Stability of a magnetic island within a sheared flow

Julio J. Martinell\textsuperscript{1} and Daniel López-Bruna\textsuperscript{2}

\textsuperscript{1}Instituto de Ciencias Nucleares, UNAM, A. Postal 70-543, México D.F., Mexico
\textsuperscript{2}Laboratorio Nacional de Fusión, As.EURATOM-CIEMAT, 28040 Madrid, Spain

It has been observed in the TJ-II heliac a close correlation between rational surfaces and transport barriers as well as a persistent MHD activity that has a dynamical evolution \cite{1}. Rational surfaces are usually the locus of magnetic island formation because the magnetic perturbations are resonant there; therefore it is the most likely region for the origin of the observed MHD activity. On the other hand, transport barriers are commonly associated with the presence of sheared flows which, in the case of the TJ-II experiments, would appear at or around the magnetic resonant surfaces. A possible sequence of events that may explain the observations in TJ-II is that the non-ambipolar transport processes in the vicinity of a rational surface give rise to a sheared radial electric field which reduces the anomalous transport creating a barrier. Then the magnetic island that may be present at the resonant surface is affected by the sheared flow according to the stability properties of the tearing mode. The island evolution is observed as MHD activity and may disrupt the transport barrier. Here we study the stability of the magnetic islands under the influence of the sheared flow around them. We start with the island of the vacuum magnetic field at a low order rational surface and analyze the effect of the plasma through the polarization drift on the stability parameter $\Delta'$, which determines the nonlinear evolution of the island width. $\Delta'$ depends on the velocity profiles near the island separatrix for which we use model profiles that include the shear. Conditions for the growth of the island are then obtained in terms of the plasma scale lengths.

References

\cite{1} D. López-Bruna el al., Nuclear Fusion \textbf{53}, 073051 (2013)