Abstract Submitted
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EPOCH code simulation of a non-thermal distribution driven by neutral beam injection in a high-beta plasma A. NECAS, T. TAJIMA, Tri Alpha Energy, S. NICKS, University of California, Irvine, R. MAGEE, R. CLARY, T. ROCHE, Tri Alpha Energy, TRI ALPHA ENERGY TEAM — In Tri Alpha Energy's C-2U experiment, advanced beam-driven field-reversed configuration (FRC) plasmas were sustained via tangential neutral beam injection.[1] The dominant fast ion population made a dramatic impact on the overall plasma performance. To explain an experimentally observed anomalous neutron signal (100x thermonuclear), we use EPOCH PIC code [2] to simulate possible beam driven non-destructive instabilities that transfer energy from fast ions to the plasma, causing phase space bunching. We propose that the hydrogen beam ion population drives collective modes in the deuterium target plasma, giving rise to the instability and increased fusion rate. The instability changes character from electrostatic in the low beta edge to fully electromagnetic in the core, with an associated reduction in growth rates. The DD reactivity enhancement is calculated using a two-body correlation function and compared to the experimentally observed neutron yield. The high-energy tails in the distributions of the plasma deuterons and beam protons are observed via a mass-resolving Neutral Particle Analyzer (NPA) diagnostic. This observation is qualitatively consistent with EPOCH [2] simulation of the beam-plasma instability.
[1] M. Binderbauer et al. "A high performance field-reversed configuration." *Phys. Plasmas* 22.5 (2015): 056110. [2] T. D. Arber et al. "Contemporary particle-in-cell approach to laser-plasma modeling." *Plasma Phys. Control. Fusion* 57.11 (2015): 113001.

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