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Using the plasma fluid equations to understand two stream instability and vice versa

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The plasma fluid equations, derived by taking velocity moments of the Boltzmann equation, are one of the most heavily employed sets of equations used in studying basic plasma phenomena. When combined with Maxwells equations, a large fraction of the plasma universe can be studied analytically and computationally. The two stream problem presents a simple framework from which the utility of the fluid equations in capturing plasma behavior can be demonstrated and compared against plasma models that employ Boltzmann or Vlasov equations directly instead of using their velocity moments to obtain a fluid representation. In this tutorial, the two stream instability will be used to introduce the fluid equations, the derivation of the plasma dispersion relation, and the determination of stability for a plasma system.