To narrow the search, we turned to a method dubbed the Integration Method. It works by calculating the total area beneath a curve, then integrating again, looking for the wavelength at which a certain percentage of the total is reached. This is vaguely characteristic of the temperature.

Applying the point-by-point process to the reduced range yields favorable results. Our recognition process has been found to be (at least theoretically) highly accurate.

References:

- Temperature Recognition Algorithm for the OPAL Mission

Overview:

The Optical Profiling of the Atmospheric Limb (OPAL) mission is an NSF CubeSat project with aims to measure the temperature in the lower thermosphere between 90 and 140 km via a tangential line-of-sight.

The end goal of the USU Student OPAL Team is to create a mock mission for the OPAL satellite. Flight modelling and line-of-sight vectoring is being handled by Kenneth Zia. Atmospheric and emission modelling is being handled by Preston Hooser. Data modeling, analysis, and interpretation is being handled by Eric Ashby.

From Light to Temperature: Lines and Curves

The main challenge is to determine the temperature from the light as seen by OPAL Atmospheric gases radiate at slightly different colors, depending on their temperature. Molecular Oxygen (O₂) emits a particular band of ‘colors’ between 755 nm and 780 nm in wavelength. The emission lines of O₂ in this locale are collectively called the O₂ A-band. At different temperatures, these emission lines come in different proportions.

Recognizing Emission Curves:

As the OPAL instrument lacks the capability to calibrate its sensors for the total magnitudes of these emission lines, it must be the relative magnitudes that are compared or, in other words, the shape of the curve.

For this study, the decided method was a point-to-point comparison of the measured emission curve with every possible theoretical emission curve in 3 Kelvin increments. To accomplish this, a two step process was used: First, we narrow the search by eliminating unlikely temperatures. Second, we apply the point-to-point comparison to the reduced range found in step one.

References: