Plasma Species Mix Diagnostic Using Hybrid Layer Reflectometry

G.W. WATSON, W.W. HEIDBRINK, University of California, Irvine, G.J. KRAMER, Princeton University, D.G. WHYTE, UCSD — A heterodyne reflectometer could provide a direct and inexpensive measurement of ion species mixes with different charge to mass ratios. Using the cold plasma dispersion relation for multiple ion species, the ion-ion hybrid cutoff frequency is uniquely determined by the density ratio and cyclotron frequencies of those two species. The phase of a \( \sim 20 \) MHz wave that travels from the launching point to the cutoff layer to the receiving antenna provides a direct measure of the hydrogen:deuterium species mix. In a recent hydrogen puffing experiment the wave was launched from the high field side of the DIII-D tokamak. Preliminary results show agreement with the deuterium density inferred from the increase in the neutron rate during a short beam pulse and from the \( \text{H}_\alpha\):\( \text{D}_\beta \) light ratio. Results indicate that a wave launched from the high field side can tunnel through the resonance layer and be reflected back to the receiving antenna.

\(^1\)Work supported by subcontract SC-G9034202 to US DOE Contract DE-AC03-99ER54463 and grant DE-FG03-95ER54294.