Fast Wave Current Drive in H–Mode Plasmas on the DIII–D Tokamak

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Abstract

Current driven by the fast Alfvén wave is measured in H–mode and VH–mode plasmas on the DIII–D tokamak for the first time. Analysis of the poloidal flux evolution shows that the fast wave current drive (FWCD) profile is centrally peaked but sometimes broader than theoretically expected. Although the measured current drive efficiency is in agreement with theory for plasmas with infrequent edge localized modes (ELMs), the current drive efficiency is an order of magnitude too low for plasmas with rapid ELMs. Power modulation experiments show that the reduction in current drive with increasing ELM frequency is due to a reduction in the fraction of centrally absorbed fast wave power. The absorption and current drive are weakest when the electron density outside the plasma separatrix is raised above the fast wave cutoff density by the ELMs, possibly allowing an edge loss mechanism to dissipate the fast wave power since the cutoff density is a barrier for fast waves leaving the plasma.

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