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A reverse-blocking effect of antiparallel magnetic fields on electron transport in gas HIROTAKE SUGAWARA, Hokkaido University — In order to analyze fundamental features of electron conduction in a magnetically neutral loop discharge (NLD) plasma, electron transport in CF_4 at 0.67 Pa along a magnetically neutral channel (NC) between gradient antiparallel $\boldsymbol{B}$ fields were simulated by a Monte Carlo method. The $\boldsymbol{B}$ field was set as $(B_x, B_y, B_z) = (0, 0, \hat{B}x)$ ($\hat{B} = \text{const} > 0$) to let the y-z plane be the NC as a simplified model of the electron path in the NLD plasma, and the $\boldsymbol{E}$ field was applied as $(E_x, E_y, E_z) = (0, E, 0)$ ($E = \text{const}$). Two modes of electron transport were observed. When $E < 0$, the electrons drifted in the -$\boldsymbol{E}$ direction. They were confined near the NC and their spatial distribution $f(x)$ was a Gaussian with a standard deviation $\sigma_x \propto \hat{B}^{-1/2}$. The values of the mean electron energy $\bar{\varepsilon}$, the effective ionization frequency $\nu_{\rm i}$, the average velocity $W_{\rm v}$ and the centroid drift velocity $W_{\rm r}$ were close to those in dc E fields without $\boldsymbol{B}$ field at the same E/N. The diffusion coefficients D_y and D_z were also close to the longitudinal and transverse diffusion coefficients $D_{\rm L}$ and $D_{\rm T}$ in the dc $\boldsymbol{E}$ field, respectively, but $D_x \simeq 0$. In contrast, when $E > 0$, the electrons were led into the regions of stronger $\boldsymbol{B}$ field by the $\boldsymbol{E}\times\boldsymbol{B}$ drift away from the NC and they hardly drifted in the $-\boldsymbol{E}$ direction because of the gyration. The parameters decreased slowly and their equilibrium values were not available in a trace up to 7.3 μs, but only D_x had its equilibrium value $E/\hat{B}$.

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