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Significant electron heating associated with magnetic island coalescence

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Kinetic properties of magnetic island calescence observed in the non-linear stage of the collisionless tearing instability have been studied. We have carried out a three-dimensional full kinetic simulation of the Harris current sheet with a large and long enough simulation run just for two islands coalescence. In the course of the coalescence, significant electron heating is observed. The amount of electron energy in the resultant island is found to be much larger than that observed in the single island case without coalescence. During the two islands coalescence, the reversed Hall current loop is enhanced around one X-line, which is going to become the resultant O-point. The strength of the quadrupolar magnetic field due to the reversed Hall current exceeds that observed around another X-line. The strong electron current flows in the narrow channel around the neutral sheet, and it is accelerated in the direction from the resultant O-point to the X-point. The interesting fact is that the enhanced current does not seem to be accelerated from the X-line. The simulation results suggest that the enhancement of the electron current in the coalescence island is responsible for the observed electron heating. We will discuss the relation between the electron current enhancement and the electron heating in detail.