SOLAR BRIGHT POINTS IN 3840 Å AND Hα

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Abstract. Analysis of bright features in 3840 Å and Hα shows that for every Ellerman bomb (Hα—0.9 Å) there is a cospatial brightening in the 3840 Å network. We give properties of these bright points in both wavelengths as well as describe: (1) the appearance, and subsequent separation, of new elements in the 3840 Å network and (2) the direct transition from a 3840 Å bright point to a new sunspot.

1. Introduction

Observations at various wavelengths typically show the presence of distinct bright features in the solar atmosphere. In fact, Sheeley and Engvold (1970) have suggested that the intensity of bright points comprising the photospheric network is generally correlated with magnetic field strength when viewed in molecular and low-excitation lines of neutral metals; furthermore, the entire photospheric network visible around 3840 Å is cospatial with the photospheric field (Chapman, 1970) as well as with general features in the chromospheric network (Chapman and Sheeley, 1968).

Ellerman bombs (Ellerman, 1917) are also intense features, appearing in Hα with wings (mustaches) extending 8–10 Å from the center-line, and producing emission broadening in other strong Fraunhofer lines (Koval and Severny, 1956, 1961). As we will show Ellerman bombs are an integral part of the photospheric network and appear as bright points (Figure 1) in the many strong lines near 3840 Å. They are found primarily outside the penumbra of most sunspots and in arch-filament systems (Bruzek, 1967) herein referred to as emerging flux regions (EFR-Zirin, 1972). An EFR is a newly forming bipolar group and is characterized by surging and intense Hα emission at the feet of the dark fibrils connecting both polarities.

The present paper gives general properties of bright features in 3840 Å and Hα. Emphasis is placed on the comparison between Ellerman bombs (defined herein as bright when seen at Hα—0.9 Å) and related points in the 3840 Å network. Special attempts were made to determine the connection, if any, between bright elements in either wavelength and developing solar magnetic fields. In particular, the dramatic birth and evolution of several sunspots visible on July 27, 1971 in McMath 445 is described.

2. Source of Data

Each of the two 10 in. refractors at Big Bear Solar Observatory is mounted with a 35 mm camera taking pictures simultaneously in both wavelengths at 10 s intervals. For the present experiment a Halle filter with 0.5 Å HBW tuned to Hα—0.9 Å was