ABSTRACT:

Title : Interchange slip-running reconnection and sweeping SEP-beams

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Abstract : We present a new model to explain how particles, accelerated at a reconnection site that is not magnetically connected to the Earth, could eventually propagate along the well-connected open flux tube. Our model is based on the results of a low-beta resistive magnetohydrodynamics simulation of a three-dimensional line-tied and initially current-free bipole, that is embedded in a non-uniform open potential field. The topology of this configuration is that of an asymmetric coronal null-point, with a closed fan surface and an open outer spine. When driven by slow photospheric shearing motions, field lines, initially fully anchored below the fan dome, reconnect at the null point, and jump to the open magnetic domain. This is the standard interchange mode as sketched and calculated in 2D. The key result in 3D is that, reconnected open field lines located in the vicinity of the outer spine, keep reconnecting continuously, across an open quasi-separatrix layer, as previously identified for non-open-null-point reconnection. The apparent slipping motion of these field lines leads to form an extended narrow magnetic flux tube at high altitude. Because of the slip-running reconnection, we conjecture that if energetic particles would be travelling through, or be accelerated inside, the diffusion region, they would be successively injected along continuously reconnecting field lines that are connected farther and farther from the spine. At the scale of the full Sun, owing to the super-radial expansion of field lines below 3 solar radius, such energetic particles could easily be injected in field lines slipping over significant distances, and could eventually reach the distant flux tube that is well-connected to the Earth.
