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Complex-Hamiltonian Paraxial Description of Damped Geodesic Acoustic Modes EMANUELE POLI, FRANCESCO PALERMO, ALBERTO BOTTINO, OMAR MAJ, HANNES WEBER, Max-Planck Institute for Plasma Physics — Geodesic acoustic modes (GAMs) are a fundamental part of the dynamics of turbulence and zonal flows in tokamaks. They exhibit simple yet non-trivial dispersive and dissipative properties. In linear numerical simulations, they are often initialized in the form of (e.g. Gaussian) packets which evolve in time. Depending on the parameters, the damping rate can be comparable to the oscillation frequency. Wigner-function methods developed in the frame of non-Hermitian quantum mechanics are shown to be applicable to damped geodesic oscillations. In this approach, the standard approximation of "weak damping", often introduced for the treatment of plasma waves, is not needed. The method requires that the properties of the plasma do not vary significantly across the width of the packet, so that a paraxial expansion can be applied. The equations governing the packet in the paraxial limit are shown to be formally the same as the equations of paraxial WKB theory, employed e.g. for high-frequency wave beams in plasmas, with the real Hamiltonian replaced by the corresponding complex one. Analytic solutions can be derived in particular cases and compared to the results of global gyrokinetic simulations performed with the code ORB5.

Emanuele Poli
Max-Planck Institute for Plasma Physics

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