Contribution ID: **54**

Type: **poster**

Enhanced Pedestal H-mode Regime on NSTX

The largest normalized energy confinement attained over a confinement time on NSTX (H98 > 1.5) was achieved in the ELM-free Enhanced Pedestal (EP) H-mode regime [1-3] that features a wide pedestal with a significant increase in the edge carbon temperature and rotation gradients. These discharges achieve improved energy and momentum confinement with a beneficial decrease in the impurity accumulation relative to a standard ELM-free H-mode regime on NSTX [3]. Access to EP H-mode is improved with reducing wall recycling via solid lithium wall coatings and by operating at large Ip. EP H-mode was often observed following the recovery from a large ELM and terminated with another ELM or core MHD activity.

Linear CGYRO [5] calculations indicate the particle and electron energy transport are predominately due to TEMs in the steep gradient region of the pedestal, while previous GS2 calculations [6] for wide pedestal discharges imply ETG modes contribute to the electron energy transport at the bottom of the pedestal. The ion energy transport throughout the pedestal is in good agreement with the neoclassical transport exceeding the anomalous transport. EP H-mode is often triggered by a transient period of lower edge ion collisionality where ÑTi increases due to reduced neoclassical ion thermal transport. The reduction in ion energy transport leads to an increase in the anomalous transport in all channels as the Te profile is stiff, consistent with linear stability calculations, BES measurements [7] and reduced 1-D transport models [4]. The increase in anomalous particle transport, combined with a reduction of the impurity pinch at lower collisionality, reinforces the lower edge density and can drive a positive feedback if the improvement in the neoclassical energy confinement at low collisionality exceeds the degradation from the increased anomalous transport.

The favorable positive feedback initiated by transiently accessing lower ion collisionality in the wide pedestal regime motivates the development of actuators for controlling the edge density that are compatible with large core density and heat flux mitigation on NSTX-U.

*Supported by the US DOE under DE-AC02-09CH11466 & DE-FC02-08ER54977.

[1] Maingi, R. et al. Phys. Rev. Lett. 105, 135004 (2010)
[2] Maingi, R. et al. J. Nucl. Mat. 390-1, 4403 (2009)
[3] Gerhardt, S. P. et al. Nucl. Fusion 54, 083021 (2014)
[4] Battaglia, D.J. et al. Phys. of Plasmas. To be submitted (2019)
[5] Candy, J. et al. J. Comp. Phys. 324 73 (2016)
[6] Canik, J. M. et al. Nucl. Fusion 53, 113016 (2013) [7] Smith, D. R. et al. Phys. Plasmas 20, (2013)

Primary author: BATTAGLIA, Devon (PPPL)

Co-authors: BELL, R.E. (Princeton Plasma Physics Lab); Dr GERHARDT, Stefan (Princeton Plasma Physics Laboratory); Dr GUTTENFELDER, Walter (Princeton Plasma Physics Laboratory); KAYE, Stanley (PPPL); Dr MAINGI, Rajesh (Princeton Plasma Physics Laboratory)

Presenters: BATTAGLIA, Devon (PPPL); BELL, R.E. (Princeton Plasma Physics Lab); Dr GERHARDT, Stefan (Princeton Plasma Physics Laboratory); Dr GUTTENFELDER, Walter (Princeton Plasma Physics Laboratory); KAYE, Stanley (PPPL); Dr MAINGI, Rajesh (Princeton Plasma Physics Laboratory)

Session Classification: Poster session