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Implementations of parallel ion viscosity in SOLEDGE3X and their impact on edge plasma turbulence

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Despite several theoretical approaches and few pioneering modelling results [1], the onset of the H-mode transport barrier around the separatrix remains a rather open issue. Understanding precisely the physics behind this enhancement on the confinement and being able to reproduce it in numerical simulations is still a major objective to analyse the performances of nowadays tokamaks and prepare the operation of future devices such as ITER. In that perspective, a dedicative effort has been made over the last decade to develop the 3D turbulent code SOLEDGE3X-EIRENE to tackle the challenge of L-H transition modelling.
Plasma rotation and poloidal velocity shear is a potential player in turbulence reduction implied in L-H transition. Hence, a special care must be taken to investigate the various mechanisms controlling plasma rotation. In this contribution, we will discuss the impact of parallel ion viscosity through its impact on momentum balance. In the fluid description, the parallel ion viscosity terms are the ones that drive the rotation towards the neo-classical value. The reference Braginskii formula is known to lack features to reproduce properly the neo-classical regime even in the high collisional Pfirsch-Schlüter regime [2]. Therefore, several corrections have been proposed in the literature to improve it in order to recover first the Pfirsch-Schluter limit [3] and sometimes even lower collisionality regimes [4]. SOLEDGE3X implements several of these expressions to test their ability to recover numerically neo-classical rotation. We report on their numerical implementation and stability. The effect of the rotation on turbulence in the simulations is also discussed.

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