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**3D Hall-mediated fast magnetic reconnection spontaneously initiated by a multi-scale instability cascade** KIL-BYOUNG CHAI, XIANG ZHAI, PAUL BELLAN, CALTECH — The Caltech astrophysical jet experiment provides a highly resolved demonstration of the interaction between single fluid and 2-fluid scales and possibly kinetic scales as well. The jet evolves through the following sequence: (i) a current-carrying MHD-driven plasma jet self-forms, (ii) the jet undergoes a kink instability, (iii) the kink provides the environment for a secondary, Rayleigh-Taylor (RT) instability, (iv) the RT instability erodes the current channel radius to a scale smaller than ion skin depth to cause fast magnetic reconnection, (v) the reconnection emits broadband obliquely-propagating, right-hand circularly polarized whistler waves, and (vi) the reconnection energizes electrons and ions. The observation of the whistler waves confirms that the reconnection is in the Hall MHD regime (i.e., 2-fluid). An energetic extreme ultraviolet burst is observed at the location of reconnection indicating strong, localized electron heating. Spectroscopic measurement shows simultaneous fast ion heating. The analysis shows that electrons are plausibly heated by Ohmic dissipation, and that ions are plausibly heated stochastically, i.e., the guiding center approximation fails, a kinetic effect.

Kil-Byoung Chai
CALTECH

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