Effect of ion temperature anisotropy on explosive magnetic reconnection

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How quickly and explosively to trigger magnetic reconnection is one of the most interesting and important problems in space plasma physics. Recent three-dimensional full-particle simulations have shown that the ion temperature anisotropy (alpha_i = Ti,perp/Ti,para) played an important role in triggering of large-scale reconnection in a super-ion-scale current sheet. Comparison with two-dimensional simulations that exclude the lower-hybrid drift instability (LHDI) effects confirmed that the saturation level enhancement was due to the ion anisotropy effects, while the LHDI effects shorted the overall time scale significantly. Those results implied that the ion temperature anisotropy was one of the key properties that enable large-scale magnetic reconnection to develop in a super-ion-scale current sheet. While that study was made in a limited anisotropy case (alpha_i=2), we have investigated parametric survey varying alpha_i=1.5 to 2 in order to see how the initial ion anisotropy will change either the reconnection rate or the saturation level, using two-dimensional full-particle simulations. We found a critical value of alpha_i, under which no explosive reconnection takes place.