

Onsager Symmetric Closure for Linear Gyro-Landau Fluid Equations

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The Trapped Gyro-Landau Fluid (TGLF) equations [1] do not have enough velocity space moments to compute the energy and momentum transport contributions from parallel magnetic field perturbations. A higher moment system requires determining new closure coefficients. The curvature drift resonance closure coefficients in TGLF are computed using the Beer-Hammett method [2]. This method numerically determines the closure coefficients that minimize the error in a fit to linear response functions. Unfortunately, the fitting procedure does not result in gyro-Landau fluid quasi-linear fluxes that preserve the Onsager symmetries [3]. The GLF23 equations [4] do respect these symmetries but this is an even lower velocity space moment system than TGLF. The original Landau-fluid closure method of Hammett and Perkins [5] was able to determine the closure coefficients analytically and they satisfy Onsager symmetry but this system does not include the curvature drift. A new system of linear gyrofluid equations is derived with closure coefficients that preserve Onsager symmetries. A system of equations with enough velocity space moments to compute the full set of electromagnetic fluxes is constructed.

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- [1] G. M. Staebler, J. E. Kinsey, and R. E. Waltz, Phys. Plasmas 12 (2005) 102508.
- [2] M. A. Beer and G. W. Hammett, Phys. Plasmas 3 (1996) 4046.
- [3] H. Sugama and W. Horton, Phys. Plasmas 3 (1996) 304.
- [4] R. E. Waltz, G. M. Staebler, W. Dorland, G. W. Hammett, M. Kotschenreuther, and J. A. Konings, Phys. Plasmas 4 (1997) 2482.
- [5] G. W. Hammett and F. W. Perkins, Phys. Rev. Lett. 64 (1990) 3019.

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