“Prominence Eruptions” Associated with “coronal Mass Ejections”

INTRODUCTION:-

Solar Phenomena have been divided into two classes ‘quiet’ and ‘active’. The quiet sun is viewed as a static, spherically symmetric ball of plasma whose depend to a first approximation on radial distance from the centre and whose magnetic field is negligible. The active sun consists of transient Phenomenon: such as sun spots, Prominences and flares, which are superimposed on quiet atmosphere and most of which exist because of the magnetic field. In fact magnetic field influences both, quiet as well as active sun.

The sun ejects matter into space. There appear to be two basic ejection classes, the first leading to the “Solar Wind” outflow and the second leading to the occasional ejection of huge discrete clouds know as “coronal mass ejections (CMEs)” (Harrison,2000). CMEs were first detected in the 1970’s by the “orbiting solar observatory” (Tousey,1973). They come out from close magnetic field regions on the sun; such as active regions, filament regions or a combination there of (Gopalswamy,2001). They are large scale solar phenomena during which 10^{11}-10^{13} kg of atmospheric magneto-plasma is put into interplanetary space at speeds ranging from several ten km/s, up to 2000km/s(Maricic et al; 2003). Associated with this eruption 10^{31}-10^{32} ergs of energy is released which is presumably supplied by the magnetic field (Riley et al;2002) CMEs often show a three part structure: The bright frontal loop, a dark cavity and the prominence.

Solar prominences are ribbons of cool (~8000k) dense gas (~10^{-11}g/Cm3) embedded in the hot tenuous corona, which forms the outer atmosphere of the sun. Magnetic fields play an important role in supporting the prominence against gravity and insulating it from the hot surrounding corona.

Prominence eruptions are one of the earliest known forms of mass ejections from the sun and have received considerable attention since the

late 1899's(see, e.g.,Tandberg-Hanssen,1995, for a historical introduction on prominences and their dynamics). Two primary types of mass motions have been recognized in prominences, one with material streaming from one part of the solar surface to another("active prominences") and the other with prominence material leaving the sun partially or completely ("eruptive prominences"). A detailed study of these moving prominences is important for a clear understanding of coronal mass ejections (CMEs) because we know now that the inner core of CMEs is made up of prominence material (see, eg., House et al;1981).

We classified the PEs as radial and transverse, depending on whether the prominence moved predominantly in the radial or horizontal direction. The radial events were faster and attained a larger height above the solar surface than the transverse events. Out of the 186 events studied, 152(82%) were radial events, while only 34(18%) were transverse events. Comparison with white-light CME data revealed that 134(72%) PEs were clearly associated with CMEs.

AIM:-

The phenomenon of prominences has been known and studied for 28 years. The relations between prominences and CMEs are very complicated: Prominence eruptions is the near surface activity most frequently associated with CMEs : Works on CMEs often treated the prominence eruption as a secondary process during the CME phenomenon because prominence may not have enough energy to drive CMEs (Hundhausen 1999; smith et al; 1992). However, Filippov(1998) has shown that CMEs can be caused by the eruption of inverse- polarity prominences i.e.; the mechanism of the prominence/CME eruption is not yet fully understood and is one of the outstanding issues of the solar physics.

Our aim is study the statistical properties and solar cycle variation of the prominence eruptions and to find the relationship between the CMEs and the prominence eruptions.

LITERATURE SURVEY:-

Following facts have emerged from the studies carried out so far:-
1. It is widely accepted that prominence eruptions are the near- surface activity most often associated with CMEs
(Gopalswamy et al; 2003).

2. Take-off of the prominence and the overlying structure is tightly synchronized, favoring the hypothesis according to which the whole structure erupts as a single entity (Maricic et al; 2004).

3. The eruption of the prominence and the associated magnetic structure could be considered as a process of catastrophic loss of equilibrium (cf. Forbes,2000).

4. The energy stored in the prominence is sufficient to power associated CMEs. The decrease in magnetic energy is direct consequence of CME expansion, this indicating that the CMEs are magnetically driven and internally powered (Ali et al,2006).

5. It is widely believed that the prominence /filament attain a critical twist before eruption (Torok & Kliem, 2003,2005).

6. The CME association of a set of H-alpha prominence eruptions and found that 92% of the eruptive prominences and 46% of the active prominence were associated with CMEs (Gilbert et al,2000).

7. 134 CMEs identified to be associated with the prominence events, 98(73%) had clear white light cores. This rate is slightly higher than the 65% reported by hori &Culhane(2002).

8. The eruption at limb on 21 April 2001 associated with two coronal mass ejections is investigated H-alpha images reveal two large-scale eruptions both showing helical internal structure. (Ali et al,2007).

9. Dynamic evolution of eruptive prominence has been highlighted as one of the keys to understanding the initiation of CME (Gilbert et al,2000).

PROPOSED PLAN:-

1. we shall try to understand the eruption of limb prominence Associated with coronal mass ejection (CMEs).

2. We shall try to study the spatial and temporal association between the prominence eruption with the corresponding CMEs, as well as their energetics.

3. We shall also study the kinematics and the geometric parameters of the prominence.

4. In the end we will try to study the relationship between the prominence & the CMEs eruptions and to examine the properties of prominences and CMEs associated with these events.

IMPORTANCE:-

CMEs constitute one of the primary factors influencing the non-recurrent dynamic conditions in the near earth space environment. This study provides a diagnostic tool for studying the association rate, relative timing and spatial correspondence between PEs & CMEs. The predicting of prominence associated with CMEs is important for preventing damage to instruments in space and at earth. The study is also important for forecasting weather more correctly.

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