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An island-induced Alfven eigenmode and effects of nonaxisymmetry on fast ions in the RFP

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The existence of a magnetic-island induced gap in the shear Alfvén continuum was predicted numerically [Biancalani et al. PRL 2010], but only recently have experimental observations of the MIAE been made in stellarator[Sun et al. PPCF 2015] and RFP plasmas [Cook et al. submitted PPCF 2016]. As the role of 3D magnetic fields in tokamaks grows in prominence, associated changes in the Alfvénic spectral properties, including MIAEs, are anticipated. The core of the NBI-heated RFP plasma exhibits several unique variants of axisymmetry-breaking magnetic perturbations that impact fast ion confinement and stability.
The appearance of magnetic islands and associated magnetic stochasticity is controllable. A well-formed core-localized island is adjustable in size, ideal for study of the MIAE. While the RFP is nominally axisymmetric, in the quasi-single-helicity limit the dominant island envelops the magnetic axis, producing a stellarator-like three dimensional geometry. Here we present observations of fast ion transport in the presence of MIAEs in a RFP plasma. We further show a relative insensitivity of fast ion confinement to magnetic stochasticity, but a strong response to a coherent, 3D core perturbation.

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