Project Proposal - A living document

Project: UV Variability in Exoplanet-Host M Class Stars

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Proposal Outline:

1. Science Motivation
2. Target Location and Observation Logistics
3. Predicted SN

Science Motivation

The habitable zone of an exoplanet depends on the characteristics of the host star of the system. If the host star is very large and bright, the habitable zone will much farther away than in a system with a smaller, dimmer star. But another factor that must be considered is the planet itself. If the planet can sustain life in an orbital region that lies short of the inner limit of the traditional habitable zone, then it must have some unique characteristics. For instance, the planet and its atmosphere must interact with the UV output from the star in a way that would prevent the UV radiation from destroying microbial life cells. As such, the variability of the UV spectrum from M class stars must be observed and studied. However, it may be possible to use the stellar spectral lines in the visible region as an analog to UV activity. With this hypothesis, the spectral lines of calcium H, calcium K, and hydrogen alpha should be observed to determine this possible correlation with the UV spectral region.

Target Location and Observation Logistics

(Yet to receive target(s) )

Read out time 42s, affects the imaging cadence: Observation window / (Readout time + exposure time) = number of exposures during observation night. If two targets with different magnitudes are observed, different exposure times will be required – more exposure time for the fainter (high magnitude) targets. This must be taken into account when planning the number of exposures, which is currently assumed to be roughly equal for each target (Target A gets X exposures; Target B gets X exposures)

Calcium II H&K lie at 3968.6 Å and 3933.8 Å[[1]](#endnote-1) . Hydrogen α lies at 6562 Å[[2]](#endnote-2). This puts the Calcium lines in the sensor’s blue channel, and the Hydrogen in the red channel. The calcium can be observed with a linear dispersion of 0.62 Å/pixel if the R1200 channel is used, and the hydrogen with 0.58 Å/pixel using the R1200 channel. The default wave centers and wavelength coverage for both channels will be suitable for observing these spectral lines. The spatial scales for the red and blue channels is 0.40”/pix and 0.42”/pix.

Signal-to-Noise Predictions

The DIS (Dual Imaging Spectrograph) telescope at Apache Point Observatory observes in blue and red channels. The SN for the red channel is SNred = 2300x10-0.2\*Mag t1/2 per Å, and for the blue channel the SNblue = 3700x10-0.2\*Mag t1/2 per Å. The exact units for the time in these calculations is unclear, and not specified by the DIS Instrumentation webpage. Possibly a phone call to the observatory before travel is advisable. Be that is it is, the remaining information on the Instrumentation webpage is all given in seconds.

If observing a V=13 target, for about 60s, the resulting SN in the red would be 44.8. For the same target in the blue channel, the SN comes out to 72.0.

By doubling the exposure time for this target, the SNred comes out to 63.3 and SNblue is predicted to be 101.8

1. Found on Wikipedia. *Fraunhofer lines.* <https://en.wikipedia.org/wiki/Fraunhofer_lines> [↑](#endnote-ref-1)
2. Found on Wikipedia. *H-alpha*. <https://en.wikipedia.org/wiki/H-alpha> [↑](#endnote-ref-2)