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A Mechanism for Soft Beta Limits in NSTX STEPHEN JARDIN, Princeton Plasma Physics Laboratory, NATE FERRARO, General Atomics, JIN CHEN, JOSH BRESLAU, STEFAN GERHARDT, Princeton Plasma Physics Laboratory — It is well known that exceeding the beta limits in a tokamak or ST in some regions of parameter space can lead to a disruption, whereas in other regions one encounters a "soft limit" where transport is increased locally but the discharge continues. To better understand the mechanism which leads to a soft beta limit, we have modeled part of the evolution of a NSTX discharge that is near or at the beta limit for interchange modes near the magnetic axis. Using the implicit 3D MHD code M3D-C^1 we find that as the central safety factor, q_0, slowly decreases toward unity due to resistive diffusion, a single n=3 interchange-like mode is the first to become unstable. As this mode grows in amplitude, it nonlinearly drives n=6, n=9, and other modes. In the early growth stages, the n=3 mode mostly distorts the magnetic surfaces. However, once the other modes reach comparable amplitude, Poincare plots of the magnetic field show that parallel thermal conductivity, which is much larger than perpendicular thermal conductivity ($\kappa_{||} \gg \kappa_{\perp}$), can cause rapid transport of the electron energy from the center to an annular region surrounding the center, reducing the central pressure that was driving the instability. In many cases, the magnetic surfaces will reform and the configuration, now with lower central pressure, will become axisymmetric again. This work was supported by the US DOE contract no. DEAC02-09CH11466 and the SciDAC Center for Extended Magnetohydrodynamic Modeling.

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