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

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

(Garcés, Catalán, & Ribas, 2011)
(Lammer+2003; Baraffe+2004)
The high energy luminosity changes on short timescales thanks to **stellar flares**.
We used the Hubble Space Telescope to observe AU Mic.

- Teff = 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)

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AU Mic has an incredibly rich FUV spectrum.
The HST light curve shows 13 flares — a flare rate of 2.5 flares per hour!
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**
arXiv:2205.09606
AU Mic is one of the only targets bright enough to detect its FUV continuum, and it’s anything from straightforward.
Main Takeaways

• We identified 13 FUV flares over 2 Hubble visits, yielding a flare rate of $\sim 2.5 \text{ hour}^{-1}$.

• 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.