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Influence of geometry on drift waves in tokamaks and stellarators

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Abstract

Linear stability of electron drift waves is investigated in the H1–NF and W7–X stellarators and the results are compared and contrasted with those of a JET like tokamak equilbria. Generally, the high frequency modes are found to be strongly localized and most unstable while the low frequency modes are found weakly localized and less unstable. In the stellarators, the most unstable modes are found where the stabilizing effect of local magnetic shear is minimum or where the coupling between the local magnetic shear and geodesic curvature is strong. However, this coupling is found to be weaker in W7–X and even more weak in tokamaks than in the H1–NF stellarator. In tokamak geometries, the existence of the high frequency modes and their frequencies and growth rates are found strongly dependent on the local shear of the magnetic field. The modes exist with their frequencies and growth rates inversely proportional to the magnitude of the shear, while, field line curvature has found less effective on these drift modes. The results of the JET–like equilibrium are also compared and contrasted with the results of a circular equilibrium with the same aspect ratio. However, in tokamaks with shaped cross section modes are found to be more localized than the modes in the circular equilibrium. Like in the stellarators, this is found to be due to the variation in the strength of the local magnetic shear, which localizes the modes along the field lines and constraints them.