Sawtooth oscillations in shaped plasmas

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Abstract

The role of interchange and internal kink modes in the sawtooth oscillations is explored by comparing bean- and oval-shaped plasmas.The $n = 1$ instability that results in the collapse of the sawtooth has been identified as a quasi-interchange in the oval cases and the internal kink in the bean shape. The ion and electron temperature profiles are followed in detail through the sawtooth ramp. It is found that electron energy transport rates are very high in the oval and quite low in the bean shape. Ion energy confinement in the oval is excellent and the sawtooth amplitude ($\delta T/T$) in the ion temperature is much larger than that of the electrons. The sawtooth amplitudes for ions and electrons are comparable in the bean shape. The measured q profiles in the bean and oval shapes are found to be consistent with neoclassical current diffusion of the toroidal current and the observed differences in q largely result from the severe differences in electron energy transport. For both shapes the collapse flattens the q profile and after the collapse return to $q_0 \gtrsim 1$. Recent results on intermediate shapes are reported. These shapes show that the electron energy transport improves gradually as the plasma triangularity is increased.

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