Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

The role of kinetic ions in magnetic reconnection ADAM STANIER, WILLIAM DAUGHTON, ANDREI SIMAKOV, LUIS CHACON, ARI LE, Los Alamos Natl Lab, HOMA KARIMABADI, Sciberquest, JONATHAN NG, AMITAVA BHATTACHARJEE, PPPL — To explain many magnetised plasma phenomena in nature and the laboratory, it is important to understand how the rates of magnetic reconnection behave in large and weakly collisional systems. A key question concerns what physics must be retained within reduced models to be able to reproduce the reconnection rates and global behaviour of fully kinetic systems. Here we model the coalescence of magnetic islands with a range of guide fields that have application to the Earth's magnetosphere. It is demonstrated that the Hall-MHD model is able to reproduce the reconnection rates of the fully kinetic system only in the presence of a fairly strong guide field ($B_g \geq 3B_x$). In the weak guide field limit non-isotropic ion pressure tensor effects that are missing from Hall-MHD are crucial to describe many key features of this reconnection test-problem [1], including the peak and average rates, pile-up field, outflow velocity, and global evolution of the system. A hybrid model which retains the full kinetic physics for ions along with mass-less fluid electrons gives good agreement with fully kinetic results for the full range of guide fields considered. These results suggest that kinetic ions may be important for a large number of reconnection events in the Earth's magnetosphere.

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Date submitted: 16 Jul 2016 Electronic form version 1.4