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Characteristic features of CMEs with respect to their source region

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It is well known that during coronal mass ejections (CMEs) a large amount of matter expels out from the sun's outer atmosphere. These ejections typically comprise millions of tons of material in the form of charge particles. Statistical investigation of coronal mass ejection during 1996 to 2004 has been carried out. The CMEs are classified into two classes, namely class (A) those occur with position angle in the range 200-350 degree and Class (B) those occur with position angle with range 50-150 degrees. It is found the properties of class A differ from that of class B. The occurrence and speed of class A are much higher than the class B.

1. Introduction

Coronal mass ejections (CMEs) are large-scale magnetized plasma structures that erupt from the sun and are transported into the heliosphere [1]. CMEs typically appear as loop-like features that disrupt helmet streamers in the solar corona. The coronagraph/ polarimeter [2] on board the Solar Maximum Mission (SMM) allowed identification of many of the properties of CMEs. The Solar and Heliospheric observatory (SOHO) spacecraft has now extensively observed CME events from solar minimum in 1996 into the present maximum phase of the solar cycle. Some of the properties of the SOHO/LASCO CMEs have been described by [3-6]. In this paper various properties of coronal mass ejection classified by their source region (position angle) are presented.

2. Selection criteria and data analysis

Our current knowledge on coronal mass ejections (CMEs) comes from two spatial domains: the near sun (up to 30 solar radii) region remote-sensed by coronagraph and the geospace and beyond where *in situ* observations are made by spacecraft. In the present study we have analyzed in detail all coronal mass ejections occurred during current solar cycle 23. Here we have taken new aspect to clarify the properties of coronal mass ejections. We have classified CMEs into two classes with respect to their position angle, namely class A and B respectively as (A) those occur with position angle in the range 200-350 degree (B) those occur with position angle with range 50-150 degree. Only small percentages of CMEs (5%) occur out of these classes. We have observed CMEs during the period 1996-2004. The occurrences of CMES is obtained from the website http://cdaw.gsfc.nasa.gov/cme list.

3. Results and Discussion

In order to classify coronal mass ejection with respect to their position angle, we have analyzed 4164CMEs (in class A) and 2416 CMEs (in class B) occurred during period of 1996-2004. The line graph of annual occurrence of two classes of CMEs is depicted in fig. 1. In the year 1996,which is the year of minimum solar activity, the occurrence of class B CMEs is not more than hundred where as, occurrence of class A CMEs is more than class B.The maximum number of both types of CME is observed in the 2002,but the occurrence rate of class A CME is more in comparison to class B [7].

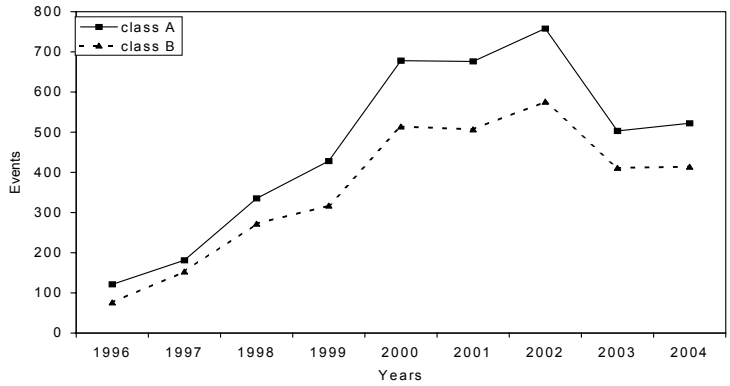

Figure 1. Vairability of occurrence of CME

The CME speed is determine when at least two height measurements are available. Sometime data gap resulted in our inability to measure the speeds of about 4% of the CMEs.

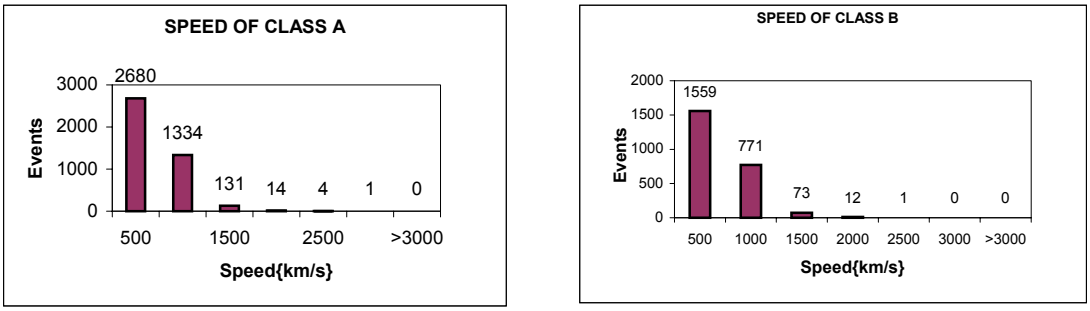

Figure2. Histogram of speed distribution of CME.

The speed of both classes of CME is depicted in figure 2. Here we have found that the speed of class A CME is more than class B in all the velocity ranges. Maximum number of CMEs of class A and B occurred in the range of 500km/s. It is also found that average speed of both classes is similar, which is 462km/s.

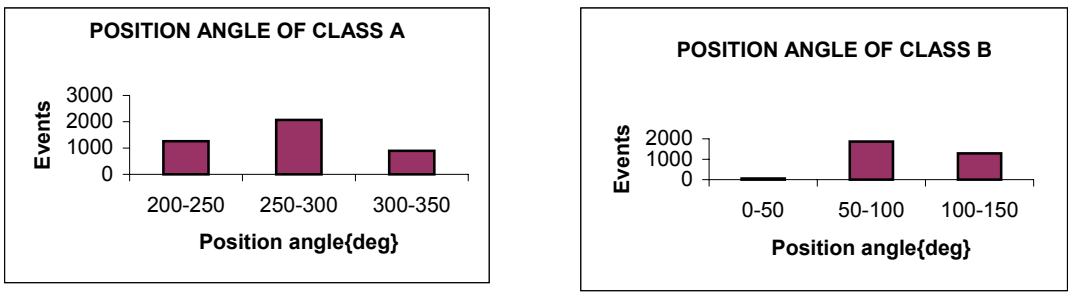

Figure.3 Histogram of the position angle distribution of CMEs.

The position angle is measured by difference of two outer edges of CMEs in the sky plane. The position angle extents are generally measured by coronagraph. The histogram of the position angle is depicted in fig.3.Here we

have also found that in class A CME, maximum number of CMEs occurred in the range 250-300degree where as minimum number of CMEs occurred in the range 300-350 degree. In case of class B CME maximum number of CMEs occurred in the range 50-100 degree and minimum number of CMEs occurred in the range 0-50 degree. This is also confirmed by earlier researchers [8].

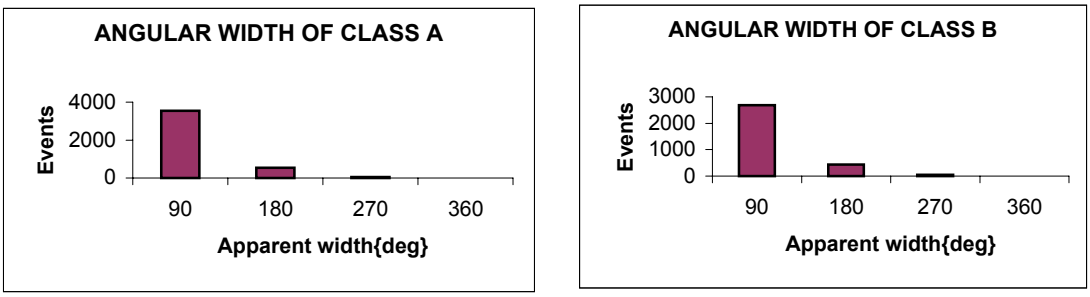

Figure 4. Histogram of angular width distribution of CMEs.

Fig.4 shows distribution of the apparent angular width of class A and class B from 1996 to 2004.In order to investigate the properties of CMEs with different angular widths, we simply grouped CMEs into four populations:(0-90º), (90-180º), (180-270º) and (270-360º). It is found that in the width distribution, the maximum numbers of CMEs occur in range 0-90º in both classes, but the number of occurrence rate of class A CME is greater than class B CME.

4. Conclusion

On the basis of above analysis, it is concluded that the occurrence rate of class A CME is greater than class B. The occurrence of both classes generally follows the phase of solar cycle. The average speed of both classes is found to be similar. The maximum numbers of CMEs (class A) have occurred in the range 250-300 º (position angle). The minimum numbers of CMEs (class B) have occurred in the range 0-50º(position angle). Hence results discussed as above clearly indicate that the properties of class A differ from that of class B.

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