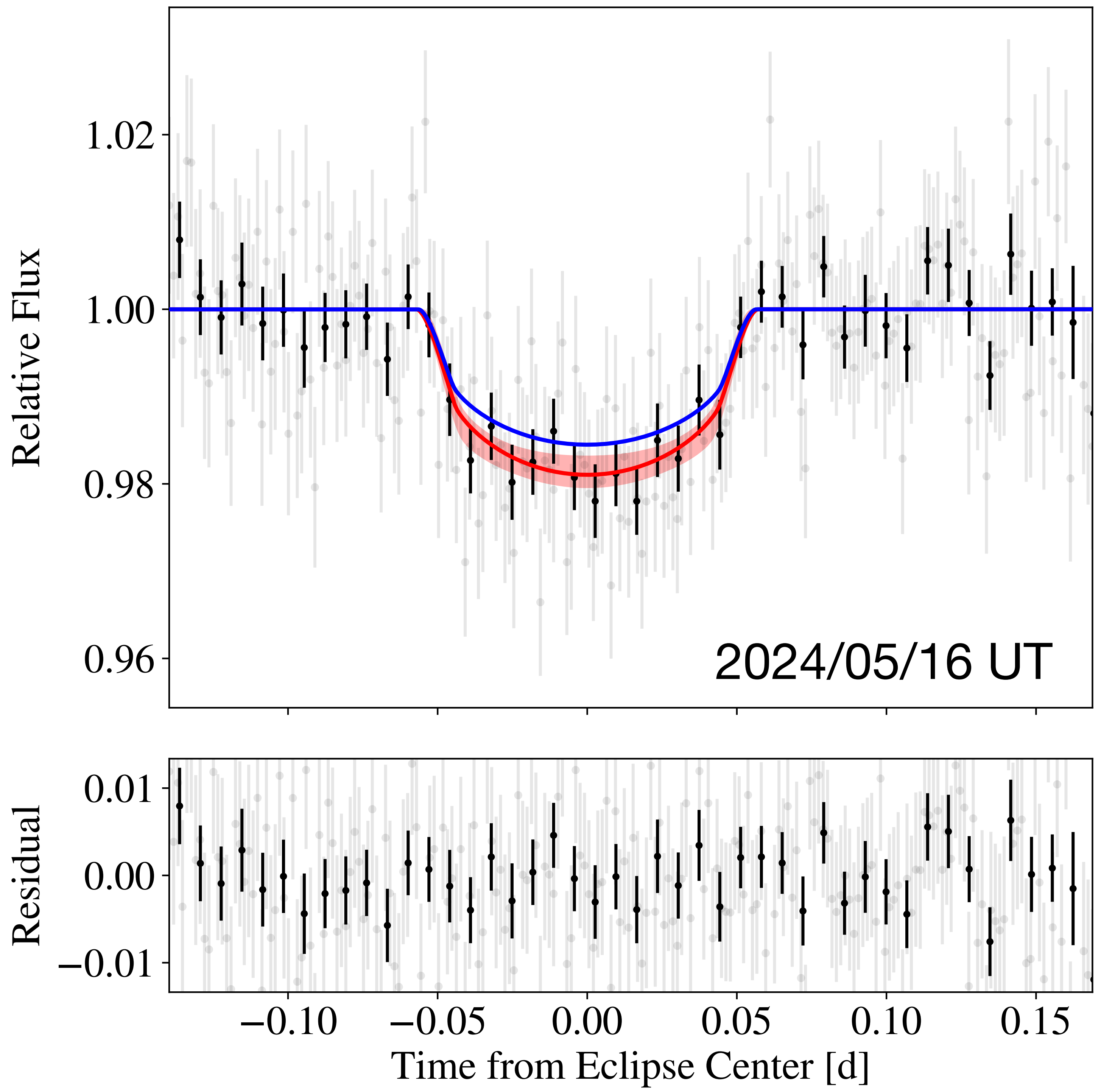
Dos Santos et al. (2022)

Image Credit: Caltech/Palomar

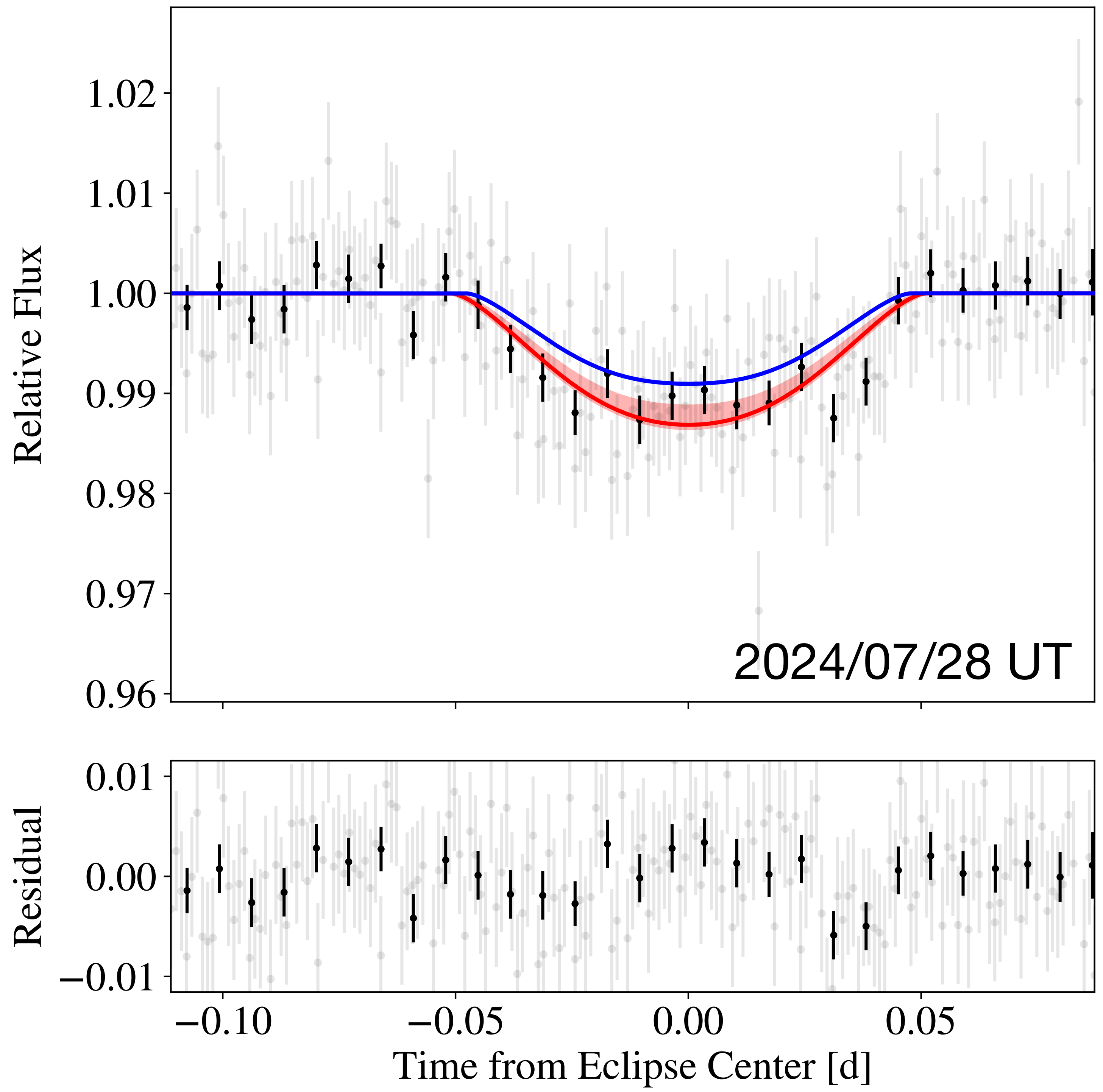
Three tentative detections of atmospheric escape!



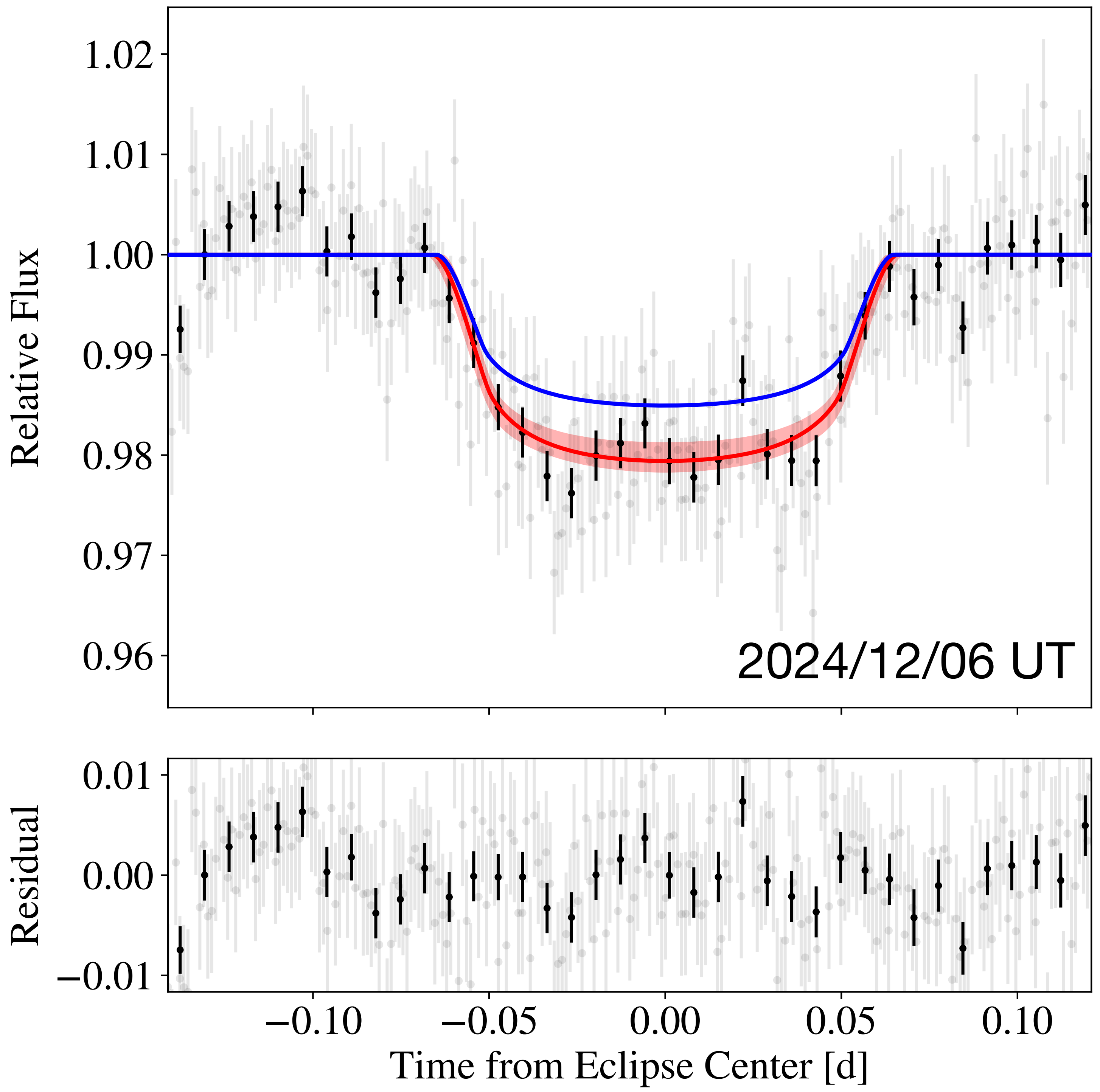
WASP-103 b (2.1σ)



WASP-93 b (1.9σ)

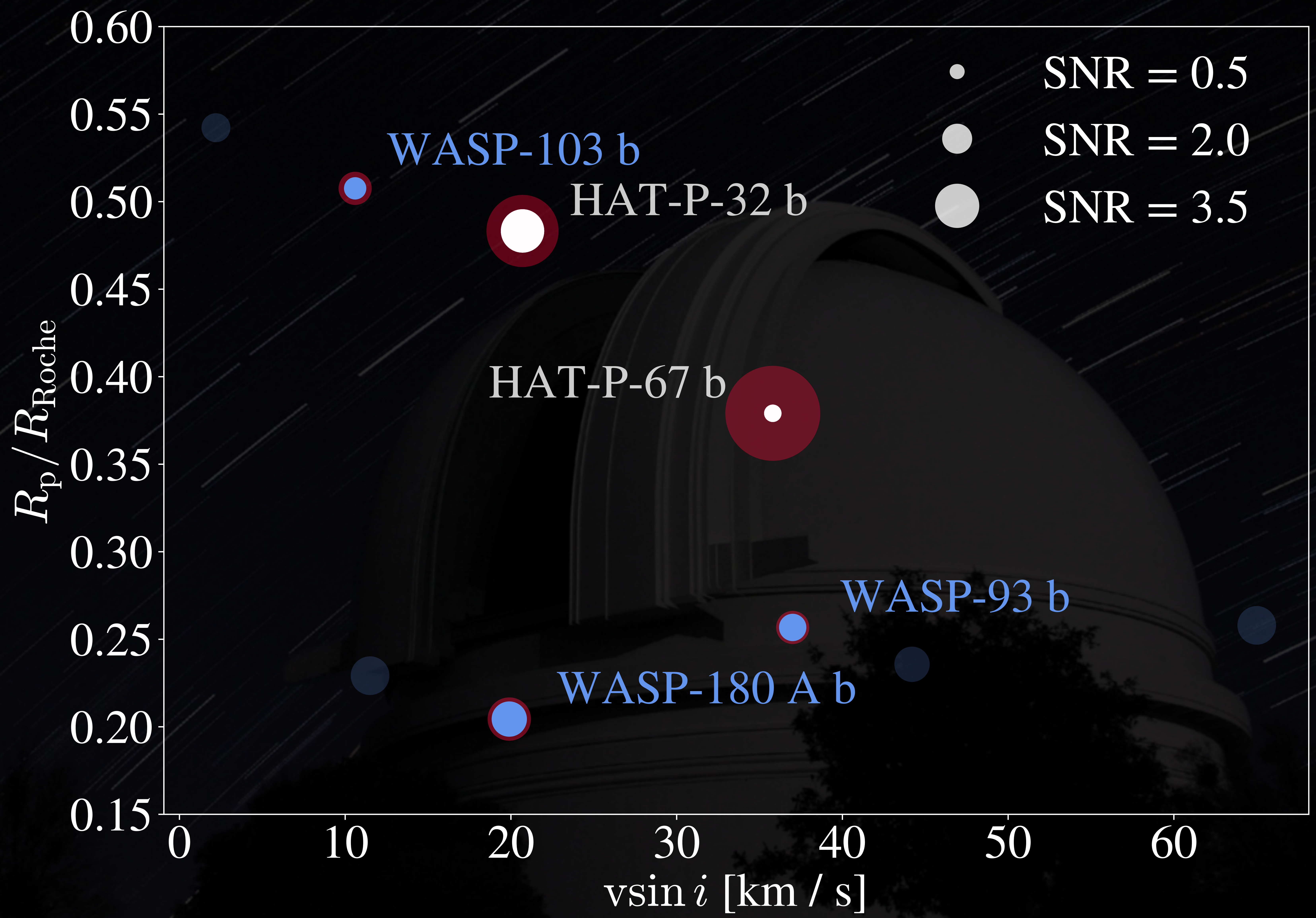


WASP-180 A b (3.7σ)



Saidel et al. in prep.

No clear solitary driver of fast outflows



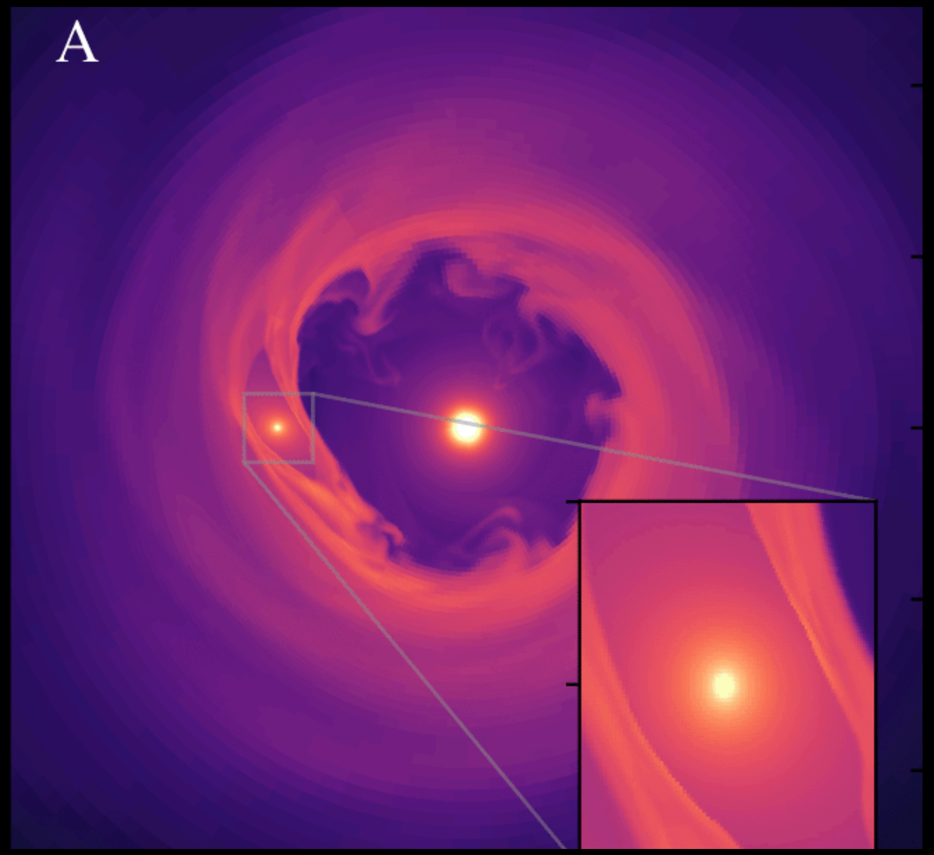
Dos Santos et al. (2022)

Image Credit: Caltech/Palomar

What's Next?

Finish survey

3D Models



Stellar XUV spectra

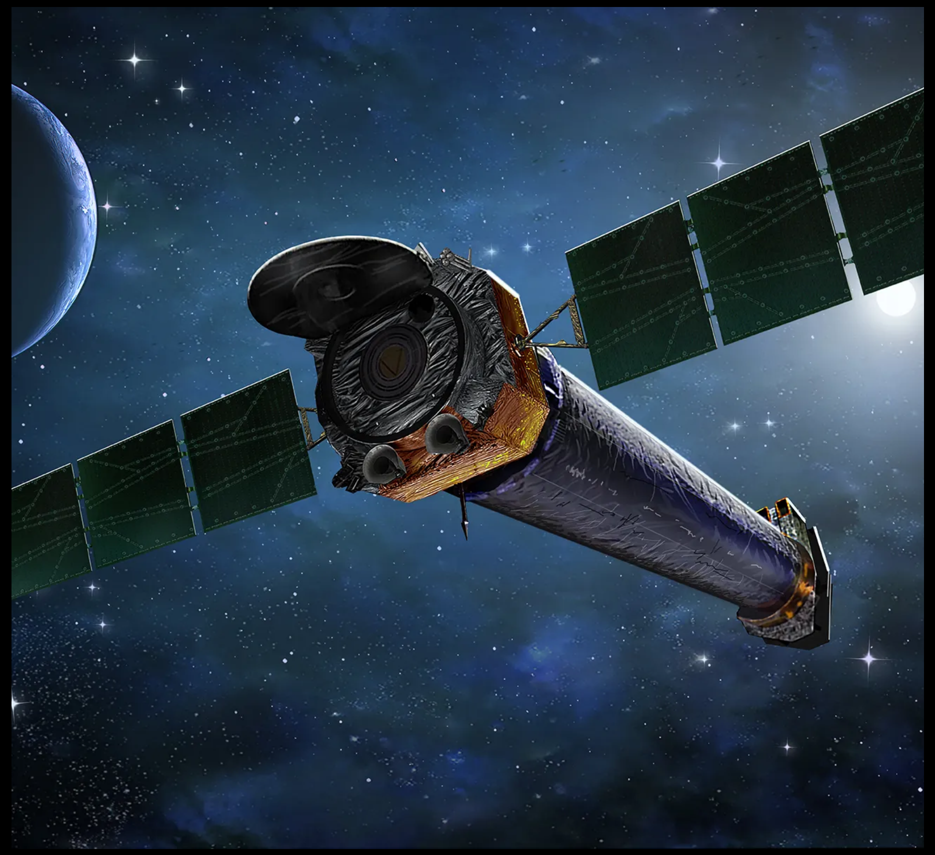


Image Credit: James Vaughan