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Time series of solar coronal bright point

Abstract

The solar corona is covered by coronal bright points (CBPs) which are observable features in X-ray and extreme ultra violet wavelengths. Since statistical properties of BPs (e.g., size, lifetime) play important role in solar coronal evolution, lots of automatic detection methods and pattern recognition approaches were developed to detect (e.g., region growing function) and track these magnetic structures all over the corona. CBPs are appeared as different morphological structures such as point-like, small-loop, and small active regions in the corona. The properties of BPs can be contained important information about coronal heating. Here, we want to review some significant characteristics of BPs and give an outline about our idea to work with the time series of coronal BPs.

Keywords: Sun, corona, Sun, bright point (BP), Technique, region growing

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Introduction

The solar corona is the origin of many phenomena having a profound effect in space weather and interstellar medium. Historically, the corona is divided into three main regions: active region (AR), quiet Sun (QS), and coronal hole (CH).[1] Coronal bright points (CBPs), which are firstly observed in X-ray and extreme ultraviolet solar images (Figure 1, left panel) and discussed in,[2,3] are emerged in quiet-Sun regions and coronal holes. Typically, these bright features have lifetimes and sizes less than an hour and 60 arcsec, respectively.[3]

The appearance of CBPs can return to the configuration of magnetic flux and canceling of magnetic bipoles.[4,5] Nowadays, by increasing received data from the Sun with high- temporal and spatial resolution space-borne and ground-based instruments established, the needs for using automatic detections and pattern recognition approaches has increased.[6–10]

One of the important problems about the Sun is coronal heating that can be related to CBPs and nano-flares.[11] Studying statistical CBPs can reveal some characteristics of solar activity.[12] Presented lots of important statistical properties of CBPs from EUV images taken by *Solar Dynamic Observatory* (SDO)/ *Atmospheric Imaging Assembly* (AIA)[13] using automatic detection methods.

The basic procedure of work

Here, we cropped a part of full disc solar image including a CBP over sequential EUV images taken at 171Å recorded by SDO/AIA. Then, the region growing function was applied to the cropped images to segregate CBP in all consecutive images (Figure 1, right panel). The time cadence between two consecutive images is 12s. The mean intensity of this segmented feature was extracted as light curves (Figure 2). A sample of CBP time series (points) with a fitting of Gaussian function (blue line) are shown in Figure 2.

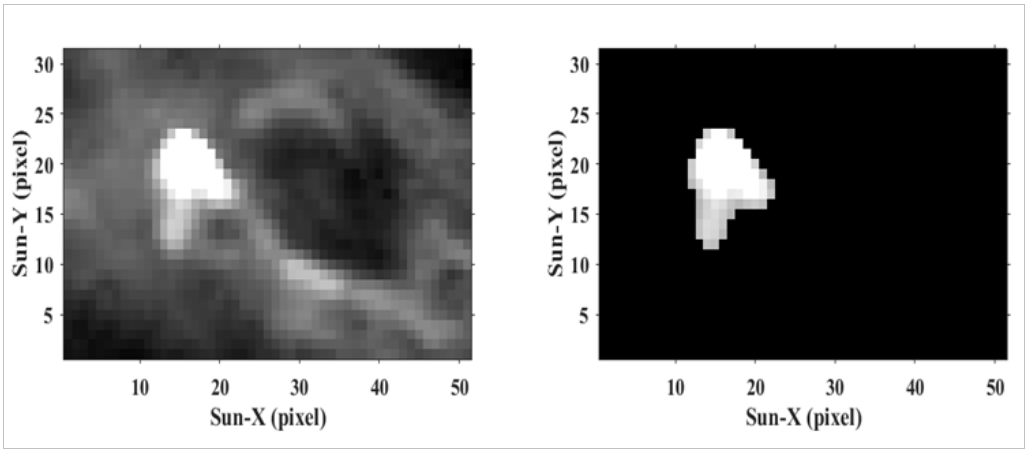

Figure 1 A cropped part of EUV image including a CBP recorded by SDO/AIA (left panel) taken at 171Å.A segmented image representing CBP (right panel).

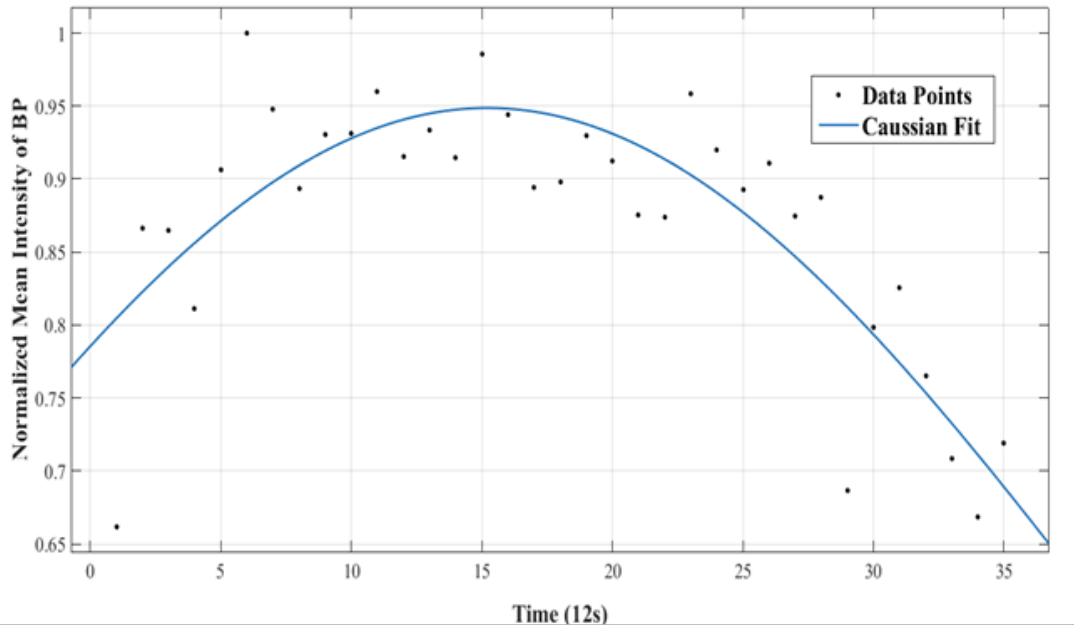

Figure 2 The extracted normalized mean intensity of one CBP (shown in Figure 1) over its lifetime in sequential EUV images with a time lag 12s. By applying a Gaussian fit, $f(x) = ae^{(-(x-b)/c)^2}$ the parameters *a*, *b* and *c* were obtained 0.95, 15.21, and 35, respectively.

Conclusion

As it is seen in Figure 2, the rising and the decay of mean intensity of the selected CBP has been occurred over approximately 7 minutes. We applied a Gaussian fit as $f(x) = ae^{(-(x-b)/c)^2}$ to the normalized light curve of the CBP. The parameters *a*, *b* and *c* were obtained 0.95, 15.21, and 35, respectively, with 95% confidence. The peak of fitting shows that the brightness of CBP reached at maximum value at 3 minutes. In the future, we aim to investigate some properties of CBPs time series, statistically, over their lifetimes. The statistical moments of CBPs (e.g., mean, variance, and skewness) may contain important information.

Acknowledgments

None.

Conflicts of interest

The author declares there is conflict of interest.

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