Hall MHD calculation of magnetic reconnection assuming coronal heating

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The solar corona is hotter than the solar surface, and its heating mechanism is not clear. Coronal heating can be explained by dissipating even 1% of the convective energy on the solar surface. One of the models that explain coronal heating is energy dissipation by nanoflares, which are thought to be small magnetic reconnections. Fast magnetic reconnection can occur by the Hall effect when the current layer scale is comparable to the ion inertia length. If the magnetic field lines twisted inside the sun rise to the corona, the density around the current layer will decrease sharply, and the ion inertia length will increase. This plasma condition might cause Hall reconnection during flux emergence. The purpose of this study is to create a model for magnetic reconnection when flux emergence occurs using Hall MHD. Gravity was added horizontally along the current sheet to simulate flux emergence. This gravity represents the gravity along the loop when the magnetic field emerges. Simulating gravitational stratification in the direction along the loop reproduced the situation where the density in the emerging magnetic field decreases in the corona. No reconnection occurs in the ideal MHD, but reconnection occurs when gravity is applied. This is because the density of the current layer was reduced by gravity, and the current layer was thinned and numerically dissipated. We added the Hall effect to the simulation and discuss the effect in the current sheet considering the gravitational stratification.

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