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Collisionless magnetic reconnection in double current layers

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Reconnection activity in adjacent current sheets can proceed in one of three different manners. First, if the distance between current sheets is sufficiently large, reconnection in each layer may proceed unaffected by the presence of the other. In this case, each layer can be treated as an independent reconnection problem. In the second scenario, it is conceivable that reconnection and its effects, such as magnetic islands, may begin to interact with each other if the two initial current layers are close enough to each other. At this point, magnetic field deformations generated by magnetic islands in one layer may be transmitted to the other layer. This interaction may suppress or enhance activity in each individual layer. In the third scenario, a sufficiently close proximity between neighboring current layers may lead to island overlapping, and ultimately to magnetic field percolation and magnetic reconnection effects across both layers simultaneously. In this paper, we present analytical estimates and the results of numerical simulations, which address all three scenarios. In particular, we will study the rate and mechanism of magnetic reconnection in each layer, and investigate the cross-layer interaction as a function of inter-layer distance by means of a percolation measure.