The impact of geometrical constraints on collisionless magnetic reconnection

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One of the most often cited features associated with collisionless magnetic reconnection is a Hall-type magnetic field, which leads, in antiparallel geometries, to a quadrupolar magnetic field signature. The combination of this out of plane magnetic field with the reconnection in-plane magnetic field leads to angling of magnetic flux tubes out of the plane defined by the incoming magnetic flux. Because it is propagated by Whistler waves, the quadrupolar field can extend over large distances in relatively short amounts of time – in fact, it will extend to the boundary of any modeling domain. In reality, however, the surrounding plasma and magnetic field geometry, defined, for example, by the overall solar wind flow, will in practice limit the extend over which a flux tube can be angled out of the main plain. This poses the question to what extent geometric constraints limit or control the reconnection process and this is the question investigated in this presentation. The investigation will involve a comparison of calculations, where open boundary conditions are set up to mimic either free or constrained geometries. We will compare momentum transport, the geometry of the reconnection regions, and the acceleration if ions and electrons to provide the current sheet in the outflow jet.