Energy Conversion in the Electron Stagnation Region of Magnetopause Reconnection

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For reconnection at the Earth’s day side, which is asymmetric, the main energy conversion occurs on closed field lines in the electron stagnation region. Energy conversion, as measured by $J \cdot E$, occurs where out-of-plane electric field components are embedded within larger regions of out-of-plane current, which is carried by strong electron flows in the M direction of the LMN coordinate system. Bracketing these energy conversion sites are electron jet reversals (along L and -L) and converging electron flows (along N and -N). These electron flows are like those that surround reconnection X lines, however, in these cases they occur completely within closed field lines. The question then is what, if anything, this energy conversion has to do with local reconnection of magnetic field lines. This paper reports on a study of two events observed by MMS on December 29, 2016 and April 15, 2018. The electron inflows have velocities between 0.05 $V_{eA}$ and 0.1 $V_{eA}$ ($V_{eA}$ = electron Alfvén speed), which are consistent with predicted reconnection rates. Laboratory measurements and 3D simulation results offer some clues about how reconnecting current sheets can evolve in a uniform background magnetic field.