Kinetic manifestation of the current profile bounding the magnetic decrease (MD) structure

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Generation mechanisms of a magnetic decrease (MD) structure, the localized depression in the magnetic field intensity, can be associated with the evolution of nonlinear Alfven waves. Most of MDs are dominantly formed close to the rear edge of a corotational interaction region (CIR), where the fast solar wind interacts with the slow wind flowing ahead. In recent MHD simulations, we have investigated the process of Alfvenic rotational field fluctuation embedded in the fast solar wind which is carried into a CIR: It is shown that this Alfvenic fluctuation disintegrates into two Alfven modes traveling in opposite directions in a plasma-rest frame. When the fluctuation field passes through the reverse shock, a local maximum in one field component emerges due to the amplification by the shock, resulting in the formation of a strong current structure which violates the force balance. The resultant net force sweeps the plasma backward to form a pressure increase and simultaneous magnetic decrease. The other edge of this structure, associated with the MD, affords another diamagnetic current, which becomes the source for a reverse Alfven mode at the trailing edge of the MD. In this way, these two Alfven modes (or associated current structures) constitute the boundaries of a MD. Kinetic manifestation of such current layer is also investigated by performing hybrid simulations to verify the processes of MD-associated energetics.