Filaments are field aligned structures that are known to form in the scrape-off-layer (SOL) in tokamaks. These structures are composed of hot electrons and ions. They can constitute a non-negligible thermal and particle flux on the first wall. As such the migration of these structures to the first wall is problematic. All unnecessary heat loading of structural components must be avoided to prolong the lifetime of a fusion device. In order to arrive at an optimal design for a next-generation machine it is advantageous to predict wall fluxes so that thermal loading and tritium retention can be modeled. One approach to predicting such fluxes in plasmas is to rely on simulation. Directly solving a kinetic equation would require the position and velocity of many particles to be tracked. For large particle numbers this can become very computationally intensive. A fluid description reduces this complexity by considering macroscopic quantities of the plasma. Velocity moments of a kinetic equation (such as the Vlasov equation) are taken and solved self-consistently. This simplification makes the problem tractable. However depending on which kinetic equation, closure and approximations are used some physics can be lost. For instance, finite Larmor radius effects are often lost.

The approach described herein is to use a gyrofluid model. gyrofluid models incorporate higher order finite Larmor radius effects more naturally than other fluid models. A formulation of a gyrofluid model from the gyrokinetic Vlasov equation is introduced [1]. Initial progress towards solving this gyrofluid model using BOUT++ [2] is presented. The focus of this simulation is the effect of a finite Larmor radius in the presence of strong local gradients. Of particular interest is the interaction between the plasma background and filament propagation near the SOL.

References


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