Model of the tokamak edge density pedestal including diffusive neutrals

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Abstract. Several previous analytic models of the tokamak edge density pedestal have been based on diffusive transport of plasma plus free-streaming of neutrals. This latter neutral model includes only the effect of ionization and neglects charge exchange. The present work models the edge density pedestal using diffusive transport for both the plasma and the neutrals. In contrast to the free-streaming model, a diffusion model for the neutrals includes the effect of both charge exchange and ionization and is valid when charge exchange is the dominant interaction. Surprisingly, the functional forms for the electron and neutral density profiles from the present calculation are identical to the results of the previous analytic models. There are some differences in the detailed definition of various parameters in the solution. For experimentally relevant cases where ionization and charge exchange rate are comparable, both models predict approximately the same width for the edge density pedestal.

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