Abstract Submitted
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L-H power threshold scaling with magnetic geometry on NSTX and the role of ion orbit loss[1] D.J. BATTAGLIA, C.-S. CHANG, S.M. KAYE, S. KU, PPPL, R. MAINGI, ORNL, NSTX TEAM — The L-H power threshold (P_{LH}) on the National Spherical Torus Experiment varies with X-point radius (R_X), plasma current (I_p), the direction of the ion grad-B drift and the amount of lithium evaporated on the divertor surfaces. The edge T_e and T_i (where $T_e \sim T_i$) just prior to the time of the L-H transition vary with the magnetic geometry, but are fairly independent of the neutral fueling rate and lithium conditioning. These observations are consistent with the X-transport theory, which describes the mean edge radial electric field (E_r) profile required to prevent non-ambipolar ion loss in a diverted plasma. A guiding-center orbit calculation in the absence of electric fields, collisions and flows provides insight into the dependence of the ion loss, and thus E_r, on the magnetic geometry and edge T_i. For example, the number of ion loss orbits remains constant as R_X is reduced from 0.64m to 0.47m only if the edge T_i increases by 60%. This is in agreement with self-consistent calculations of E_r using the neoclassical XGC0 code and experiments that measured edge T_e and T_i to be $40 - 60\%$ larger. Similar agreement is also observed between guiding-center calculations, XGC0 results and the measured P_{LH} versus I_p and ion grad-B direction.

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