Central Flattening of the Fast-ion Profile in Reversed-Shear DIII-D Discharges with Alfvén Eigenmode Activity*

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ABSTRACT. Neutral beam injection into a plasma with negative central shear produces a rich spectrum of toroidicity-induced and reversed-shear Alfvén eigenmodes in the DIII-D tokamak. Application of fast-ion D_α (FIDA) spectroscopy shows that the central fast-ion profile is nearly flat in the inner half of the discharge. Neutron and equilibrium measurements corroborate the FIDA data. The temporal evolution of the current profile is also strongly modified, as is the toroidal rotation profile. The flattening and reductions in central fast-ion density correlate with the amplitude of TAE and RSAE activity. Calculations by the ORBIT code do *not* explain the observed fast-ion transport for the measured mode amplitudes. A simulation of this discharge with the HMGC code suggests that transient Energetic Particle modes may be primarily responsible for the fast-ion transport, while the experimentally obvious TAEs and RSAEs may be relatively unimportant. A search for the predicted Energetic Particle modes is planned.

As all of the material in this invited talk has or will appear in archival journal publications, only a list of references is provided here. Internal fluctuation measurements of the TAEs and RSAEs in reversed-shear discharge #122117 and their excellent agreement with NOVA predictions appear in Refs. [1, 2]. The FIDA, equilibrium pressure, and neutron measurements of fast-ion transport in discharge #122117 appear in Ref. [3], which also briefly describes the inability of ORBIT-code simulations to account for the observations. A more complete description of the ORBIT simulations will appear

in a full-length article that is being submitted to *Nuclear Fusion* in conjunction with this meeting [4]; data showing the correlation of fast-ion profile flattening with the amplitude of the various types of Alfvén eigenmode activity in a large number of discharges will also be contained. Measurements of the effect of the fast-ion redistribution on the toroidal rotation profile will appear in a separate publication [5].

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References

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