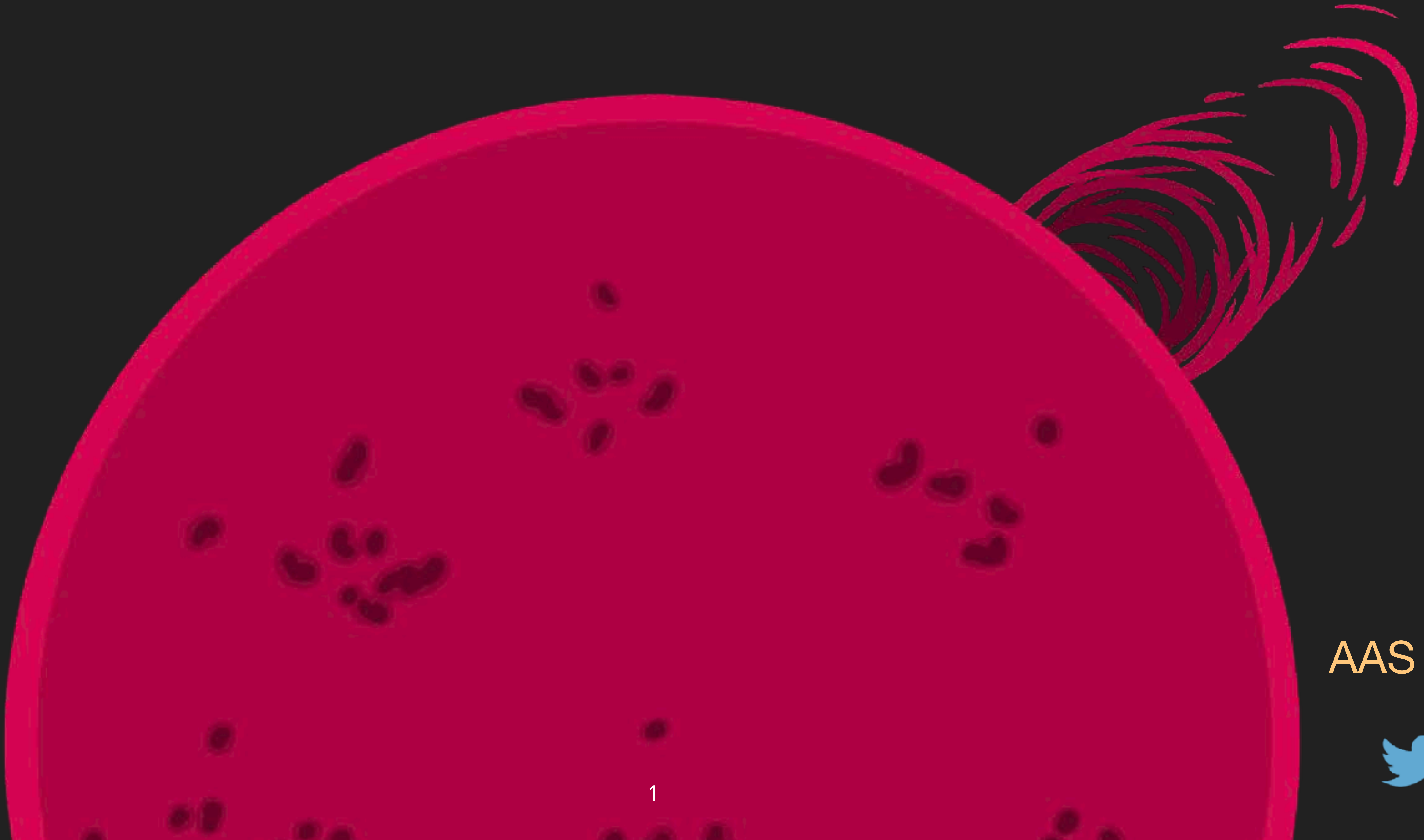
Far-Ultraviolet Flares on AU Mic and the Implications for its Planets



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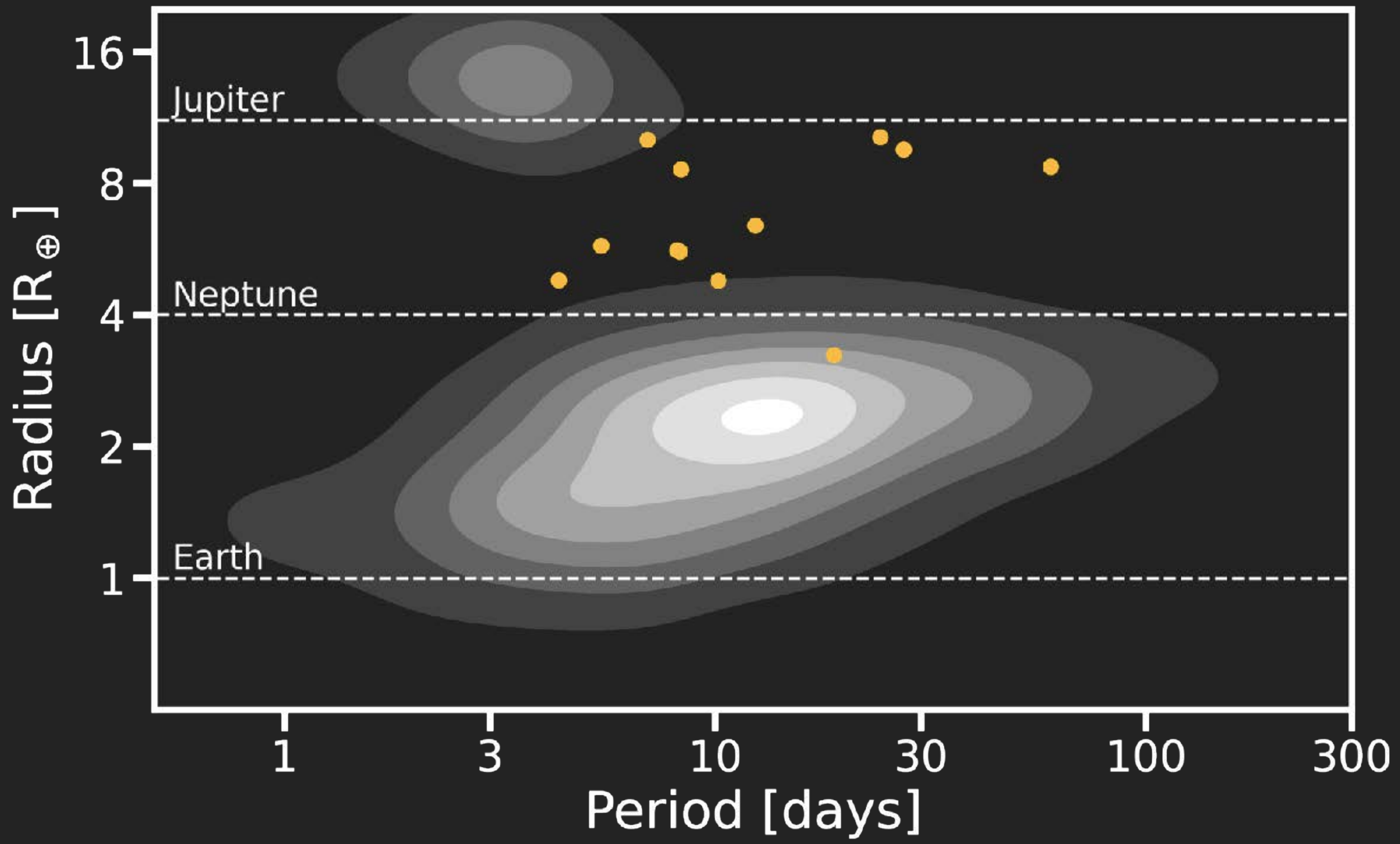
@afeinstein20

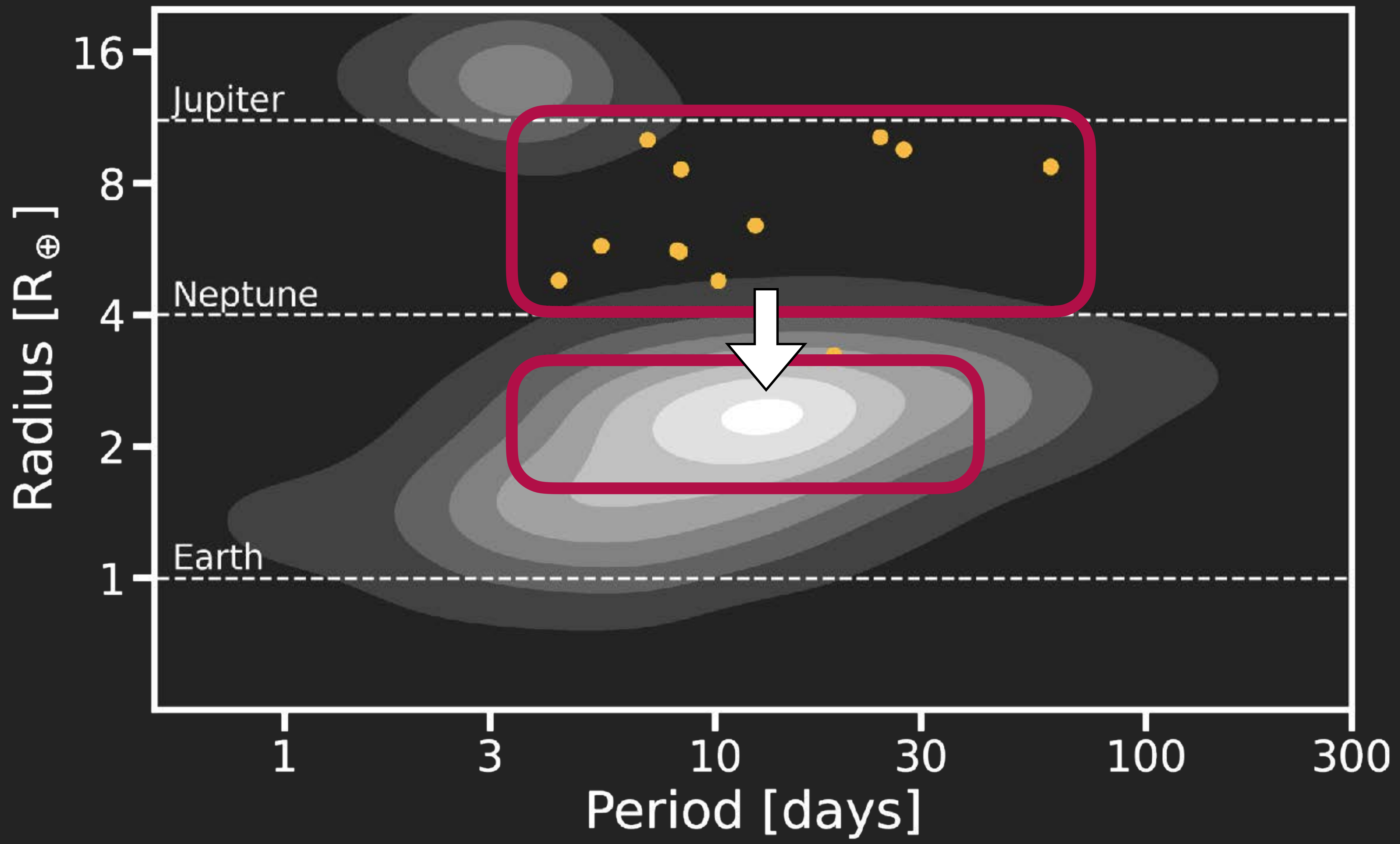
From *Kepler* and *TESS*, we now know of thousands of exoplanets, but only a dozen are younger than 100 Myr.



Distribution of transiting exoplanets (3800 planets)

Planets < 100 Myr (12 planets)

The question — What processes are driving the differences in exoplanet radii as a function of age?



Distribution of transiting exoplanets (3800 planets)

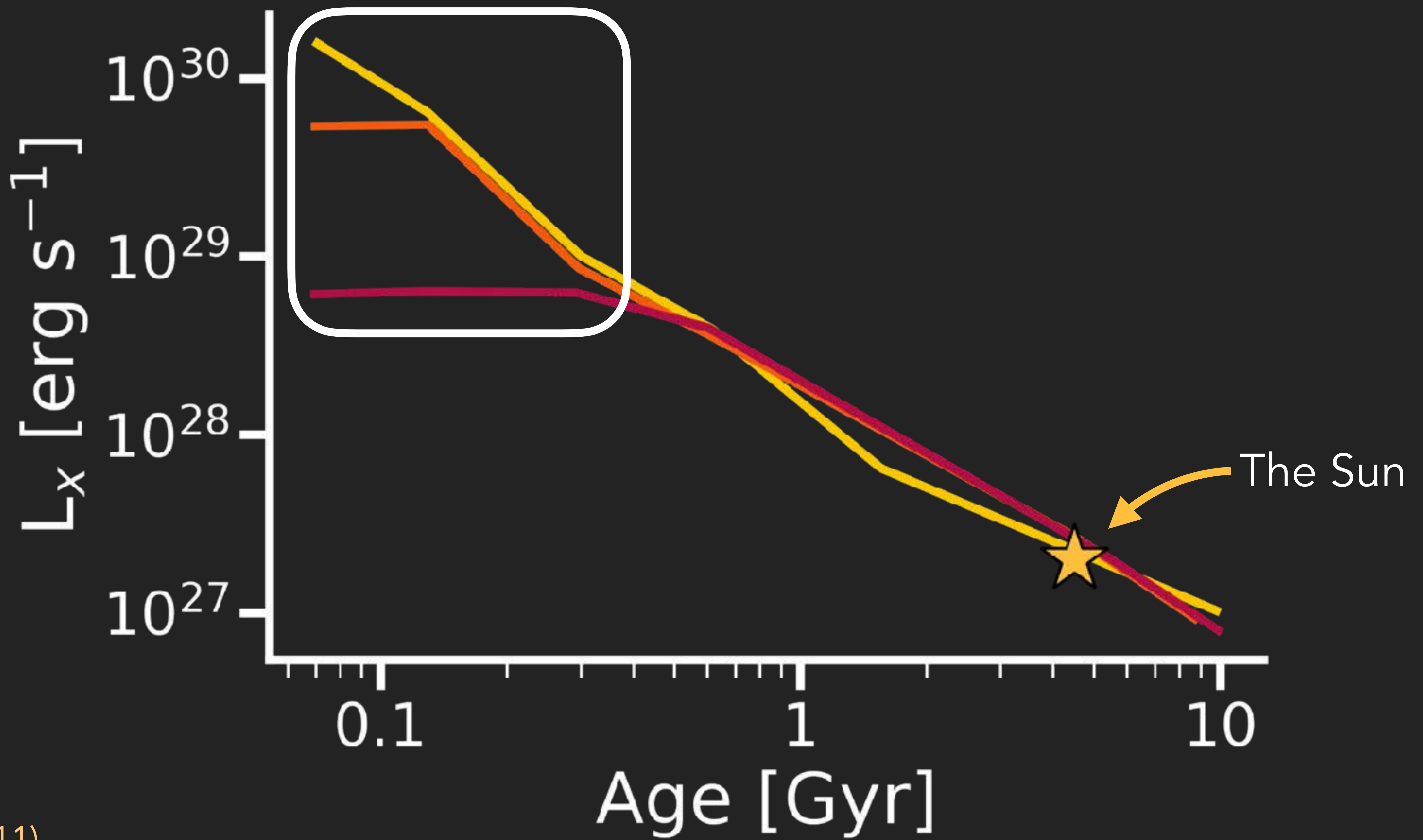
Planets < 100 Myr (12 planets)

Young planets live in highly irradiated environments, compared to old planets.

G stars

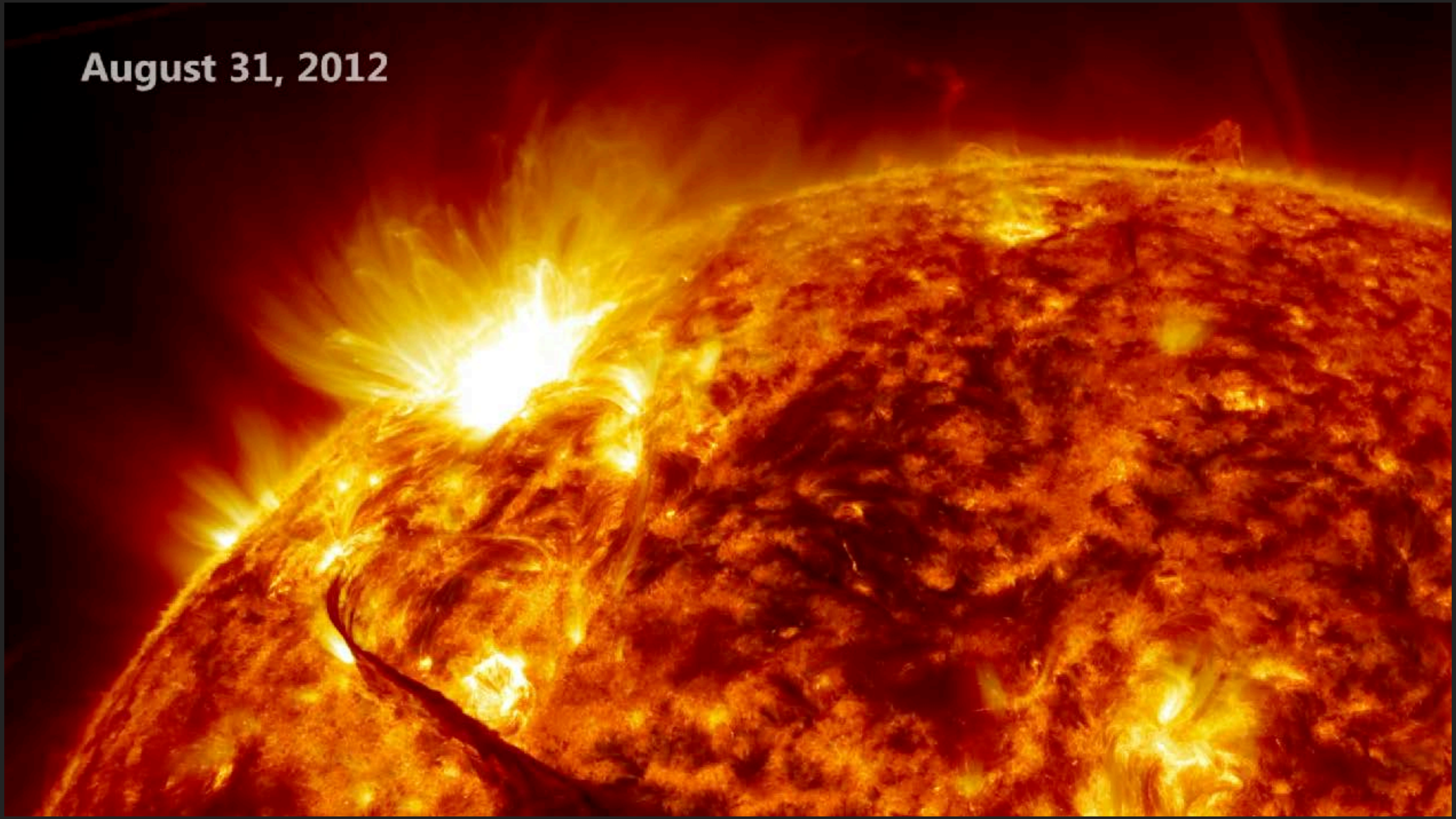
K stars

M stars



(Garcés, Catalán, & Ribas, 2011)
(Lammer+2003; Baraffe+2004)

The high energy luminosity changes on short timescales thanks to stellar flares.

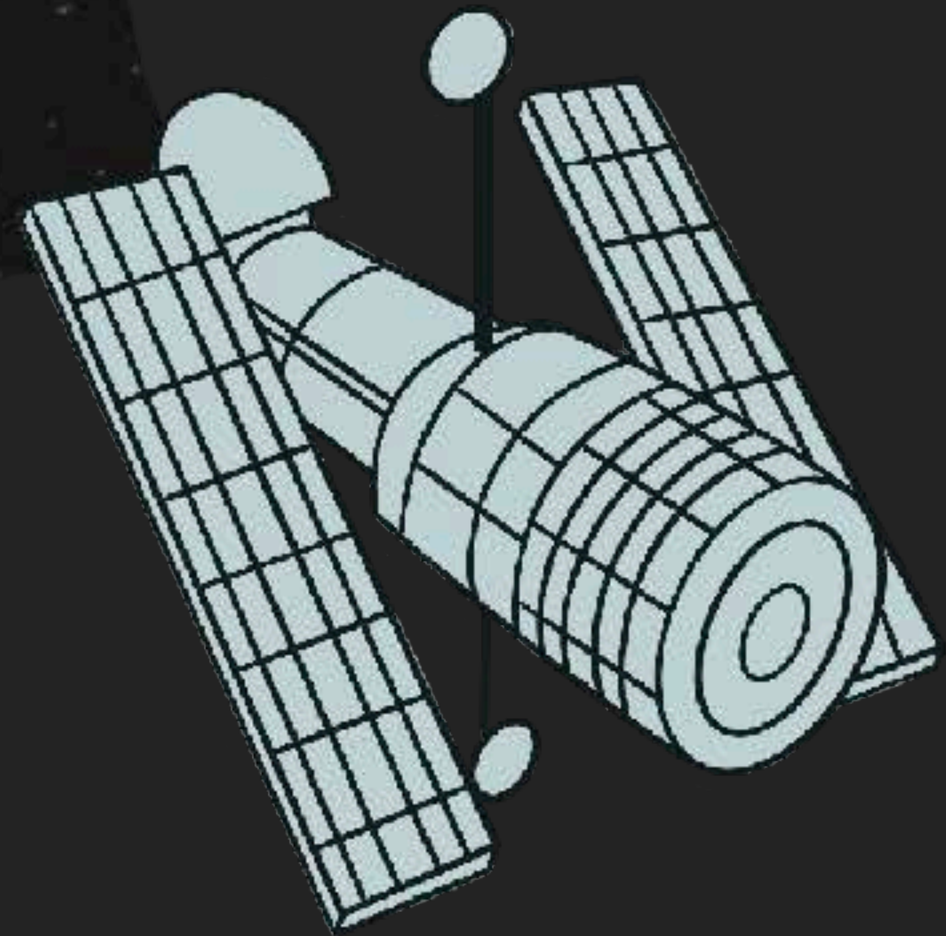


(NASA Solar Dynamics Observatory)

We used the *Hubble Space Telescope* to observe AU Mic.

- T_{eff} = 3700 ± 100 (M3.5V)
- d = 9.72 pc (*Gaia* DR2)
- Age = 22 ± 3 Myr
- Why this system? Two new close-in transiting exoplanets (Plavchan+2020)

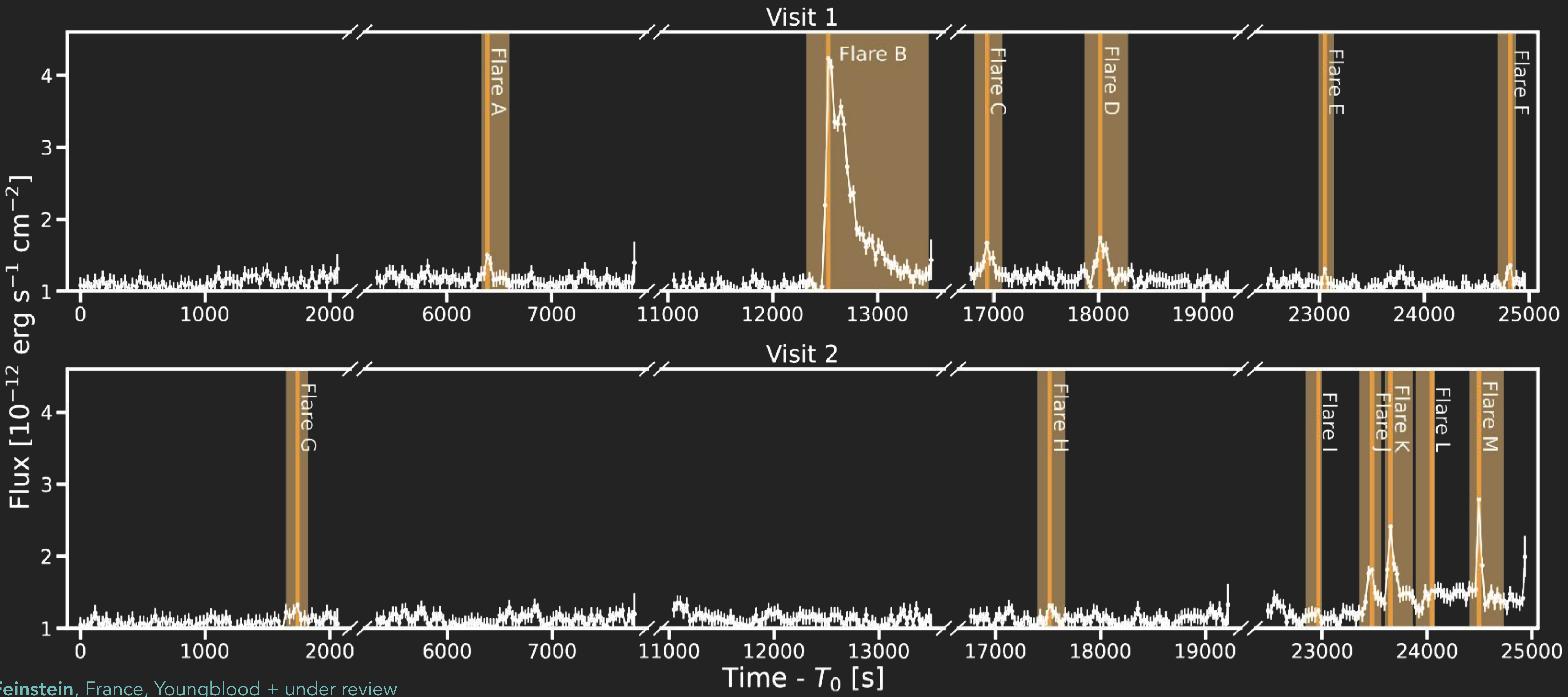
PI: Wilson Cauley



AU Mic has an incredibly rich FUV spectrum.

Feinstein, France, Youngblood + under review
arXiv:2205.09606

The HST light curve shows 13 flares — a flare rate of 2.5 flares per hour!



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The presence of super flares (> 10^{33} erg/s) can increase the instantaneous mass loss by six orders of magnitude.

Feinstein, France, Youngblood + under review
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AU Mic is one of the only targets bright enough to detect its FUV continuum, and it's anything from straightforward.

Feinstein, France, Youngblood + under review
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Main Takeaways

- We identified 13 FUV flares over 2 Hubble visits, yielding a flare rate of **~2.5 hour** $^{-1}$.
- Instantaneous mass-loss rates in the presence of super-flares **could** be observable.
- Understanding the contribution of short-duration flares to overall atmospheric mass-loss is still an **open question**.
- We highlight **new extreme features** in the continuum at $\lambda < 1100$ Å, which clues us into astrophysical processes that occur during flares on other stars.
- Paper is on the **arXiv:2205.09606**.

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