How do evolving stars impact their close-in planets?

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The **tidal dissipation rate** greatly **increases** as the star evolves off the main-sequence. Tidal **decay timescales reduce significantly** for short period planets, and may even become **shorter than the sub-giant lifespan** of the star[1].

Population Prediction:

A lack of short period planets orbiting evolved host stars should be observed.

We have performed a **systematic transit search** using photometry from the **TESS Full-Frame-Images** to study the impact of these effects on the **post-main sequence planet population**.

We can measure the planet **occurrence rates** with the inclusion of **injection-recovery simulations**[2].

Planet Search Pipeline[2]

BLS Transit Search
~500,000 evolved stars
~24,000 BLS detections

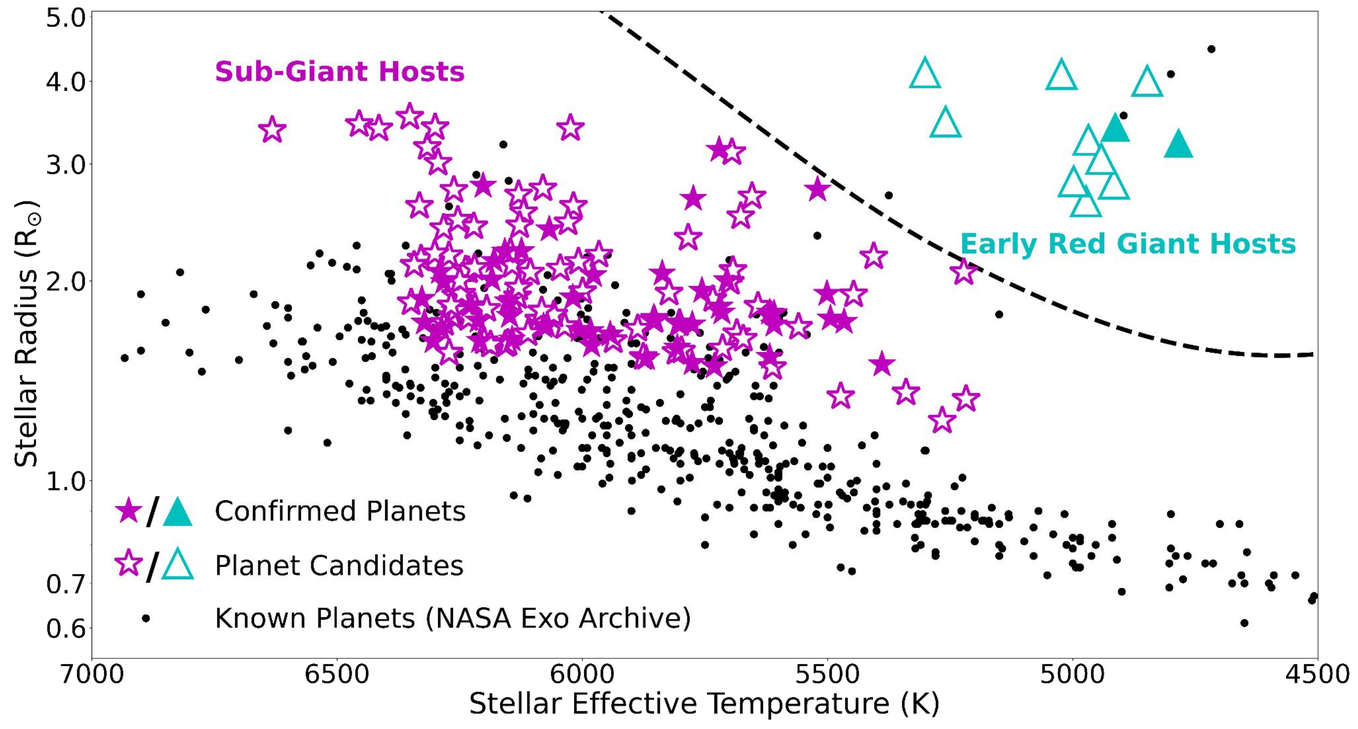
→ **False Positive Identification** (e.g. eclipsing binaries, variables)
~2,600 planet candidates selected

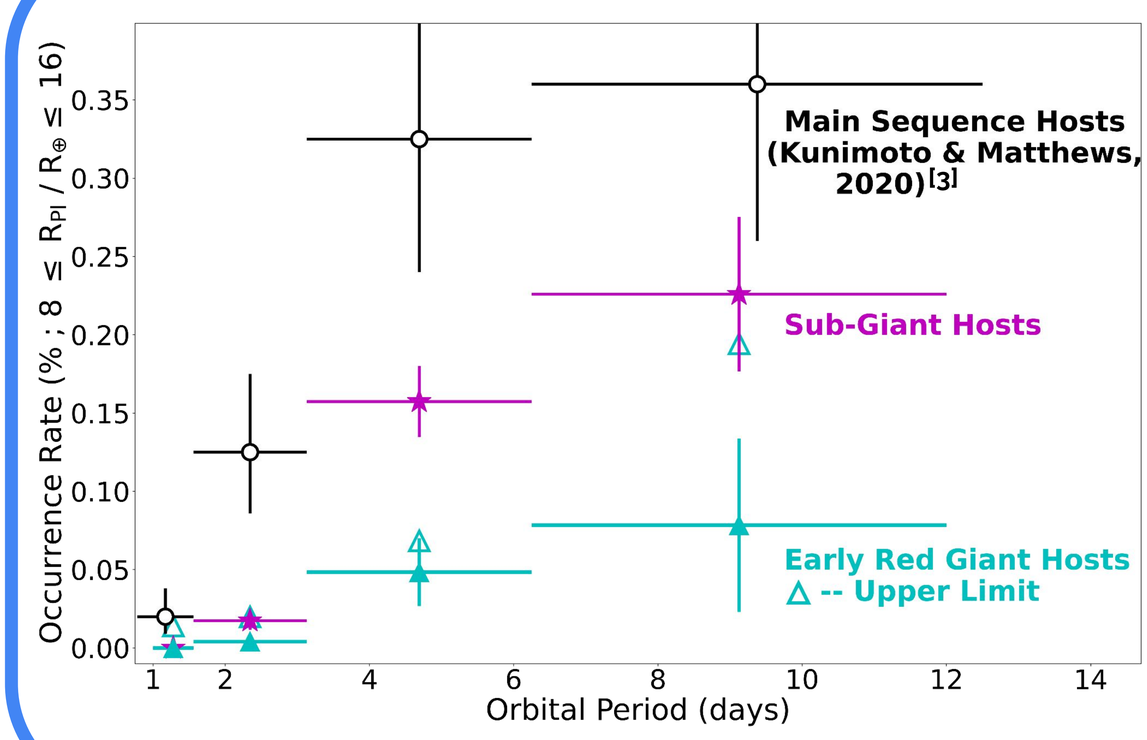
→ **Transit Fitting Analysis**
~400 good quality candidates

→ **Full Candidate Vetting** (e.g blend scenarios; existing follow-up; visual)
146 candidates remain

Host stars of our 146 planets and candidates

Using **~2 million simulated transiting planet** signals we can **quantify the detection efficiency** of our pipeline and **calculate giant planet occurrence rates!!**





Close-in planet occurrence decreases for post-main sequence host stars

1. Significant reduction in occurrence rates for periods ≤ 4 days
   Evidence for **faster tidal decay** for **evolved host stars**
2. Hint of overall reduced occurrence rates for all hot Jupiters around more evolved stars
   Could be linked to **lower rates of giant planet formation** for **older host stars**

This is a work in progress! Stay tuned for :

- Refined **occurrence rate** and **uncertainty estimates**.
  - Including consideration of **host star metallicities** and **masses**.
- **Radial velocity follow-up** of new candidates.
- **Statistical analysis** of **planet parameters** for the post-main sequence planet population.

[1] Weinberg et al., (2024); ApJ, 960, 50
[2] for an example see Bryant et al., (2023); MNRAS, 521, 3663
[3] Kunimoto & Matthews (2020); AJ, 159, 27