SOLPS-ITER simulation of MAST neutral penetration versus aspect ratio

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In this poster, we will study neutral penetration depth inside the separatrix as a function of the aspect ratio using SOLPS-ITER and varying the aspect-ratio from 1.5 (MAST-like) to 3.16 (DIII-D like). In regular tokamaks, to compare the neutral penetration depth inside the separatrix, an analogy with optics is used and the concept of opaqueness is introduced. To simplify comparison across devices with fusion relevant temperature, opaqueness is defined as $n_e \times a$ where n_e is the average of pedestal and separatrix electron densities, and a is the minor radius of the tokamak [1]. The minor radius is a stand-in for the pedestal width, which is not known a priori to provide a link to machine size. However, the relationship between machine-size and minor radius is broken for spherical tokamaks. The dimensionless version of opaqueness is adopted. It is defined as the ratio of the width of the pedestal, Δn_e, to the neutral penetration decay length λ_{n_D} [2] . The neutral density profiles are calculated using SOLPS-ITER [3] starting from a MAST H-mode experiment. Transport coefficients and boundary conditions are determined by matching experimental measurements. Without altering either transport coefficients or boundary conditions, we increase the major radius of the SOLPS-ITER geometry to increase the aspect ratio. This allows us to compare the neutral density profiles as a function of aspect ratio and determine the opaqueness $\Delta n_e/\lambda_{n_D}$ and compare it to $n_e \times a$ [1].

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This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Fusion Energy Sciences DE-SC0021306, DE-SC0007880, DE-SC0023372.