Weekly Report

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June 29, 2012

1 More comparing brightness data

This week I worked on looking at the brightness of the same starin larger data sets, both looking at different days and different sites. In order to facilitate working with a larger data set than before I wrote a program that would do most of the things I used to do by hand either automatically or through a better interface. This allowed me to gather data for two different sites, with eight or so days of useful data out of a month for each site.

For the month of January 2011 in particular I found that the middle ten to twelve days of the month had to be thrown out altogether because of the Moon. It appears that the Moon tends to make entire nights' worth of data unuseable, as when it is in the field of view, pixels are either saturated completely or flooded by reflections within the optics. This leaves about ten days each at the start and end of each month, most of which must be rejected also, due either to cloud cover or aurora.

While stars are typically still visible behind the aurora, the radiation produced by the aurora can't simply be subtracted the way I've been removing background so far. Aurora produces a region around the star that is much less uniform than the clear background, so to ensure that a reasonable number is being subtracted from the star I have to look at an even smaller region around the star than usual to remove as background. This is assuming aurora simply adds to a star's counts without interfering the way clouds would.

From the useful data I found that a good night's worth of brightness values consistently produces a well-defined curve that increases then decreases, corresponding to when the star (identified as Capella) travels away from, then towards the horizon. It may be useful to determine how well these curves correspond to typical atmospheric effects, by looking at how airmass affects apparent magnitude for example.

One simple means of extracting information that can be compared between curves and sites is to take the values the star produces nearest the zenith, as it is within this region that airmass and brightness change the least. The data from the Gillam, Manitoba site was found to consistently produce such a curve, having an average pixel value of around 7500 near the zenith. Meanwhile, data from The Pas had an average pixel value of about 8500. The former is at a latitude of 56.35° while the latter is at 53.82°. According to JSkyCalc, the airmass at Capella's location, at Gillam's latitude,

is indeed higher than that at The Pas, meaning there's more atmosphere for Capella's light to pass through at Gillam, but whether the relative difference can be attributed entirely to atmospheric extinction hasn't been determined yet. This seems to me like a good step toward the goal of assessing whether the instruments placed at different sites operate identically.