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Electromagnetic simulation of strongly-shaped, high-beta NSTX plasma with the gyrokinetic code XGC A. Y. SHARMA, M. D. J. COLE, B. J. STURDEVANT, Princeton Plasma Physics Laboratory, Princeton, NJ, A. MISHCHENKO, Max-Planck-Institut fr Plasmaphysik, Greifswald, Germany, S. KU, R. HAGER, C. S. CHANG, W. GUTTENFELDER, S. M. KAYE, Princeton Plasma Physics Laboratory, Princeton, NJ — The explicit electromagnetic (EM) version [Cole et al., in preparation] of the global gyrokinetic particle-in-cell code XGC is used to study global electromagnetic instabilities in NSTX shot 132588, which features strong shaping at high plasma beta. We identify the dominant modes that are present under these conditions and investigate their effect on plasma transport and, in particular, the electron thermal transport. The explicit EM gyrokinetic implementation uses the Hamiltonian formulation of EM gyrokinetics, and has thus far successfully mitigated an associated numerical cancellation problem via a combination of the pullback scheme [Mishchenko et al., PoP, 2014] and an adjustable control variate method, even for the extreme case of NSTX shot 132588, despite the severity of this problem increasing with plasma beta and with the complexity of the magnetic geometry. A fully-implicit EM gyrokinetic scheme is also implemented in XGC. This scheme uses the symplectic formulation of EM gyrokinetics, for which the cancellation problem is absent, and accelerates the implicit numerical scheme with a fluid preconditioner [Chen and Chacon, CPC, 2015]. Basic verification results are presented for this scheme, including the well-known global intercode benchmark of [Gorler et al., PoP, 2016].

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