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Edge Instability Limiting the Pedestal Growth on Alcator C-Mod Experiment and Modeling

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Improvement in global confinement and fusion performance are found to be correlated with the pressure at the top of the edge barrier ("pedestal height") both in experiments and theory. Performance predictions for future devices such as ITER rely on experimental validations of the hypothesis in the predictive models. To date, the leading model for pedestal structure prediction is EPED. This model uses both the peeling ballooning theory to limit the pedestal height and relies on the onset of the kinetic ballooning mode (KBM) to constrain the pedestal gradient. This paper presents detailed measurements on an edge instability limiting the pedestal temperature after edge-localized-modes (ELM) on Alcator-Mod. Using a suite edge diagnostics and a magnetic probe placed near the separatrix, this instability was determined to be on ion scale and its onset is consistent with the KBM. This instability was corroborated using gyrokinetic calculations in the edge. The edge pedestal was determined to be ballooning unstable. In addition to the identification of the instability, the paper will also assess the levels of transport produced by this instability.

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Primary author: Dr DIALLO, Ahmed (PPPL)

Presenter: Mr HUGHES, Jerry (USA)

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