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Magnetic reconnection driven by intense lasers and electron acceleration

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Here we demonstrate turbulent magnetic reconnection in laser-generated plasmas created when irradiating solid targets. Turbulence is generated by strongly driven magnetic reconnection, which fragments the current sheet, and we also observe the formation of multiple magnetic islands and flux-tubes. Our findings reproduce key features of solar fare observations. Supported by kinetic simulations, we reveal the mechanism underlying the electron acceleration in turbulent magnetic reconnection, which is dominated by the parallel electric field, whereas the betatron mechanism plays a cooling role and Fermi acceleration is negligible. Then, we adopted the same analytical method to analyze the relativistic laser-induced and current-induced magnetic reconnection, and found the electron acceleration mechanism had some difference.

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