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Neoclassical transport fluxes inside transport barriers in tokamaks[1] K.C. SHAING, ISAPS, National Cheng Kung University, Taiwan and Engineering Physics Department, University of Wisconsin, USA — Inside the transport barriers in tokamaks ion energy losses sometimes are smaller than the value predicted by the standard neoclassical theory. This improvement can be understood in terms of the orbit squeezing theory in addition to the sonic poloidal $E \times B$ Mach number $U_{p.m}$ that pushes the tips of the trapped particles to the higher energy. In general, $U_{p.m}$ also includes the poloidal component of the parallel mass flow speed. These physics mechanisms are the corner stones for the transition theory of the low confinement mode (L-mode) to the high confinement mode (H-mode) in tokamaks. Here, detailed transport fluxes in the banana regime are presented using the parallel viscous forces calculated earlier. It is found, as expected, that effects of orbit squeezing and the sonic $U_{p.m}$ reduce the ion heat conductivity. The former reduces it by a factor of $|S|^{3/2}$ and the later by a factor of $R\left(U_{p,m}^2\right)\exp\left(-U_{p,m}^2\right)$ with $R\left(U_{p,m}^2\right)$, a rational function. A nonlinear equation for $U_{p.m}$, similar to the bifurcation equation for L-H transition, is derived. Discussions between the theory presented here and earlier with that from a different group will be presented.

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K. C. Shaing
ISAPS, National Cheng Kung University, Taiwan and Engineering
Physics Department, University of Wisconsin, USA

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