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Particle simulation on blob formation and propagation in an open system

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It is understood that plasma blobs produced near a separatrix are responsible for the most radial transport of plasma density in SOL. Particle simulation was first performed on a blob from its production to the propagation. The particle simulation uses the (2 and 1/2) dimensional electrostatic implicit code with 256 x 128 meshes. Ions (electrons) are distributed to have a tanh(x) density profile in x and the ions (electrons) flow in the y-direction with the ExB drift shear as an initial condition, where the conducting boundary condition in x and the periodic boundary condition in y are adopted. The effective gravitational acceleration force g(x) is applied in the x-direction, where g(x) changes its sign along x so that an interchange mode is stable in x < 64 and it is unstable in x > 64. A Kelvin-Helmholtz instability was driven by the drift velocity shear at first, so that ions and electrons in the high density region (x < 64) came into the unstable region (x > 64) to the interchange mode. The resultant interchange instabilities were localized around x = 64 and saturated at a low amplitude because of a small amount of ions and electrons contributing to an interchange instability. A blob was born after the saturation of an interchange instability under the ExB drift shear. Then the blob was found to propagate in x stably after it was born. This result indicates that the blob with a special initial condition can propagate stably. In fact it was shown that a blob produced from the initial three small charged-up clumps began to propagate stably in x. By the way, it is understood that a blob with an initial monopole structure is deformed into a characteristic mushroom shape, i.e. a blob receiving the charge separation is able to propagate but is deformed from a circular shape to a mushroom one, which means that a monopole shaped blob is unstable. The electron motion along a magnetic field line is considered to be a candidate for the stable propagation of blob. The line-tying, however, cancels the charge separation due to grad-B drift, which stops the blob propagation although it makes a blob stable. The line-tying effects on a monopole shaped blob propagation were studied also, that the line-tying was first found to inhibit the blob propagation by canceling the charge separation caused by the grad-B drift before it made the blob propagation stable.

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