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MD simulations for oscillatory behavior of non-Maxwellian fluid moments in a magnetized plasma

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In a plasma, the perpendicular components of non-Maxwellian fluid moments oscillate in the presence of a magnetic field. An analytic solution for a uniform plasma predicts the relaxation rate and oscillation frequency of the non-Maxwellian fluid moments.[1] In this work, we reproduce the temporal behavior of the moments via molecular dynamics (MD) simulations. The results confirm that the perpendicular components of rank-l moments oscillate with harmonics of the gyrofrequency, as predicted. Additionally, the eigenmodes in the oscillations are extracted by applying the appropriate linear combination of the moment components. Our research offers insights into phenomena in magnetized plasmas driven by non-Maxwellian moments, such as the temporal behavior of heat flux, a well-known non-Maxwellian moment, in a tokamak.

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Reference

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