

3D magnetic null points as a site for reconnection

We explore the behaviour of three-dimensional magnetic null points which are subjected to various perturbations. We begin by discussing the response of perturbed line-tied 3D magnetic null points under a relaxation process. The results of simulations are presented, which illustrate that for certain types of perturbation, a current singularity forms at the null point. As in the case of a 2D X-point, the only requirement for singularity formation is that the separatrix field lines are subjected to some shear which acts to close up the angle between them.

We go on to describe the results of dynamical simulations for various types of perturbation of an initially potential null point. In particular we focus on the types of current concentration which may develop in the vicinity of the null. It is demonstrated that rotational-type perturbations lead to currents on the spine and fan of the null, whereas shearing perturbations of the separatrices lead to currents which focus in towards the null point itself. The resulting flows and field line behaviour are discussed.