Abstract Submitted
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3D MHD modeling of fusion plasmas with the PIXIE3D and SpeCyl codes D. BONFIGLIO, S. CAPPELLO, M. VERANDA, Consorzio RFX, Italy, L. CHACÓN, LANL, NM, D.F. ESCANDE, Aix-Marseille Université, CNRS, France — Recent advancements in nonlinear 3D MHD modeling of fusion plasmas with the PIXIE3D and SpeCyl codes are reported. The fundamental mathematical correctness of the two codes was proven by a nonlinear cross-benchmark study [1]. The codes have then been used to model the three main configurations for magnetic confinement, namely tokamak, stellarator and reversed-field pinch (RFP) plasmas. Qualitative agreement with respect to experimental observations in the RFX-mod device operated as both RFP and tokamak has been demonstrated by taking advantage of numerical features such as the possibility of applying 3D external magnetic perturbations [2]. More recently, 3D magnetic perturbations have also been used to obtain stellarator fields. The toroidal coupling between MHD modes (as provided by PIXIE3D in toroidal geometry) affects both the MHD dynamics and the magnetic topology. In addition, PIXIE3D solves the heat transport equation with self-consistent coupling between resistivity (affecting Ohmic heating) and temperature. The use of this feature will be discussed, with particular attention to the RFP case.

[1] D. Bonfiglio *et al.*, Phys. Plasmas **17**, 082501 (2010)
[2] D. Bonfiglio *et al.*, Phys. Rev. Lett. **111**, 085002 (2013)

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