# Paleoclassical Transport Explains Electron Transport Barriers in RTP and TEXTOR

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This paper reports on a test of the paleoclassical transport model [1] on a set of experimental results from the RTP and TEXTOR tokamaks.

On RTP it was found that electron thermal transport has a layered structure: zones with high diffusion coefficient ($\chi_\mathrm{e}$) are alternated with narrow zones of low $\chi_\mathrm{e}$, i.e., Internal Transport Barriers (ITBs). The latter are closely tied to low order rational $q$ surfaces. The experimental results were initially successfully simulated with a purely empirical transport model, in which the ITBs are prescribed as function of $q$ only.

In TEXTOR it has been observed that the core electron temperature $T_\mathrm{e}$ stays constant for some time after the switch-off of off-axis ECRH, which is indicative of a local suppression of electron thermal transport. This delay can be as long as 35 ms, i.e. $\simeq 1.5$ energy confinement times. The effect critically depends on the exact location of the ECR heating and on the magnetic field strength; this indicates that the effect is closely related to details of the $q$ profile.

As paleoclassical transport is thought to be the dominant electron thermal transport mechanism in low $T_\mathrm{e}$ plasmas (up to $\sim 1$ keV in present tokamaks) and, moreover, the paleoclassical transport model predicts ITBs near low rational $q$, the RTP and TEXTOR results mentioned above are considered as an ideal test case of this model.

Indeed, many of the observed features in RTP and TEXTOR are reproduced by the paleoclassical model. In particular, bifurcations in the evolution of a discharge caused by a tiny shift of the ECRH power depostion radius are reproduced remarkably well by the paleoclassical model.

[1] J.D. Callen, a) *Phys. Rev. Let.* 94, 055002 (2005), b) *Phys. Plasmas* 12, 092512 (2005), c) *Nucl. Fusion* 45, 1120 (2005), and d) *"Derivation of paleoclassical key hypothesis"*, *Phys. Plasmas* 14, 040701 (2007)