Radial Evolution and Turbulence Characteristics of a coronal mass ejection

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We investigate a coronal mass ejection (CME) associated with an X3.9 solar flare occurred on 25 June 1992. The soft X-ray light curve observed by the GOES satellite reveals this flare to a long-duration event. A system of large post-flare loops and their evolution have been observed at the activity site throughout the period of the enhanced X-ray emission. The moving metric type IV radio burst indicates the speed of the ejecta to be $\sim$350 kms^{-1}. The solar proton intensities, in the energy range 1–100 Mev observed in the interplanetary medium, show gradual-decay profiles lasting for more than two days and suggest the acceleration process happening at the loop top. However, the delayed-proton-event onset at the Ulysses spacecraft, way far from the sun, is the consequence of the acceleration of the ambient plasma and it is consistent with the scintillation results obtained over a range of distances (0.2–1 AU). The interplanetary scintillation data reported in this study have been obtained from the Ooty Radio Telescope and the Solar Terrestrial Environment Laboratory measurements at 327 MHz. The scintillation data are useful to infer the spatial and kinematical characteristics of the propagating mass and the results indicate that the the speed of the CME could have climbed to a maximum of $\sim$2500 kms^{-1} and then decelerated as $V_{CME} \sim R^{-0.8}$. The speeds obtained from the radio and scintillation results are suggestive that the coronal shock wave may be absent in the interplanetary medium. Further, the density turbulence spectrum within the CME seems to be flatter, $\Phi_{N_e(CME)} \sim \kappa^{-2.8}$, also having a small dissipative-scale length, $S_{i(CME)} \leq 5$ km and it is significantly different from that of high-speed flow from coronal holes and low-speed wind originating above closed-field coronal streamers. The turbulence spectrum provides information on the region of the corona where the CME originated.