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Abstract for an Invited Paper
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Foundations of Plasma Kinetic and Dielectric Response Theory

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This talk will review the foundations of plasma kinetic and linear dielectric response theory, as well as its application to predicting the stability properties of low temperature plasmas. Plasma kinetic theory for the reduced phase-space distribution will be derived by coarse graining the exact N-body Klimontovich description. In the limit that interactions between charged particles are weak, this is approximated by the Vlasov equation. The Vlasov equation can be used to compute the linear dielectric response function for a plasma, which describes the dispersion and growth or damping of fluctuations, including Landau damping. A general stability condition called the Penrose criterion can be obtained by applying Nyquists method to the plasma dielectric response function. The Landau damping, and growth, of waves predicted by the kinetic theory has no analog in fluid theory. To demonstrate this, stability conditions in the presence of counter-streaming populations, as are common near boundaries of low-temperature plasmas, will be investigated. Connections with the fluid limit and nonlinear solutions from PIC simulations will also be discussed.