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Kinetic Studies of ICC Devices using High Order PIC in Finite Elements CHARLSON C. KIM, University of Washington - PSI Center, NIMROD TEAM — We present progress on the implementation of a full Lorentz particle in cell (PIC) module for the NIMROD code. This is an extension of the drift kinetic δf PIC module already in place in NIMROD.[1] The Lorentz force PIC (LFP) module will be used to study the effects of energetic ions in innovative confinement concept (ICC) devices - particularly their impact on stability and confinement in the context of the hybrid kinetic-MHD model. As an initial step in development, we demonstrate the LFP module as tracer particles to study various ICC topologies and the resultant phase space. To couple the kinetic physics of the particles back into the MHD fluid model of NIMROD we calculate the energetic particle stress tensor moment on NIMROD's high order finite element, pseudospectral grid. This work will lead to a $3D$ nonlinear MHD code that self consistently includes the effects of an energetic tail. Representative ICC devices modeled are FRCs, RFPs, spheromaks and dipole configurations.

[1]C. C. Kim and the NIMROD Team, "Impact of velocity space distribution on hybrid kinetic-magnetohydrodynamic simulation of the $(1, 1)$ mode", Phys. Plasmas **15**, 072507, (2008)

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