Early results from reprocessing with SuperWASP

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Reducing RMS Noise

Don’t ignore faint stars

Figure 2: RMS noise binning for non-flatfield corrected images

Binning the data up to transit duration timescales reveals that flatfielding does go some way to re-de-reddening the noise but that systematics still remain.

Role of Flatfielding

Flatfielding does not significantly improve the SuperWASP noise characteristics. This may be due to flatfields being taken at twilight, when the sky is bluer, causing flatfields to add their own noise as well as accounting for pixel sensitivities.

Improved Precision

When these factors are combined to make lightcurves [2], Figure 5 shows our clear improvements in lowering the rms noise when compared to the post-systematics correction results from the previous pipeline using SYSREM detrending [3]. This significant decrease in rms noise even for dimmer stars allows more precise photometry around K and M dwarfs. As these are among the most common stars in the galaxy and have relatively small radii, they are favourable for planetary transit surveys.

K/M Dwarf Selection

We selected late K and M stars in 8 reprocessed SuperWASP fields, following the method in Gaidos et al [4] as follows:

V < 15, V - J > 2

The original method used V < 14. We search down to V = 15 due to our improved noise statistics. Dwarf stars were distinguished from giants, by requiring their reduced proper H2 motion satisfy H2 > 2.2(V-J) + 2.0

More Dwarf Stars, Less Noise

As seen in Figure 7, our reprocessing results in rms errors of 0.05 mag at V = 14, marked by dashed lines. This an improvement over the 0.08 mag rms noise for Gaidos et al’s previous analysis [4] at the same brightness, which used the original SuperWASP pipeline.

Figure 8 details the selection of K and M dwarfs in SuperWASP from Figure 6. Our improved noise distribution allows an increase in the number of M dwarfs searchable for transits on the same noise value compared to the original pipeline. These may be suitable targets for exoplanet transit searches.

References


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