

Dependence of non-local effects on plasma parameters during cold-pulse experiments in Alcator C-Mod

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Abstract

Past work at C-Mod showed that the threshold density for the appearance of non-local effects (fast core temperature increase following edge cold-pulse injection) depended primarily on density and collisionality in ohmic plasmas. New results show that in RF-heated L-mode plasmas ($P_{rf} = 0.6 - 1.2MW$, $B_t = 5.4T$), the threshold density is higher, and does not strongly depend on collisionality. A new parameterization procedure shows that diffusive propagation of the cold-pulse is usually observed along with the non-diffusive response. The non-diffusive response seems to be triggered at the inner core and propagates as a heat pulse. This procedure also revealed that the amplitude of the core response depends on density in both ohmic and RF plasmas. We also found in ohmic plasmas at high

current ($I_p = 1.1MA$) that, using the new parameterization, the core response is always non-local, suggesting that the threshold depends not only on density, but also on current. Past work on C-Mod also showed that rotation reversals and non-local effects were concomitant in ohmic plasmas at low current ($I_p = 0.55 - 0.8MA$). However, new experiments with RF L-mode plasmas show that the intrinsic rotation reversal threshold differs from the threshold for appearance of non-local effects. Cold pulses were injected using a laser blow-off (LBO) system. The fast temperature increases after the cold-pulse injections at the edge can be observed in the core channels of fast ECE profile diagnostics. These surprisingly fast effects (peak within $\sim 10ms$, while $\tau_e \sim 25ms$) with inverse polarity cannot be fully described with a diffusive model and what triggers them is still an open question. This presentation will also discuss plans for LBO development at DIII-D, which will allow for cross-machine comparison of non-local effects. This work is supported by U.S. Department of Energy under contract numbers DE-FC02-99ER54512 (C-Mod) and DE-FC02-04ER54698 (DIII-D) and La Caixa Fellowship.

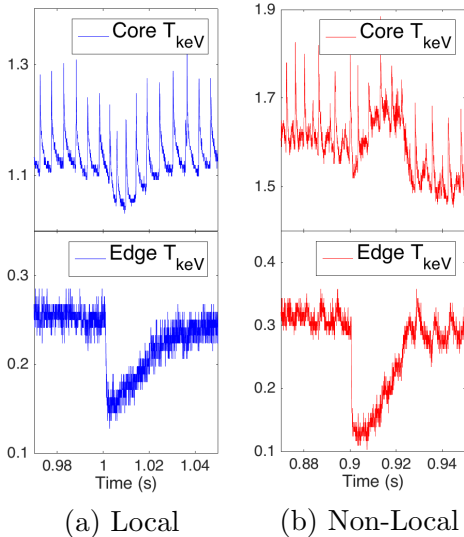


Figure 1: Time traces of core and edge electron temperature of Ohmic L-mode plasmas ($I_p = 0.8MA$, $B_t = 5.4T$), using GPC ECE diagnostics. In (b), a fast temperature increase following the edge cold pulse injection at 0.9s appears in the core channel