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News from the Geodesic Acoustic Mode: Magnetic Shear-, q-, and Geometry Effect

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The generation of GAMs has been studied in greater depth by three-dimensional turbulence simulations. A change of the magnetic shear, in particular, a switch to negative shear profoundly affects the amplification mechanics of the GAMs. Essentially, negative shear flips the symmetry of the turbulence modes with respect to the shear flows, altering the sign of the Stringer-Winsor forces. The phenomenon readily suggests an experimental test, which would quantify the role of the Stringer-Winsor effect in comparison to the Reynolds stress in exciting the GAMs. The safety factor q controls the coupling of the GAMs to the parallel velocity, i.e., sound waves. Lowering q increases this coupling. Since the parallel sound waves in turn are heavily damped by the turbulence, they act as a loss channel. Thus sufficiently low q leads to a quench of the GAM activity, as has been found in recent experiments, too. Finally, the shape of the flux surfaces has great influence on the frequency of the modes and the relative strength of the Stringer-Winsor force. Again, the results suggest a relatively straightforward comparison with experiments. In all these cases one has to carefully differentiate between changes of the turbulence brought about by the parameters, and changed properties of the GAMs and their interaction with the turbulence.