Radius Valley Project Plan

General Concept

The overall plan is to use multi-transiting systems to break the degeneracies in measuring exoplanet radii. Since each planet orbits the *same* star we can fix several parameters and better fit the rest!

Radius Fitting Plan

We'll collect any 3+ multiplicity systems that span the radius valley and for each we aim to derive estimates of their planetary radii using either `exoplanet` or Julia. In each case we will need to consider the following:

1. **Detrending:** Decide how to convert TPFs to lightcurves
    - Correct using pixel level detrending? Does this remove all systematics?
2. **TTVs:** For each system we need to make a decision about TTVs (probably using `TTVFaster` package to check how strong TTVs would be)
    - Either we used fixed ephemeris or free transit times
    - Latter can be too free and smear out the ingress and egress when TTVs are not present
    - The former is a reasonable assumption if you are not close to resonance or if you're separated by quite a lot (since no TTVs)
3. **Limb Darkening:** Choose what order of limb darkening model to use (quadratic default)
4. **Sampling:** Ensure time sampling of model doesn't have a strong effect
5. **Stellar noise sources**: Consider the presence of starspots and companions
    - Starspots (both in transit and out of transit) - out can result in periodic noise, can change mean surface brightness of the star, in of course affects the depth of the transit
    - Are there stellar companions that result in dilution?
    - Any outliers from CRs or flares?
6. **Model specifics:**
    - Does parameterisation of the model affect the results?
    - Do priors affect the model?
    - Is the sample properly converged?

Expected Results

After working out the radii we can make a statement about the location of the gap. In addition we can work out how that correlates with stellar and orbital parameters.