Imaging Dynamic Solar Activity in Hydrogen-Alpha Light

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Abstract

In this project, we monitor the evolution of solar features, including prominences and filaments, as they travel across the solar surface. To do this, we take images by attaching a single lens reflex camera to a Coronado Hydrogen-alpha solar telescope, with the sensor plane at the focal plane. Light from the sun enters the objective lens. Each point on the solar surface corresponds to one point on the image plane. When viewing the image, these points are displayed as pixels. By calculating the arcseconds per pixel and the kilometers per pixel, we can determine the size of the solar features observed.

Feature Measurement Using Prime Focus Photography

Light from the sun enters the objective lens. Each point on the solar surface corresponds to one point on the image plane. When viewing the image, these points are displayed as pixels. By calculating the arcseconds per pixel and the kilometers per pixel, we can determine the size of the solar features observed. Plate Scale = 206265 (arcseconds in a radian)

Exposure Times

We find exposure times 0.004-0.01 seconds accentuate certain aspects of disk activity, while exposure times 0.025-0.1s bring out different aspects as well as better shown activity on the limb. Exposure times below 0.004s become too dark, while times between these two ranges listed blend most activity with the rest of the solar surface. Above 0.1s, the increased light begins to wash out the image making it difficult to distinguish any activity.

References


Prominence

4.87x10^5 km in height
3.71x10^5 km base width

Filament

1.39x10^5 km in length

Hydrogen-Alpha Light

White light images of the sun depict how the sun appears to the naked eye, white light being the collection of all visible wavelengths of light. Some features of the sun become lost in white light images, but if a filter is used to select which wavelengths are observed, this is no longer an issue. The Coronado H-alpha telescope is specifically designed to view red light of 393.4 nanometers. With this particular wavelength, we are able to see solar activities such as ribbon-like structures called “filaments” on the solar disk and “prominences” when seen extending off the solar limb.

Feature Measurement Using Eyepiece Projection Photography

This is comparable to prime focus photography with the addition of an eyepiece. We find the "/px and the km/px following calculation methods used with prime focus, and now take magnification into account. In Fig 1., the total image is compiled of separate images taken with 10mm eyepiece.

Calculating plate scale

Fig. 6. Cut across the base of a prominence.

Monitoring Brightness

Using pixel brightness values, we can monitor the brightness of a desired region (see fig. 4-7). An increasing value corresponds to a brightening region and a decreasing value to a dimming.

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