

Multi-species Model for study of Ion Plasma Filaments

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In future devices as ITER the main fuel will be comprised of a mix of deuterium and tritium to achieve burning plasma conditions. Additionally, in a burning plasma Helium and radiating impurities are often main components which should be considered. In order to further the understanding of the effect the plasma mix has on plasma turbulence and transport it is necessary to be able to model the individual species separately.

We present results on the use of a multi-species model for simulating the influence of isotopes on transport and turbulence in the edge and SOL. The model is an extension of on the four field HESEL model¹, ion density and pressure equations for each new species is considered.

We examine the influence on multiple species with different mass and charge on the propagation of blobs as a first application of the enhanced code.

Simulations of seeded blobs show that ions with similar charge but different mass can be sufficiently well described by using an effective mass for ions. However, when dealing with multiple charge states, the system can no longer be described using an effective charge as in particular the associated FLR effects differ leading different dynamics.

In general the use of a multi ion species model present a much more versatile tools as it can describe systems that are ill suited for effective mass studies, such as local seeding of neutral impurities.

¹Madsen, J. et al, Physics of Plasmas 23, 032306 (2016)