Abstract Submitted
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Landau, Case, van Kampen and Collisionless Fluid Closures[1]
ILON JOSEPH, Lawrence Livermore National Laboratory — Landau damping represents a fundamental paradox within plasma physics. The equations of motion of classical particles and fields are symmetric under time-reversal; yet, the open system formed by integration over velocity space is not invariant and damping results from phase-mixing. Here, it is shown that the Case-van Kampen theorem can be extended to magnetized plasmas: the linear eigenfunctions provide a complete representation of the particle distribution function and exponentially damped and growing eigenmodes must appear in pairs. The numerical Case-van Kampen transformation can performed efficiently in Fourier velocity space and allows fast timescales in the evolution of the system to be treated using exponential integration. On the other hand, fluid moments require integration over velocity space, and, thus, representation of Landau damping requires explicit introduction of the arrow of time through a collisionless damping operator. This operator captures linear phenomena at the cost of damping nonlinear phenomena such as the plasma echo. Numerical comparisons of these two rather different representations will be presented.

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