Magnetic Helicity is Conserved at a Tokamak Sawtooth Crash

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ABSTRACT

The sawtooth instability causes sudden changes in magnetic topology during combined neutral beam and fast wave heating in the DIII-D tokamak. Measurements with a Motional Stark Effect diagnostic provide accurate determination of the equilibria before and after the sawtooth reconnection events. The global magnetic helicity $\int \mathbf{A} \cdot \mathbf{B}\, dV$ changes $0.2\% \pm 0.9\%$ at a sawtooth crash. The local change in helical flux, χ, is roughly consistent with the Kadomtsev model within large errors. The volume in which the helical flux changes is $85\% \pm 15\%$ of the volume predicted by Kadomtsev, while the central value of χ is within 1% of the predicted value.