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Fast magnetic reconnection due to anisotropic electron pressure PAUL CASSAK, ROBERT BAYLOR, West Virginia University, RAYMOND FERMO, University of Alabama, Huntsville, MATTHEW BEIDLER, West Virginia University, MICHAEL SHAY, University of Delaware, MARC SWISDAK, JAMES DRAKE, University of Maryland, College Park, HOMA KARIMABADI, University of California at San Diego and SciberQuest, Inc. — A new regime of fast magnetic reconnection with an out-of-plane (guide) magnetic field is reported in which the key role is played by an electron pressure anisotropy described by the Chew-Goldberger-Low gyrotropic equations of state in the generalized Ohm's law, which even dominates the Hall term. A description of the physical cause of this behavior is provided and two-dimensional fluid simulations are used to confirm the results. The electron pressure anisotropy causes the out-of-plane magnetic field to develop a quadrupole structure of opposite polarity to the Hall magnetic field and gives rise to dispersive waves. In addition to being important for understanding what causes reconnection to be fast, this mechanism should dominate in plasmas with low plasma beta and a high in-plane plasma beta with electron temperature comparable to or larger than ion temperature, so it could be relevant in the solar wind and some tokamaks.

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