Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

I-mode impurity removal and energy confinement[1] SILVIA ESPINOSA, Courant Inst, PETER J. CATTO, MIT Plasma Science and Fusion Center — Using high-z wall materials attempts to switch the fusion challenge from heat load handling to removing impurities. We propose a means of measuring the radial impurity flux from currently available diagnostics, providing insight on optimal tokamak operation to prevent impurity accumulation [PoP 24, 055904 (2017)]. Our description is a modification of Per Helander's high Z impurity treatment [PoP 5, 3999 (1998)]. It uses poloidal impurity flow measurements rather than a main ion kinetic calculation of screening effects. High confinement mode operation was discovered 35 years ago to almost quadruple fusion power, and later explained by turbulence reduction by sheared flows. Less than a decade ago, improved mode operation was discovered to have the same desirable property, while removing impurities and providing fueling. Thanks to the impurity radial particle flux measuring technique developed, we explain the outward radial impurity flux without invoking a (sometimes undetected) turbulent mode [PPCF 60, 094001 (2018)]. This theory is supported by the observed ExB flow shear, which also explains the desired energy confinement via turbulence reduction.

[1]Research supported by DoE and NSF, 'La Caixa' and 'Rafael del Pino' Foundations, DOE Grant DE-FG0291ER54109 and NSF RTG/DMS1646339.

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Date submitted: 25 Jun 2020 Electronic form version 1.4