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MHD Wave Propagation and Kelvin–Helmholtz Instability in Asymmetric Magnetic Slab System

Magnetohydrodynamic waves are ubiquitously detected in the highly structured solar atmosphere. At the same time, the solar atmosphere is also a highly dynamic plasma environment, giving rise to flows of various magnitudes, which can lead to instability of the waveguides. Recent studies have not only introduced waveguide asymmetry to generalize "classical"symmetric modelling of the fine structuring within the solar atmosphere, but also considered steady states as well. Building on these studies, here, we investigate magnetoacoustic waves guided by a magnetic slab within an asymmetric magnetic environment, in which the slab has steady background flow. This idealised approach may give us insight into the physics of the lower solar atmosphere. Based on the analytical investigation of how the phase speeds of the guided waves are affected [1], here, we model the behaviour of magnetoacoustic waves in the asymmetric environment. A wider parameter regime is employed as well as we verify the limiting flow speeds required for the onset of the Kelvin–Helmholtz instability obtained through several analytical simplifications. This model is part of a series of studies aimed to generalize, step-by-step, well-known symmetric waveguide models and understand the additional physics stemming from introducing further sources of asymmetry [2,3,4].

[1] Zsámberger, N. K., Tong, Y., Asztalos, B., & Erdelyi, R., 2022, ApJ,935(1), 41.

[2] Barbulescu, M., & Erdélyi, R. 2018, SoPh, 293, 86

[3] Zsámberger, N. K., Allcock, M., & Erdélyi, R. 2018, ApJ, 853, 136

[4] Zsámberger, N. K., & Erdélyi, R. 2020, ApJ, 894, 123

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