Abstract Submitted
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An Invertible Collision Operator for Single Species Plasmas.[1]
M.W. ANDERSON, T.M. O'NEIL, UCSD — Inversion of the Fokker-Planck collision operator typically is not possible by analytic means. Thus, we propose a simpler alternative operator that preserves the essential properties of the true operator and yet is invertible by eigenfunction expansion. The simplified operator satisfies the following properties: it conserves particle number, momentum, and energy; it vanishes for any Maxwellian distribution function; it yields a Maxwellian distribution as the long-time solution of the Boltzmann equation $\partial f/\partial t = (\partial f/\partial t)_{\text{coll.}}$; and, being of the Fokker-Planck form, it captures the dominant role of small angle scattering in plasmas. The new operator is a modification of the Lenard-Bernstein operator,[2] which is invertible by eigenfunction expansion,[3] but does not conserve momentum or energy. Of course, all three conservation properties are necessary for connection to fluid theory. As an application of the new operator, the torque exerted by a rotating field asymmetry on a nonneutral plasma is calculated. This result agrees well with measurement.[4]

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[2]A. Lenard and I.B. Bernstein, Phys. Rev. **112**, 1456 (1958).
[3]C.S. Ng, A. Bhattacharjee, F. Skiff, Phys. Rev. Lett. **83**, 1974 (1999).
[4]J.R. Danielson *et al.*, adjacent poster.

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