Radial Propagation of GAMs and Zonal Flows

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We derive the collisionless dispersion relation for Geodesic Acoustic Modes in tokamaks, in the limit where ion Landau damping is exponentially small. We show that electron Landau damping is also very small. Nonlinear scattering is thus expected to be the dominant attenuation mechanism for propagating GAMs. A lower limit on attenuation is set by ion-ion collisions. For tokamak reactor parameters, the GAM group velocity multiplied by the collision time is comparable to the minor radius. Thus, the GAMs may be a candidate for wave transport of energy in reactors.

The radial propagation of zonal flows is also considered. In the presence of global velocity shear, the zonal flow characteristics may allow for radial propagation, which may take the form of heat pulses [**?**]. We revisit the problem of poloidal rotation decay, with an equilibrium (long wavelength) velocity shear. The residual flows are found to have a real frequency determined by the equilibrium velocity shear.

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References

[1] W. Nevins, private communication.