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A Generalized Boltzmann Kinetic Theory for Strongly Magnetized Plasmas (PhD Oral-24)[1] LOUIS JOSE, SCOTT BAALRUD, University of Iowa — Traditional Boltzmann kinetic theory models the Coulomb collisions of unmagnetized and weakly magnetized plasmas in which the typical gyroradius is larger than the Debye length. Conversely, O'Neil's kinetic theory models Coulomb collisions of extremely magnetized plasma transport regime in which the typical gyroradius is smaller than the distance of closest approach. Here, we develop a generalized collision operator that can treat Coulomb collisions in plasmas across all magnetization strength regimes and which asymptotes to the traditional kinetic theory, or O'Neil's theory, in the appropriate limits. To demonstrate the utility of the collision operator, it is used to compute the friction force on a massive test particle. In the strong magnetization regimes, the friction force is found to have a transverse component that is perpendicular to both velocity and Lorentz force in addition to the stopping power as predicted by linear response theory. Good agreement is found between the collision theory and the linear response theory in the regime in which both apply, but the generalized collision operator extends the theory to regimes inaccessible using the linear response theory.

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