Triggering of explosive reconnection in a thick current sheet by temperature anisotropy boosted tearing mode

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It has been widely believed that collisionless magnetic reconnection is triggered when the current sheet thickness thins and becomes comparable to the ion larmor/inertia scale. Here we challenge this argument by performing two-dimensional kinetic simulations of magnetic reconnection triggering. In the simulations, the current sheet subject to reconnection is filled with plasmas having temperature anisotropy and its thickness (L) is larger than the ion scale. Previous studies showed that the growth rate of the tearing mode is enhanced by the anisotropy and the current sheet with L=1, in which the ordinary tearing mode is not effective in triggering vigorous reconnection, is destabilized by the temperature anisotropy boosted tearing mode. What we newly show here is that the temperature anisotropy boosted mode seeds explosive magnetic reconnection even when the initial current sheet thickness is made more than an order of magnitude thicker. The highlight results are: (1) the mass ratio is not an issue in this study allowing us to explore the unprecedented large-L case mentioned above, and (2) the maximum reconnection rate has no dependence on the initial sheet thickness and peaks at 0.2 (in the widely used normalized unit). We also discuss the physical process through which the non-linear tearing instability evolves into explosive magnetic reconnection.