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The acceleration of plasma flow during steady-state collisionless magnetic reconnection

Magnetic reconnection is ubiquitous in astrophysical plasmas. It serves as one of the most effective mechanisms to convert magnetic energy into the kinetic energy of particles. Such energy conversion can result in extreme particle acceleration as in solar flares. In many astrophysical environments, the collisional mean free path and the collision time can be much larger than the related length and time scales of the problem, so the plasmas are essentially collisionless. Without collisions, unlike typical fluids, the reconnection inflows exhibit a crossover feature, meaning the incoming plasmas from the two upstream sides of the reconnection region can pass through each other before turning the corner to become outflows. We found that the particles can be accelerated after crossing over to the other upstream side. Importantly, majority of them do so. The acceleration mechanism of the cross-over flow is investigated and analyzed. (grant RTA6280002 from Thailand Science Research and Innovation)

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