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The electron drift effect on the axi-symmetric global Alfven eigenmodes

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The axi-symmetric Alfvenic perturbations were observed on TFTR almost two decades ago and on JET more recently. They are global Alfven eigen-modes (GAEs) with characteristic frequency like that in cyclindrical plasmas, and the dominant poloidal mode number m=+/-1. The ellipticity of cross section is invoked to explain the splitting of the cylindrical ideal MHD Alfven continuum in a recent research. In this work, we studied the axi-symmetric GAEs using the two-fluid model. The simple geometry with concentric circular cross section is adopted. The cylindrical Alfvenic continuum splits into two branches due to the drift effect from the electron temperature gradients alone, without taking into account the non-circular shaping of cross sections. For profiles of the safety factor, electron temperature and density in a typical tokamak plasma, the two separate accumulation points are near the edge region of the plasma. It gives an interpretation of the two axi-symmetric Alfven modes observed on TFTR. The toroidal coupling of the m=1 and m=-1 components results an up-shift of the continuum, but has no effect on its splitting. The radial mode structure is similar to that predicted from ideal MHD codes.

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