# Impact of AC edge biasing on the edge and SOL regions of a tokamak

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Tokamaks have radio frequency (RF) antennae for various purposes such as auxiliary heating, current drive, stabilization of sawtooth oscillations, etc. Various studies [1] on the experimental devices show that the RF antenna generates rectified DC potentials due to the presence of an RF sheath that may change the radial current [1] and consequently parallel current. This DC potential can be obtained by averaging the electron current through the antennae over a long period of applied RF biasing. The change in radial current modifies the radial electric field and it shear that can control the plasma turbulence in the boundary region of a tokamak [2,3,4]. Therefore, an application of RF biasing potential on the antennae can modify plasma turbulence in the boundary region of a tokamak and hence heat & particle loads on the antenna and limiter/divertor plates.

In this work, we study the RF biasing and its impact on the edge and SOL regions of a tokamak theoretically/numerically using a set of drift-reduced Braginskii model equations that exhibits the fluid description of the plasma. RF biasing has been given through the electron current in the model equation that earlier used to study the electrode biasing for DC potentials [3,4]. These model equations have been simulated on the BOUT++ framework. Radial profiles of plasma density, electron temperature, and potential obtained from the simulation are shown in Fig.1 for DC bias (64 V), without (w/o) bias, 50kHz, 100kHz, 1MHz, and 10MHz frequency respectively with RF amplitude 64 V. The simulation results indicate a clear frequency-dependent response of plasma profiles to RF biasing. Low-frequency RF bias (50 kHz and 100 kHz) does not significantly alter the plasma parameters, while high-frequency RF bias (1 MHz and 10 MHz) produces changes similar to those induced by DC biasing. These findings highlight the importance of bias frequency in plasma control applications, with high-frequency RF biasing serving as a potential substitute for DC bias to achieve desired plasma conditions. Various parameters such as radial profiles of electric field and its shear, flux, heat and particle load, frequency and spectra, etc. will be presented. This study will also provide a way to modify the edge and SOL turbulence, anomalous transport, heat and particle loads on the plasma-facing components of a tokamak by RF biasing.

## References.

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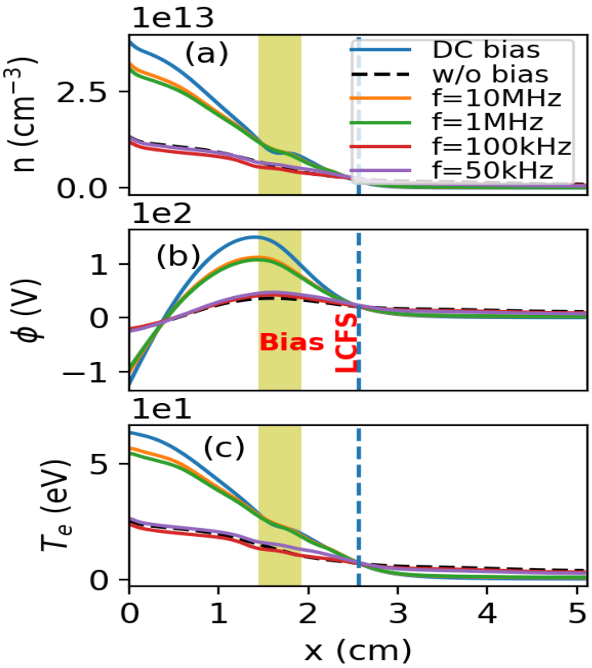


Figure-1 (a), (b), and (c) show the radial profile of plasma density (n), potential ($\phi$), and electron temperature ($T_e$) respectively.