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Global gyrokinetic models for energetic particle driven Alfvén instabilities in 3D equilibria[1] DON SPONG, Oak Ridge National Laboratory, IHOR HOLOD, University of California - Irvine — The GTC global gyrokinetic PIC model has been adapted to 3D VMEC equilibria and provides a new method for the analysis of Alfvénic instabilities in stellarators, 3D tokamaks, and helical RFP states. The gyrokinetic orderings ($k_{||}/k_{\perp}$ <<1, ω/Ω_{ci} <<1, ρ_{EP}/L <<1) are applicable to a range of energetic particle driven instabilities that have been observed in 3D configurations. Applications of this model to stellarators have indicated that a variety of different Alfvén instabilities can be excited, depending on the toroidal mode number, fast ion average energy and fast ion density profile. Both an LHD discharge [1] where bursting n = 1 Alfvén activity in the TAE gap was observed and a W7-X case [2] have been examined. TAE,/EAE/GAE modes have been found in the simulations, depending on the mode family and fast ion profiles used. The dynamical evolution of the instabilities shows the field period coupling between n and n + Nfp expected for a stellarator. The development of gyrofluid reduced models that can capture relevant physics aspects of the gyrokinetic models will also be discussed.

[1] M. Osakabe, et al., Nuclear Fusion 46, S911 (2006).
[2] A. Mischenko, A. Könies, et al. Nuclear Fusion 54, 104003 (2014).

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