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Simulation of Observed EGAM Induced Beam-Ion Losses in DIII-D*

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During counterbeam injection experiments in DIII-D a non-perturbative beam-driven instability, the energetic particle geodesic acoustic mode, or EGAM, was observed [1]. A theoretical description of this EGAM was given by Fu in [2]. The EGAM is an n=0 mode, located in the core of the plasma with a frequency that is about 50% below the ideal geodesic acoustic mode (GAM). The mode is observed frequently in DIII-D when the countergoing beams are injected early during the current ramp up phase. When the EGAM appears, drops of 10 to 15% in the 2.5 MeV neutron emission are observed. Since 2.5 MeV neutron signal in those DIII-D experiments is dominated by beam ion collisions with the thermal plasma, the drop in neutron emission indicates a decrease in the fast-ion population. Recently, accurate measurements have been made of EGAM induced fast ion losses with a fast-ion loss detector (FILD) mounted below the mid-plane in DIII-D.

In this paper we report on state-of-the-art fast-ion loss simulations that were done with the full particle-orbit following code SPIRAL for the first 50 ms of beam injection, where the 3-D beam birth deposition as calculated by TRANSP was used. A very good qualitative agreement between the measured and the simulated pitch, loss rate, and gyro radii was found.

[1] R. Nazikian, et al. Phys. Rev. Lett. **101**, 185001 (2008).
[2] G.Y. Fu, Phys. Rev. Lett. **101**, 185002 (2008).

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