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Feedback Control of the Safety Factor Profile Evolution in DIII-D Advanced Tokamak Discharges¹ J.R. FERRON, P. GOHIL, C.M. GREEN-FIELD, J. LOHR, T.C. LUCE, C.C. PETTY, M.R. WADE, General Atomics, T.A. CASPER, R.J. JAYAKUMAR, M.A. MAKOWSKI, LLNL, M. MURAKAMI, ORNL, D. MAZON, CEA — In an advanced tokamak discharge in DIII-D, the qprofile is established during the plasma current ramp-up and early flattop phases and sustained during the subsequent high beta phase. Initial feedback control experiments have focused on ensuring that the desired q profile at the start of the high beta phase, $1.5 < q_{min} < 2.5$ and $q(0) - q_{min} \approx 0.5$, is reproducibly obtained. The rate of evolution of the current density profile, and thus the q profile, is modified through changes in the conductivity with electron heating. Closed loop control of the q evolution has been successfully tested in both L-mode and H-mode using either ECH at $\rho \approx 0.4$ or neutral beam power as the actuator. The q evolution can also be modified with changes in the plasma current ramp rate or noninductive current drive. The q profile evolution data are being compared to models to facilitate development of improved controllers.

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