

Magneto-acoustic waves in an asymmetric magnetic slab

Progress in spatial magneto-seismology



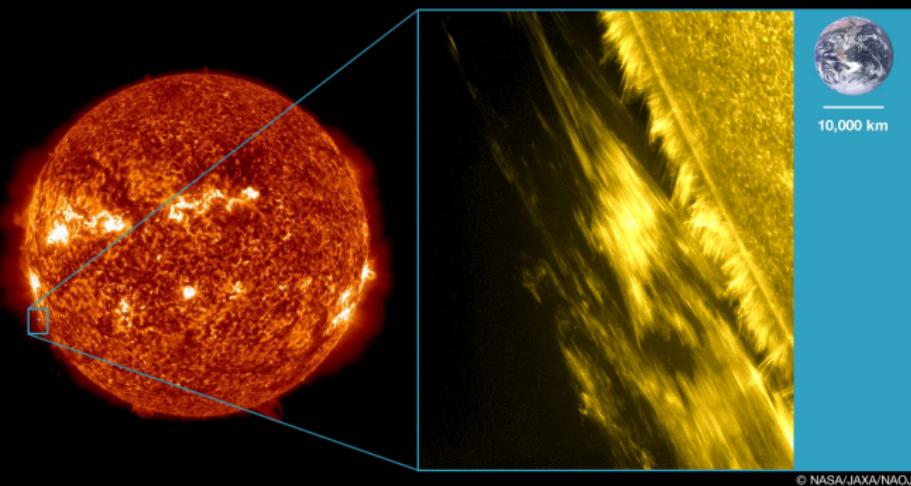
Matthew Allcock
and
Robertus Erdélyi



The
University
Of
Sheffield.

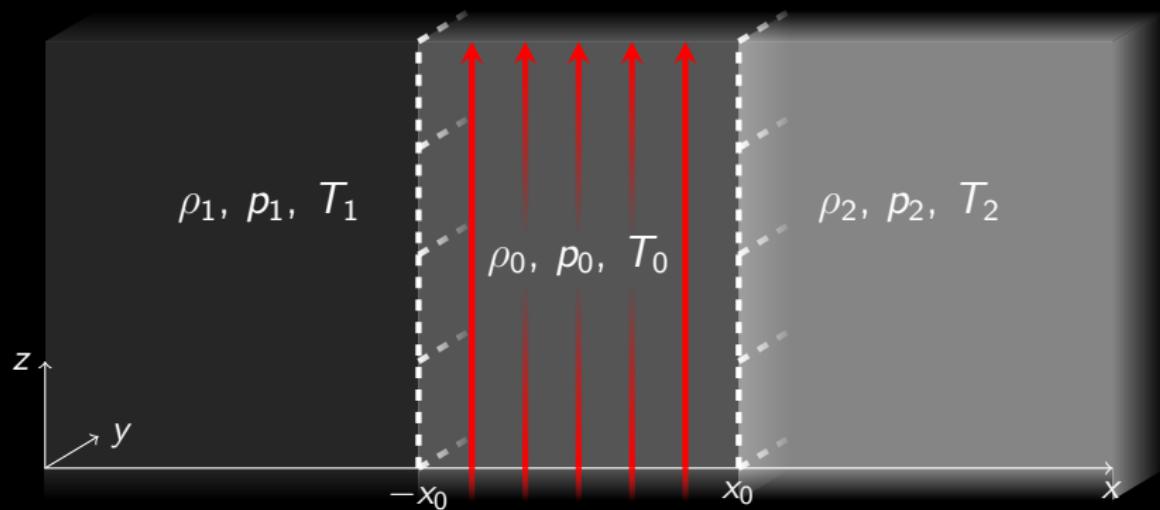


Motivation



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Equilibrium conditions



- Uniform magnetic field in the slab.
- Field-free plasma outside.
- **Different** density and pressure on each side.

Asymmetric slab modes

Slow **quasi-kink** surface mode

Red tubes: magnetic fieldlines,
Direction field: velocity perturbation,

$$v_A = 0.9c_0$$

$$c_2 = 1.2c_0$$

$$c_1 = c_2\sqrt{\rho_2/\rho_1} = 1.231c_0$$

$$\rho_2/\rho_0 = 2$$

$$\rho_1/\rho_0 = 1.9$$



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Asymmetric slab modes

Fast **quasi-kink** body mode

Number of nodes: 1

Red tubes: magnetic fieldlines,

Red/blue contours: **high/low** density perturbation,

Direction field: velocity perturbation,

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Fast **quasi-kink** body mode

Number of nodes: 2

Red tubes: magnetic fieldlines,

Red/blue contours: **high/low** density perturbation,

Direction field: velocity perturbation,

$$v_A = 0.9c_0$$

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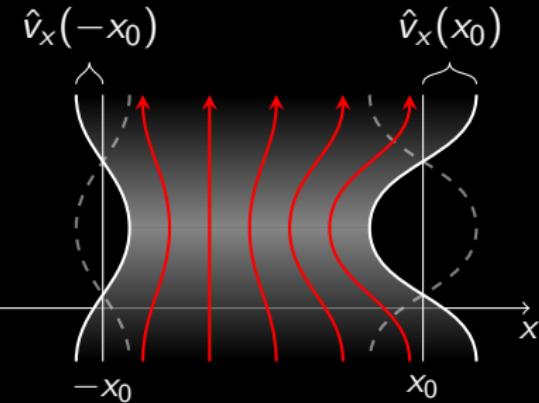
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Amplitude ratio



Amplitude ratio

$$R_A := \frac{\hat{v}_x(x_0)}{\hat{v}_x(-x_0)}$$

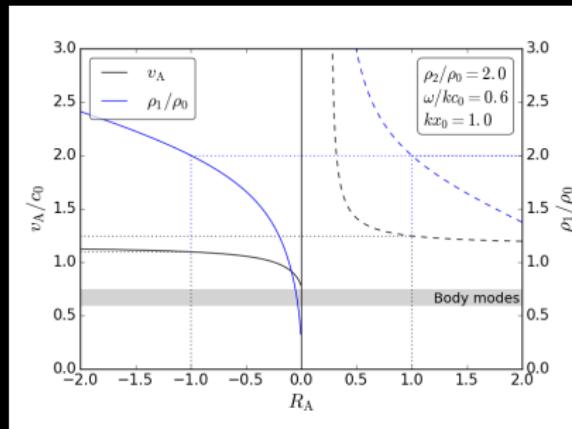
(Top = quasi-kink
Bottom = quasi-sausage)

$$= (+) \frac{\rho_1 m_2}{\rho_2 m_1} \frac{(k^2 v_A^2 - \omega^2) m_1 \frac{\rho_0}{\rho_1} - \omega^2 m_0 \left(\frac{\tanh}{\coth} \right) (m_0 x_0)}{(k^2 v_A^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} - \omega^2 m_0 \left(\frac{\tanh}{\coth} \right) (m_0 x_0)}$$

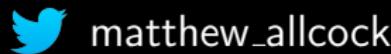
Solar magneto-seismology

Parameter inversion

- **Observe:** ω , k , x_0 , T_i , and R_A .
- **Solve** to find: v_A and hence **magnetic field strength**.



"a day without the Sun is, you know, night"



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