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Fast Ion Transport during Sawteeth in the DIII-D Tokamak¹

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The transport of energetic ions in the presence of sawteeth is an important issue in tokamaks operating with the central safety factor $q < 1$. By altering the plasma cross section between bean and oval shapes, the nature of the sawtooth crash shifts from one dominated by the internal kink to one dominated by quasi-interchange. The q profile is measured by a motional Stark effect diagnostic. The FIDA diagnostic measures the spatial profile of fast ions before and after the crash. Two-dimensional imaging of the FIDA light diagnoses the transport of counter-circulating fast ions. The FIDA data show that fast ions up to the injection energy are redistributed in the bean while, in the oval, only lower energy ions experience appreciable transport. The observations are in qualitative agreement with the theoretical expectation that significant transport occurs when characteristic orbit times are longer than the sawtooth reconnection timescale.

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