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Improved confinement in ELM-suppressed high-density H-modes at the ITER field via modification of the plasma boundary with Lower Hybrid RF[1]

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Injecting Lower Hybrid (LH) power into Alcator C-Mod's high-density H-mode plasmas has enhanced global confinement by increasing pedestal temperature gradients, modifying edge rotation, and decreasing edge and SOL turbulence. These new experiments indicate that edge LHRF can be used as a tool to increase confinement via *direct modification* of boundary quantities. Ray-tracing modeling and accessibility calculations for the LH waves indicate that the LH waves do *not penetrate to regions inside the top of the pedestal* and are not driving current in these plasmas; instead the LH power modifies the boundary conditions. When moderate amounts of LH power (P_{LH}/P_{tot} =20%) are applied to high-density EDA H-modes (n_{eo} =3.5x10^{20} m^{-3}), we observe the following effects: edge/SOL fluctuation power *decreases by roughly an order of magnitude*; pedestal temperature gradients are increased; global energy confinement time and H-factor increase by 30-40% (H_{98} from 0.7 to 1.0); co-current core and pedestal rotation velocities increase; power to the (outer) divertor target increases promptly with an increment that is roughly 1/2 of the injected LH power, qualitatively consistent with the inaccessibility of the LH waves; and the central frequency of the edge-localized Quasi-Coherent Mode down-shifts and becomes much more coherent. These H-mode confinement improvements brought about by the edge LHRF are the result of changes in the pedestal (e.g. changes in rotation/shear and increased pedestal temperature gradients), with no substantial change in peaking of core density or temperature profiles. There is not perfect correlation with edge turbulence suppression, indicating that the turbulence decrease may be a necessary, but not sufficient, condition for the pedestal and confinement improvements.

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