Numerical Research on Coalescence of Magnetic Islands to Study Effects of Impotant Parameters on Structural Changes around O-point

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A series of computational research has been done to investigate coalescence of magnetic islands during magnetic reconnection by two-dimensional (2-D) particle-in-cell (PIC) code. In this research we have focused on structures in the magnetic O-point, in which a final coalescence occurs. Especially, the structures of out-of-plane magnetic field have been argued. A systematic survey has been done varying D_0, m, B_G and M, where D_0 is the initial current sheet half thickness, m is the number of the initial small magnetic islands, B_G is the initial value of out-of-plane magnetic field, and M is the ion-to-electron mass ratio, respectively. In the initial setup, we chose one-dimensional Harris equilibrium with small perturbations used in the Geospace Environment Modeling (GEM). **First** influence of m on structures of out-of-plane magnetic field is discussed. If m=2, quadrupole magnetic field comes out when two islands are merging into final bigger island. The direction of the magnetic field is opposite to the Hall magnetic field. Thus in this presentation, this coalescence is named "reversed Hall" type. In contrast, when m=4 and 8, the structure is quite different from that of "reversed Hall" type. When well-matured two magnetic islands (composed of 2 or 4 early small island) are coming closer to each other, flux of out-of-plane magnetic field between the islands is compressed to converge at the O-point, which is located almost the center of the final bigger magnetic island. Consequently, a strong out-of-plane magnetic field appears at the O-point. Therefore in this presentation, this type of coalescence is named "compression" type. The larger the parameter m is set, the stronger the compressive effect gets. **Second** when D_0 increases, the same tendency is found. The larger D_0 is set, the more strongly magnetic flux is compressed. This is because the amount of conversion from magnetic energy into kinetic energy during reconnection is proportional to D_0 and hence fiercer outflow pushes matured magnetic islands more strongly. **Third** when B_G is small, the field structure shows "reversed-Hall" structure even though m>=4. An understanding can be made that "reversed-Hall" field dominates over "compressed" field because there is little flux of out-of-plane magnetic field which would be compressed to converge at the O-point. Effectiveness of this idea will be discussed. **Finally** effect of M on the structural change in coalescence found to be negligibly small. **Additionally**, temporal development from "reversed Hall" type to "compression" type also will be considered.