A first look at similar features of the edge transport in L- and H-modes.

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The ELMy H-mode scenario is the baseline scenario foreseen for ITER to reach the Q=10 target. It has been studied extensively both experimentally and theoretically and yet many questions remain concerning the predictions of a new ELMy H-mode experiment. For ITER the actual value of the energy gain Q as predicted by 1.5D transport codes is strongly dependent on the value of the temperature at the top of the edge transport barrier known as the H-mode pedestal. It has been shown that the pedestal width and height can be predicted based on first-principles models such as the EPED model [1]. In 1.5D simulations the steep gradients of the pedestal region can be obtained by reducing the diffusion coefficients for particle and heat transport to their neoclassical levels (see [2] for example).

Recent observations in the TCV tokamak during dedicated experiments in standard L-mode plasmas [3] have revealed the existence of an edge region where the profiles properties are similar to those of the H-mode pedestal. Consequently, the plasma can be divided into three separate regions with different transport properties. The transport in the central region is dominated by the sawtooth activity leading to relatively flat profiles. Outside of this central region, the transport is stiff and the inverse scalelength R/L_T is relatively independent of the heat flux. The profiles in the edge region are characterized by a temperature gradient constant across this region. It is shown that this gradient is not stiff and is increasing with increasing plasma current, increasing EC heating power, increasing density and with a change of the plasma triangularity from positive to negative [3].

The main focus of this work is the study of the edge and pedestal region using ASTRA simulations [4]. We do not consider the coupling with the scrape-off layer region. We use a new approach which imposes a given value for the gradients of both the density and electron temperature in the edge region. This new approach allows us to consider both L- and H-modes in a similar way. We compare the results of these simulations in L-modes using the previously mentioned TCV discharges with the ones from typical TCV H-mode discharges. For the H-mode pedestal we also compare the standard approach using a reduction of the diffusion coefficients in the edge region with a new approach. Particular emphasis is put on the evolution of the edge bootstrap current and its influence on the edge q profile.

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