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A twenty-moment model for collisionless guide field reconnection[1]

JONATHAN NG, AMMAR HAKIM, AMITAVA BHATTACHARJEE, Princeton Plasma Physics Laboratory, Center for Heliophysics — The integration of kinetic effects in fluid models is an important problem in global simulations of the Earth's magnetosphere and space weather modelling. Here we introduce a new fluid model and closure for collisionless magnetic reconnection and more general applications. It has recently been shown that electron pressure anisotropy is important in setting the structure of the reconnection region, and a closure based on the drift kinetic equation using a distribution of trapped and passing particles has been derived [1,2,3]. We extend the model and present a general expression for moments of the distribution function. By evolving the heat flux tensor and closing at the fourth velocity moment, we obtain a self-consistent set of fluid equations, which includes the evolution of the off-diagonal elements of the pressure tensor. The model is implemented in a two-fluid code [4] and the results are compared to PIC simulations of guide field reconnection.

[1] Egedal et al. Phys Plasmas (2013)
[2] Le et al. Phys Rev Lett (2013)
[3] Ohia et al. Phys Rev Lett (2012)
[4] Hakim et al. J Comp Phys (2006)

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