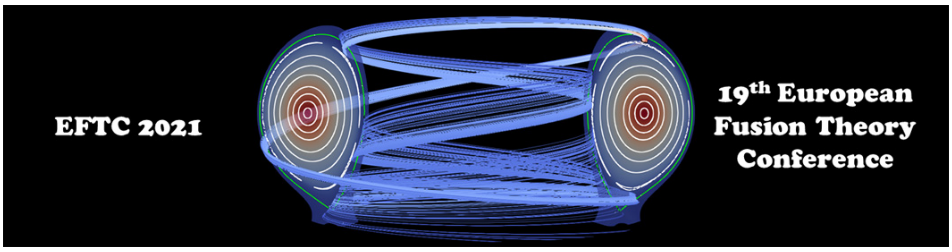

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Turbulent heat flux versus density gradient: an inter-machine study with the gyrokinetic code stella

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It has been experimentally observed in both tokamaks and stellarators that peaked density profiles lead to enhanced confinement regimes. The reduction in transport is believed to be related to the stabilization of ion-scale turbulence. In this conference contribution, we perform gyrokinetic simulations with the gyrokinetic code stella focusing on the effect of the density gradient on nonlinear heat fluxes. The influence of the magnetic geometry is investigated by means of an inter-machine study that includes the W7-X, LHD, TJ-II and NCSX stellarators, as well as the Cyclone Base Case tokamak. The
simulations are collisionless and a vanishing electron temperature gradient is assumed. For the devices listed above, we have computed the ion heat flux as a function of the normalized density gradient, a/L_n, for a fixed value of the normalized ion temperature gradient, $a/L_{Ti}=3$, by means of nonlinear stella simulations with kinetic electrons. We show that, in a broad range of the scanned a/L_n values, W7-X and NCSX exhibit a strong reduction of the ion heat flux with increasing a/L_n. In TJ-II the reduction is more modest and in LHD the ion heat flux has a weak dependence on a/L_n. In contrast to the stellarators, we have found that the ion heat flux of the tokamak increases strongly with the density gradient. By comparing the results, it is clear that, in stellarator geometry, the behavior of the linear growth rates as a function of a/L_n does not correlate with the behavior of the ion heat flux. Finally, in this conference contribution we will also discuss the effect on the ion heat flux of treating the electrons adiabatically or kinetically, as well as the effect of taking zero or finite a/L_{Ti}.

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