A Comparison of Plasma Ion Rotation and Magnetic Mode Rotation in Alcator C-Mod

By

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ABSTRACT

There is still much to be learned about the ion toroidal rotation, the magnetic mode rotation, and the conditions under which they couple in a tokamak plasma. One way to better our understanding of these is through a comparison of the ion impurity rotation frequency and the sawtooth precursor frequency under various plasma conditions. In order to perform this analysis for a large number of experimental shots in Alcator C-Mod, an automated routine was written for determining the sawtooth precursor frequencies and loading these frequencies into a database, along with the ion impurity rotation frequencies and other plasma parameters taken at the times of the sawtooth precursors. It was determined that these frequencies agree most of the time, and their disagreement is in many cases the result of ion impurity rotation frequencies above 23kHz, sometimes the result of RF heating in excess of 4.2MW. According to the data in the database, there is a linear dependence between the two frequencies and $W_{\text{MHD}}/I_p$, as has been observed with previous research; however, comparable correlation exists between the frequencies and $\beta_p$, $\beta_n$, and $W_{\text{MHD}}/I_p^2$. At the same time, there appear to be candidate power laws for the two frequencies which include $\beta_p$, $\beta_n$, $W_{\text{MHD}}$ and $I_p$, $W_{\text{MHD}}/I_p$, and $W_{\text{MHD}}/I_p^2$.

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