

# EVIDENCE OF ASYMMETRIC VARIATION OF THE EMISSIONS OF THE SOLAR CORONA

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**Abstract.** We attempt to present clear evidence that the east coronal hemisphere appears brighter than the west in the green and the red spectral emissions as well as in the white light of the solar corona. In addition, a simple scenario which could explain optical inequalities between the east and the west solar hemisphere has been formulated.

**Key words:** Green Line – Red Line – Solar Corona

## 1. Introduction

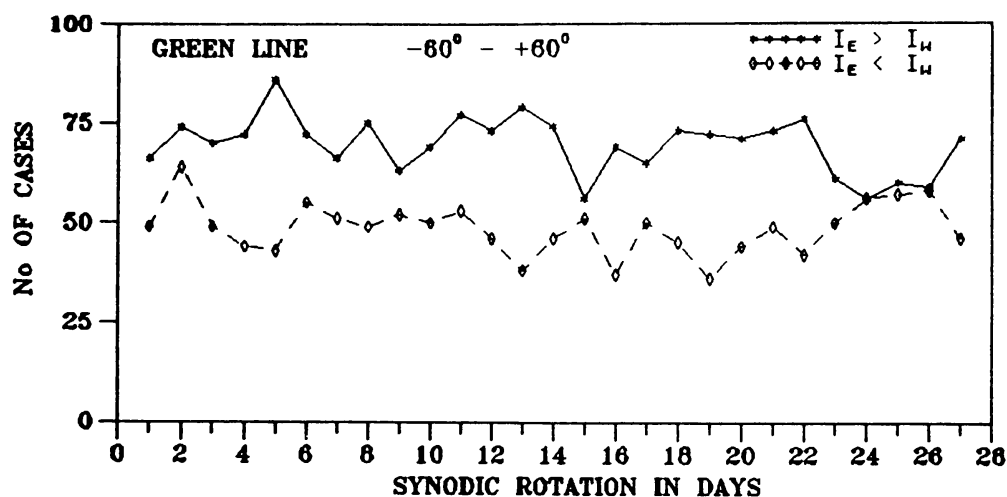
Some evidence that the east solar limb appears brighter than the west has been presented even since the sixties but nothing has been confirmed up today (Trellis, 1960; Tritakis *et al.*, 1988; Tyagun and Rybanský, 1981; Xanthakis *et al.*, 1991). In the present article we try to underline obvious evidence that the east limb brightness is higher than the west in the optical emissions of the corona, that is in the green, red and the white light. All the work has been based on daily measurements of the absolute intensity of the coronal emission lines  $\lambda 5303 \text{ \AA}$ ,  $\lambda 6374 \text{ \AA}$  and the white light which have been collected by the Pic du Midi observatory within the period 1944-1974. These data sets have been separated in 27 time series each, which start from the 27 first days of the record, respectively. In this way, each time series contains data with time lag of 27 days, that is data which correspond to the same, more or less, areas of the solar corona.

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## 2. Inequality in the Brightness of the Green, Red and White Light Between the East and the West Coronal Hemisphere

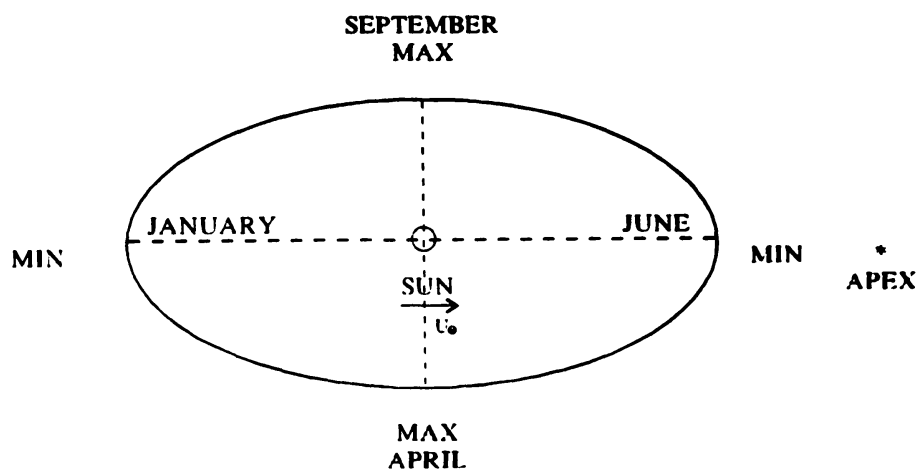
The detection of possible inequalities between the east and the west solar limb has been succeeded by the calculation of the asymmetry coefficient  $I=(E-W)/(E+W)$ , where  $E$  and  $W$  are intensities of an optical emission around the east or the west solar limb, respectively, for successive days with a time lag of 27 days that is during days they differ by a whole solar rotation. In this way, we compare intensities that always coincide with the same more or less areas of the Sun. In Fig. 1 a sample of results of the above mentioned comparison where the number of cases when the east part of the solar corona appears brighter ( $I_E > I_W$ ) or fainter ( $I_E < I_W$ ) than the west in the green spectral emission of the corona, is depicted. From this figure it is obvious that the east part of the solar corona appears brighter than the west, in most cases.



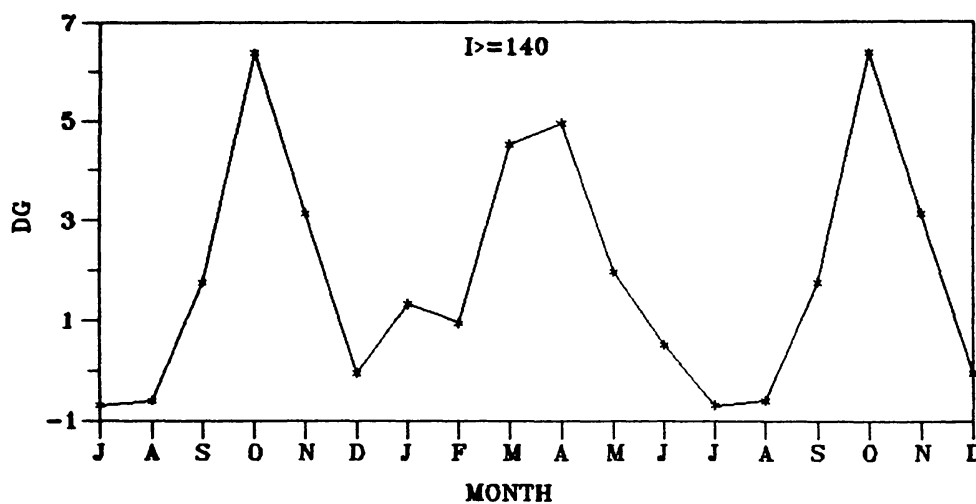
**Figure 1.** Number of cases where the east part of the solar corona appears brighter ( $I_E > I_W$ ) or fainter ( $I_E < I_W$ ) than the west in the green line emission. Observations within a  $\pm 60^\circ$  latitude zone on both sides of the solar equator have been taken into account.

## 3. Possible Scenario

Several authors have mentioned that the motion of the Sun towards the apex causes activity enhancements in the solar hemisphere which faces to this point. From this point of view, when the Earth stands on the solstices (in June and January) the inequalities between the east and west solar limb should be almost zero. In contrast, when the Earth stands on the equinoxes (in September and April) the maximum of the east-west inequalities should be observed (Fig. 2). In Fig. 3, epoch analysis of the east-west differences of the green coronal absolute brightness for observations with



**Figure 2.** Epochal location of the Earth around the Sun, in relation to the apex point. Areas of maximum and minimum values of the east-west difference of the coronal spectral brightness are also depicted.



**Figure 3.** Superposed epoch analysis of the green line intensities above the threshold of  $140 \times 10^{-6} B_{\odot}$ .

intensities above the threshold of  $140 \times 10^{-6} B_{\odot}$ , where  $B_{\odot}$  is the absolute photospheric brightness in the center of the solar disk, is depicted. It is very interesting that in this figure there are very clear peaks around April and October (equinoxes) while very low values appear in the intermediate months.

## 4. Conclusion

It is very possible that the east-west inequality which seems to appear in the intensity of the green spectral emission line of the solar corona concerns the very high intensities, above the threshold of  $140 \times 10^{-6} B_{\odot}$ , when the Earth is located around the equinoxes.

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