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**Radial Redistribution of Neutral Beam Ions Induced by Multiple Alfvén Eigenmodes in DIII-D**[1]

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For the first time the detailed radial structure of multiple Alfvén eigenmodes and the associated transport of 80 keV neutral beam ions in the DIII-D tokamak have been measured using an upgraded array of internal fluctuation diagnostics in combination with a new spectroscopic diagnostic for the confined fast ion population. Knowledge of the fast ion redistribution and the internal structure of Alfvén waves affecting fast ion transport are critical for understanding equilibrium, stability and transport physics in advanced confinement regimes in ITER. The observed mode activity in DIII-D includes toroidal Alfvén eigenmodes (TAEs), reversed-shear Alfvén eigenmodes (RSAEs) and their spatial coupling. The measured radial mode structures are in close agreement with calculations of the modes and their coupling using the NOVA code. The ideal MHD calculations take into account the effects of adiabatic compression in order to predict the ratio of temperature to density fluctuations and the results are also found to agree closely with internal measurements. Fast ion measurements indicate a significant depletion of the central beam ion population during the peak of the observed mode activity. The detailed identification of these modes allows for the accurate calculations of fast ion transport using the particle following ORBIT code. The ORBIT code analysis, using real plasma geometry and the measured structure of Alfvén eigenmodes, will be compared to the measured radial redistribution of neutral beam ions. These results are directly applicable to future burning plasma experiments like ITER where alpha particle driven Alfvén eigenmodes are expected and a predictive model of the fast ion loss and redistribution is required.

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