A novel non-specular mechanism for chaotic ray scattering of internal waves in a 3D anisotropic stadium

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Fluids, subject to symmetry breaking, support propagation of anisotropic internal waves. Internal wave rays obey a non-specular reflection law, as their inclination is solely dictated by their frequency. Although satisfying the linear Poincare equation, in non-trivial basin geometry the ray dynamics exhibits non-linear phenomena such as convergence onto wave-attractors [**?**]. Here we present a novel analysis of a 3D internal wave ray billiard in a basin with complex geometry based on the 2D Buminovich stadium [**?**]. We show and explain how variation of basin geometry controls ray convergence rates that in turn shift the ray dynamics between regimes of near-ergodicity, chaotic scattering, and non-chaotic scattering with self-similar patterns. The results relate to a broad context of physical phenomena as the ray dynamics reveal unexpected richness resulting from the interplay between elliptically induced ergodicity and hyperbolic induced focusing.

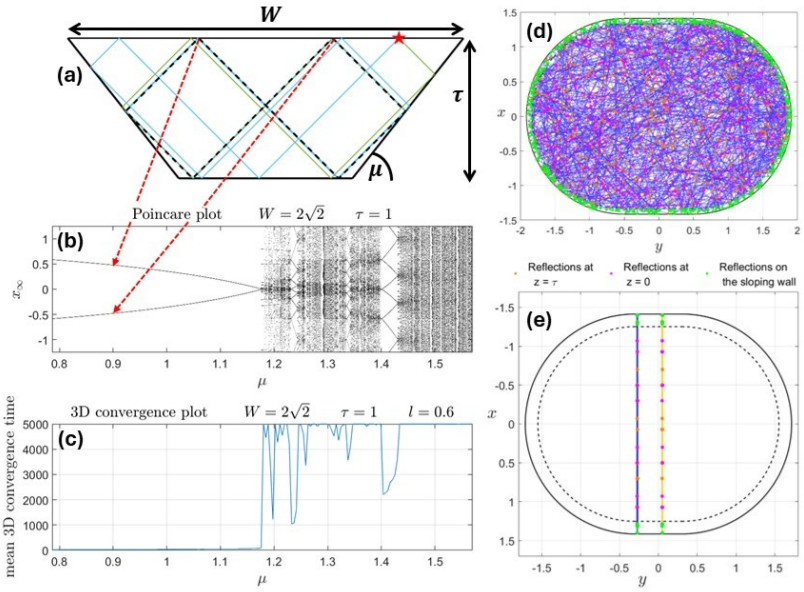

Figure 1. 2D wave-attractor structure (a),(b) dictates 3D ray convergence times (c) that in turn decide whether internal wave rays follow near ergodic trajectories (d) or converge onto wave-attractors (e).

References

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