ABSTRACT

In order to improve our current understanding about Prominence Eruptions, we have carried out study of Prominence Eruptions associated CMEs during the solar cycle 23.

The new observations from NORH and SOHO have improved our Knowledge and understanding of Prominence Eruptions and CMEs in many ways, with extended spatial and spectral coverage, as well as improved sensitivity and dynamic range over earlier radiographs and coronagraphs.

Prominences are caused by charged solar material being caught up by the strong magnetic field loops and lifted off of the surface. If the magnetic field is strong enough, it can pull the particles out of the pull of the Sun's gravity and create coronal mass ejections. It is well established that quite often prominence eruptions (PEs) are associated with coronal mass ejections (CMEs). A proper understanding of the prominences can be provide useful information about solar sources and, this study provides a diagnostic tool for studying the association rate between PEs and CMEs. Recent researches have established that during the ascending phase of solar activity, large geomagnetic storms are correlated with the passage of interplanetary CMEs towards Earth. CMEs are strongly correlated with eruptive prominences, which are, turn in, and linked to geomagnetic storms. The predicting of prominence associated with CMEs is important for preventing damage to instruments in space and at earth.

The eruption of limb prominence on 7 December 2001 associated with CMEs is investigated. The prominence reached a height of 3, 86,428 km. The maximum velocity observed was 87.5 km/sec. Finally, the energy and mass stored in the prominence of the associated CMEs is estimated.

The observations show the well known three-part structure of CMEs: a bright leading edge, a dark cavity, and a bright core (prominence). The spatial

and temporal correlation between prominence eruption and initiation of CME is found by us is good. Since there was no flare or radio burst associated with the eruption, our analysis supports the idea that neither radio bursts nor flares are necessary for CMEs production though generally, they have good association with CMEs.

We have found that the average kinetic energy of the CMEs is about 2.2×10^{30} erg, whereas the average kinetic energy stored in the prominence is about 1.69×10^{24} erg. The average mass of CMEs is about 2.9×10^{15} gm and that of prominence is about 5.1×10^{10} gm. Clearly the average mass of CMEs is greater than that of PEs. Further PEs could be the inner core of CMEs. These values suggest that CMEs moving faster than prominence.

In this thesis, the relationship of PEs and the associated CMEs by using a large data set for the period 2002-2008 covering solar cycle 23, have been investigated. NORH observed 165 prominences of all types, out of them 66% are found radial events (Eruptive prominences/EPs) while only 33% are transverse events (Active prominences/APs). When we compare the data with white- light CMEs data it is found that 41% Prominences are clearly associated with CMEs and 62% of CMEs associated with EPs have cores, while only 46% APs have cores. We found that the average height and speed of radial events are larger than the transverse events and 99% of EPs reached at height $1.1R_o$ (solar radius). Our study of temporal and spatial behaviour of prominence and CMEs events shows that the PEs and CMEs seem to start nearly at the same time.

We have studied some properties such as speed, apparent width, acceleration and latitudes, etc. of all types of Prominence Eruptions (PEs) and the associated Coronal Mass Ejections (CMEs) observed during the period of 1997-2006 covering the solar cycle 23.

During this period more than 14000 CMEs were observed by SOHO/LASCO, whereas NORH has found 376 prominence eruption events, out of them 195 prominences are associated with CMEs.

The average speed of prominences and associated CMEs are 51km/sec and 559km/sec, respectively. The average angular width is 32^{o} and 74^{o}, respectively. As expected the associated CMEs are relatively faster and wider than the prominences. About 6% of prominences show little acceleration, i.e. they move with constant speed, but about 53% of prominence decelerated i.e. their speed goes on decreasing as they move away from the Sun. The remaining 40% have positive acceleration, i.e. their speed goes on increasing. The distributions of PEs are biased towards deceleration. About 4% associated CMEs show little acceleration whereas 45% of CMEs are decelerated. The remaining 49% have positive acceleration. The associated CMEs have a clear bias towards positive acceleration.

The present study is important as PEs associated CMEs may provide an excellent source of advanced warning of geoeffective solar eruptions.

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