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P4.1054 Singular global components and frequency shift of the continuum GAMs in shaped tokamak plasmas

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Geodesic acoustic modes (GAMs) of a global character are frequently observed in tokamak plasmas. While many aspects of GAMs require a kinetic treatment, the MHD model offers a suitable framework for analytically studying various global aspects of these modes, including higher-order effects of plasma shaping, plasma flows, and the magnetic perturbations connected with the GAM [1]. In this contribution, we extend the MHD analysis in [1] in order to study two additional aspects of the GAM. We first show that, as a part of the continuous MHD spectrum, the GAM eigenfunctions include components that exist outside the GAM surfaces and have singularities of type (P - P0)^-1 or ln|P - P0|, where P is a flux function that labels the magnetic surfaces, and P = P0 defines the singular (or GAM) surface [2]. Hence, in addition to the m = 0 and m = 1 delta function components of the plasma flow and of the density and pressure perturbations existing at the GAM surface, the GAM continua also include = 0 and = 1 singular components varying as (P - P0)-1 near P = P0, and extending from the plasma centre to the edge. This gives these Fourier components of each GAM in the continuum a global character. We also calculate the effects of a finite aspect ratio and a non-circular plasma cross section on the GAM frequency, and recover the dependence on inverse aspect ratio and Shafranov shift of the GAM frequency previously derived within gyrokinetic theory by Gao [3]. While the dominating shaping effect on the GAM frequency comes from plasma elongation, we show here that there is a higher-order triangularity effect that can also be significant. The calculated triangularity effect predicts a nearly linearly increasing GAM frequency with increasing triangularity, a phenomenon observed also in the TCV tokamak.
[1] Wahlberg C and Graves J P 2016 Plasma Phys. Control. Fusion 58 075014 [2] Pao Y P 1975 Nucl. Fusion 15 631 [3] Gao Z 2010 Physics of Plasmas 17 092503

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