Investigating the Coronal Magnetic Field from the Type-II radio burst event on 2 May 2013

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Abstract

We studied the characteristics of the Type-II solar radio burst event which occurred on 2 May 2013 through combined space observations from the Solar and Heliospheric Observatory (SOHO) and the Solar Terrestrial Relations Observatory (STEREO), in parallel with the ground-based observation from the DARO-CALLISTO station in Germany. The type-II burst frequency range was 25 – 180 MHz and it was preceded by a group of Type-III radio bursts related to a solar flare event (M1.1) from the same active region (AR 1731).

We calculated the density jump and the Alfven Mach number by applying the Rankin – Hugoniot relations on the clear band-splitting. By using the four-fold Newkirk electron density model we could convert the plasma frequency of the type-II burst into height [R] in terms of solar radii. Then we calculated the shock speed [Vs], the Alfven speed [Va], and the coronal magnetic field strength [B] at heights ranging from 1.961 – 1.988 Rs. The accompanied partial-halo (Angular width = 344o from SOHO) CME event was detected by STEREO Ahead, with a linear speed 518 km s-1, by STEREO Behind, with a linear speed 429 km s-1, and by SOHO, with a linear speed 671 km s-1, and we traced the evolution of the event using the height-time profile.

We found a common behavior in the shock speed, Alfven speed, and the coronal magnetic field strength dependencies with height, in which these features are decreasing steeply with height until reaching the height (~ 1.975 Rs) then they continue decreasing slightly.

Investigating the Coronal Mass Ejections associated with DH-Type-II radio bursts and solar flares during the solar cycle 24

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Abstract

We studied a set of 92 CME events, with focusing on the halo-CMEs, associated with decametric – hectometric (DH) Type-II radio bursts and solar flares during the period 2008 – 2014. The datasets used in this work are obtained from the SOHO/LASCO CME catalog, the WIND/WAVES catalog of DH-type-II radio bursts, and the NOAA reports for details about the solar flare.

We found that the events are mostly distributed at 14.47o at the northern solar hemisphere and -16.13o at the southern solar hemisphere. There was a longitudinal dependence for the CME width, speed, acceleration, mass, and kinetic energy. For the CME width, most of the disk events were partial halo CMEs (90%), while the halo-CMEs were comprising 73.3%. and their number was decreasing with longitude to be 64.9% for partial halo-CMEs and 47.7% for halo-CMEs.

For the CME speeds, the mean speed showed an inverse proportionality with the longitude, in which the disk events had a mean speed of ~ 2479 km s-1, while the limb events had a mean speed of ~ 1280 km s-1. For the CME acceleration, it was obvious that all CMEs were decelerated and the limb CMEs. For the CME energies and masses, the disk and intermediate CMEs had the least mean kinetic energies, 7.8 × 1031 and 7.02 × 1031 ergs, respectively. And also the least mean masses, 8.69 × 1015 and 9.21 × 1015 g, respectively. While the limb CMEs had the highest mean kinetic energy (1.48 × 1032 ergs) and mean mass (1.17 × 1016 g). The mean peak fluxes of solar flares for different longitudes were comparable to each other but the disk flares were a little bit more energetic, but the limb flares tended to last longer with a mean duration of 95.3 minutes.

There were correlations between the CME’s kinetic energy and its initial speed (R = 0.5), the duration of the associated flare (R = 0.5), the peak flux of the associated flare (R = 0.7), and the duration of the associated DH-type-II radio burst (R = 0.6). We found that the longer the duration of the DH-type-II radio burst is, the more energy it has. And the more energy and mass the CME have, the less frequent it occurs.