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TH/P3-09: Nonlinear Acceleration Mechanism of Collisionless Magnetic Reconnection

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A mechanism for fast magnetic reconnection in collisionless plasma is studied for understanding sawtooth collapse in tokamak discharges. Nonlinear growth of the tearing mode driven by electron inertia is analytically estimated by invoking the energy principle for the first time. Decrease of potential energy in the nonlinear regime (where the island width exceeds the electron skin depth) is found to be steeper than in the linear regime, resulting in acceleration of the reconnection. Release of free energy by such ideal fluid motion leads to unsteady and strong convective flow, which theoretically corroborates the inertia-driven collapse model of the sawtooth crash [1].

[1] D. Biskamp and J. F. Drake, Phys. Rev. Lett. 73, 971 (1994).

Country or International Organization of Primary Author

Japan

Primary author: Mr HIROTA, Makoto (Japan)

Co-authors: Prof. YAGI, Masatoshi (Japan Atomic Energy Agency); Dr AIBA, Nobuyuki (Japan Atomic Energy Agency); Prof. MORRISON, Philip (University of Texas at Austin); Dr ISHII, Yasutomo (Japan Atomic Energy Agency)

Presenter: Mr HIROTA, Makoto (Japan)

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