Beam-Ion Acceleration during Edge Localized Modes in the ASDEX Upgrade Tokamak - DTU Orbit (17/11/2018)

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The acceleration of beam ions during edge localized modes (ELMs) in a tokamak is observed for the first time through direct measurements of fast-ion losses in low collisionality plasmas. The accelerated beam ion population exhibits well-localized velocity-space structures which are revealed by means of tomographic inversion of the measurement, showing energy gains of the order of tens of keV. This suggests that the ion acceleration results from a resonant interaction between the beam ions and parallel electric fields arising during the ELM. Orbit simulations are carried out to identify the mode-particle resonances responsible for the energy gain in the particle phase space. The observation motivates the incorporation of a kinetic description of fast particles in ELM models and may contribute to a better understanding of the mechanisms responsible for particle acceleration, ubiquitous in astrophysical and space plasmas.

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