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3D plasma turbulence and neutral simulations using the Hermes model in BOUT++: a study of linear devices and the tokamak edge and divertor region JARROD LEDDY, BEN DUDSON, University of York — Understanding the transport processes in the low temperature plasma at the boundary region of magnetic confinement fusion (MCF) devices is crucial to the design and operation of future fusion reactor devices. It influences the divertor heat load, and probably the core confinement as well. The dominant source of this transport is turbulence, which serves to mix the high and low temperature regions of the plasma. The nature of this plasma turbulence is affected by not only the plasma parameters, but also the neutral species that also exist in these low temperature regions. The interaction of neutrals with the plasma turbulence is studied in linear device geometry (for its simplicity, yet similarity in plasma parameters), and the result is a strong interaction that impacts the local plasma and neutral densities, momenta and energies. The neutral gas is found to affect plasma edge turbulence primarily through momentum exchange, reducing the radial electric field and enhancing cross-field transport, with consequent implications for the SOL width and divertor heat loads. Therefore, turbulent plasma and fluid simulations have been performed in multiple tokamak geometries to more closely examine the effects of this interaction. These cases were chosen for the variety in configuration with ISTOK having a toroidal limiter (ie. no divertor), DIII-D having a standard divertor configuration, and MAST-U having a super-X divertor with extended outer divertor legs. Progress towards the characterization of neutral impact on detachment and edge behavior will be presented.

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