A survey of the coldest planets around low-mass stars

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I will search light curves from the *TESS* (and potentially *K2*) mission for **long-period (P>20 days) planets** orbiting **M dwarf stars** to constrain the **occurrence rate** of their coldest planets and find targets for **future characterization.**

Scientific Motivation

Study the demographics of cold planets orbiting M dwarfs

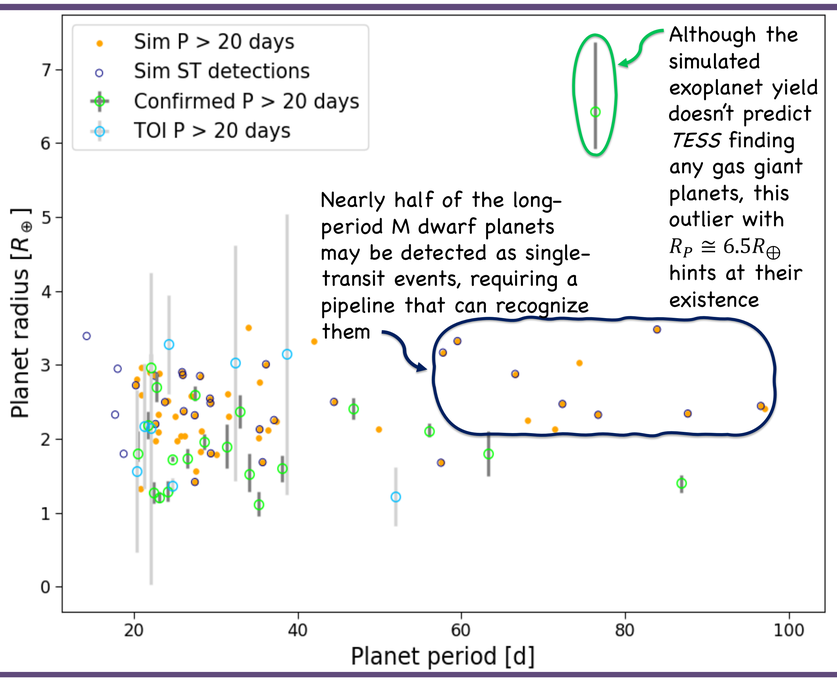
- *TESS* provides more potential to observe planets closer to the snow line (beyond which water freezes) of low-mass stars with **great potential for future observations**
- I can **create a more robust estimate of the prevalence of cold planets** in M dwarf planetary systems

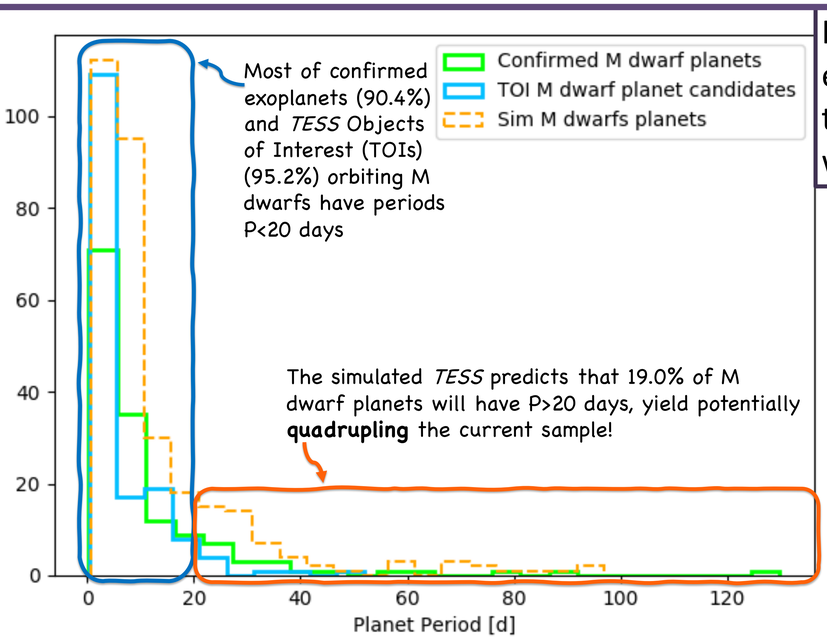
Determine the frequency of gas giants around low-mass stars

- Though the core accretion theory **predicts few gas giants around low-mass stars, m**icrolensing and radial velocity (RV) surveys **have found a several cold Saturns and Jupiters** orbiting M dwarfs
- *TESS's* survey strategy provides a comprehensive study of M dwarfs allowing for **constraints on the frequency** of cold giant planets **even in the event of a null detection**

Find candidates for mass and atmospheric characterization:

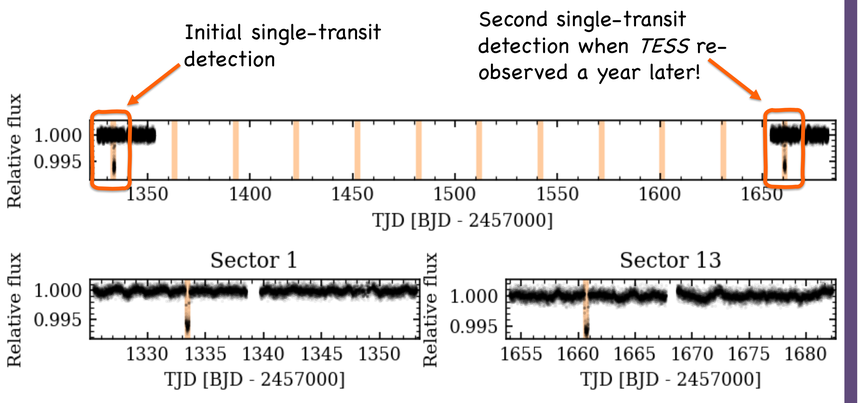
- *TESS* will be the first mission to provide targets largely accessible for mass and atmospheric characterization
- Studying the atmospheres of cold M dwarf planets could **inform theories of planet evolution and gas giant formation**
- Any gas giants we find will be **ideal targets for RV follow-up** dwarfs from which I can **constrain the frequency** of cold giant





I use the Barclay et al. 2018 simulation (Sim) to estimate the yield of this project as roughly 27 single-transiting and 32 multiply-transiting M dwarf planets with P >20 days from the *TESS* primary mission.

Due to the short transit durations of M dwarf planets, I will utilize the 2-minute cadence observations by *TESS* to find targets.



Approach

Pipeline

- Designing a **pipeline** to recognize both single- and multiply- transiting planets from *TESS* light curves **using the Box Least-Squares algorithm**

Vetting and Completeness

- A recursive **artificial neural network** can quickly and efficiently **vet targets**
- Using the **injection/recovery method** to determine the **completeness of the pipeline**

Follow-up

- ***TESS's* Extended mission** will re-observe many targets, constraining the orbital periods of **single-transiting planet candidates** and reducing the error in those of multiply-transiting ones
- Follow-up using ground-based photometric and spectroscopic facilities to **constrain the true periods of single-transiting targets and validate/confirm planet candidates**

References

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