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Nonlinear ballooning instability dynamics of tokamak edge plasmas[1] C.C. HEGNA, P. ZHU, University of Wisconsin — The edge pressure gradient of H-mode confined tokamaks is thought to be limited by ideal MHD ballooning mode stability. Previous nonlinear theories of ideal MHD ballooning instabilities have been developed using a perturbation theory in mode amplitude and the conventional ballooning theory asymptotic expansion parameter $n^{-1/2}$ [1,2]. However, as pointed out by Connor et al [3], for edge pressure driven modes, the conventional linear ballooning mode theory is not appropriate and a procedure using the small parameter $n^{-1/3}$ must be employed. In this work, we develop a theory for the intermediate nonlinear regime of ideal MHD ballooning instabilities localized to the edge. In the intermediate nonlinear regime, the characteristic mode amplitude is comparable to the radial mode width [2]. For edge plasmas, this corresponds to $\xi \sim n^{-2/3}$, rather than the scaling $\xi \sim n^{-1/2}$ of conventional ballooning theory. Efforts to understand coupling of the ballooning instability to the peeling mode drive will also be discussed. [1] O. A. Hurricane, et al *Phys. Plasmas* **4**, 3565 (1997). [2] P. Zhu and C. C. Hegna, submitted to *Phys. Plasmas* (2008). [3] J. W. Connor et al, *Phys. Plasmas* **5**, 2687 (1998).

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