# Effect of Particle Sources on the Structure of the H-mode Pedestal*

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In ELMing H-mode plasmas, due to a stiff temperature profile, the energy confinement time increases with the pressure pedestal height. Therefore it is important to understand the physics of the pedestal in order to find means of improving confinement through increasing the pedestal pressure. In this paper we report results and interpretation of recent DIII-D experiments that were designed to understand the role of the recycling particle source in the formation of the density pedestal. Our high spatial resolution measurements show that the width of the density pedestal is inversely proportional to the pedestal density, and insensitive to the quality of transport. These results are consistent with predictions of an analytic fueling model [1,2] that assumes a constant diffusivity within the range of the recycling neutrals and allows for poloidal asymmetries in the location of the recycling neutrals. In other words, the structure of the density profile is primarily determined by atomic physics and not the shape of the transport barrier. According to the model, the location of the recycling neutrals strongly influences the achievable pedestal density. The pedestal density increases as the neutral source moves away from the X-point. Therefore, an open divertor is predicted to allow access to higher pedestal densities. We have also observed that typically the width of the transport barrier, as defined by the width of $\chi_{eff} = (n_e \partial T_e/\partial r)^{-1}$, typically is less than a factor of two wider than the density pedestal width. Furthermore, it is observed that the width of the temperature pedestal becomes wider as the width of the density pedestal becomes narrower. These observations suggest, as predicted by Hinton’s theoretical model [3], that the edge density gradient scale length is a key parameter in the formation of the transport barrier. We expect to report also the results of scheduled follow up experiments, designed to determine the role of the density gradient in the formation of the heat transport barrier.

[1] M.A. Mahdavi et al, Nucl. Fusion **42** (2002) 52-58.
[2] R. Groebner, to be published in Physics of Plasmas 2002.
[3] F.L. Hinton, G.M. Staebler Phys. Fluids **5** (1993)1281.

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