MHD waves in asymmetric waveguides

Robertus Erdelyi

Abstract

The recent suit of high spatial and temporal resolution of satellite and ground-based observations have enabled to make a leap forward in studying MHD waves in solar magnetic waveguides present from the chromosphere to corona. The building block of solar atmospheric magnetism is often modelled in the form of a magnetic slab or magnetic flux tube. The foundations of the theory of MHD waves applicable to solar waveguides, in the way we use them today, were laid down in the early 1980s. The basic concept was that MHD waveguides are embedded in a symmetric plasma environment. This theory was later further developed by adding a number of important subtleties, incl. variation in cross-section, stratification, various inhomogeneities along or across the waveguide, curvature, etc. However, one aspect was hardly considered: the waveguides may not actually be in a symmetric (non)magnetised plasma environment. Here, we demonstrate, how to overcome this important aspect and report on the development of theory of MHD waves and their applications to waveguides in asymmetric (non)magnetised plasma environment. We also present a number of solar magneto-seismologic applications to a range of waveguides present in the lower solar atmosphere (e.g. sunspot light bridge, light wall) or even in the chromosphere or low corona (e.g. prominences). We show how observed information of MHD waves and oscillations can be employed to obtain diagnostics about the asymmetric environment the waveguides are embedded in. We also show briefly how such waveguides support the development of local instabilities relevant for plasma heating.