

Simulations of synergy in fast-wave heating experiments when two frequencies are applied in DIII-D with neutral beam injection

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Abstract. In recent fast wave heating and current drive experiments with neutral beam injection in DIII-D, synergy was observed in measured neutron emission rates and in fast ion D-alpha (FIDA) signals from vertical FIDA spectroscopy when 6th harmonic 90 MHz fast wave power is additionally coupled to the plasma preheated by 4th harmonic 60 MHz fast wave power. The 5-D Monte-Carlo guiding center drift-orbit code ORBIT-RF coupled with the 2-D linear full wave code AORSA reproduces the trend of observations in these two observables when 60 MHz and 90 MHz fast Alfvén waves (FWs) are simultaneously applied to the plasma. Preheating the plasma with 60 MHz FW accelerates a significant fraction of the beam ions to energies higher than their injection energy (~ 80 keV), thus increasing the damping of the subsequently applied 90 MHz FW power, and producing a synergy, which is not predicted by linear wave damping theory.

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