

Magneto-acoustic waves in an asymmetric magnetic slab

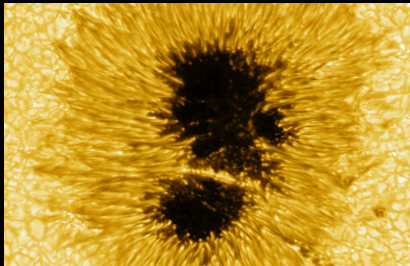
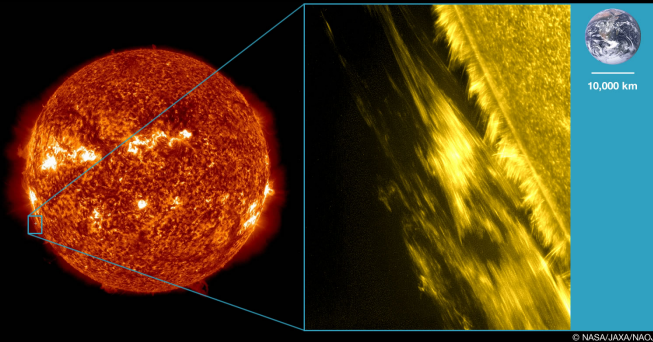
Matthew Allcock
and
Robertus Erdélyi



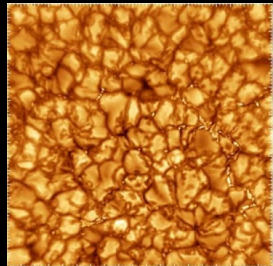
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Motivation

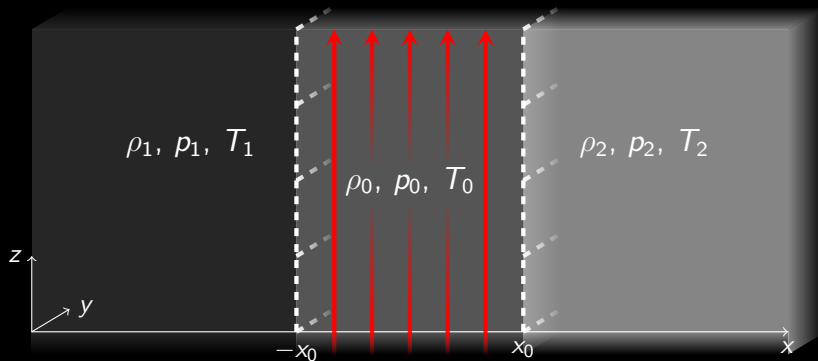


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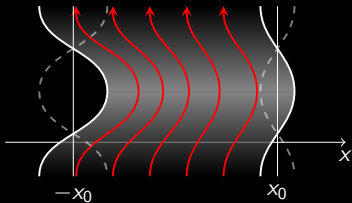
BBSO/NJIT

Equilibrium conditions - Asymmetric slab

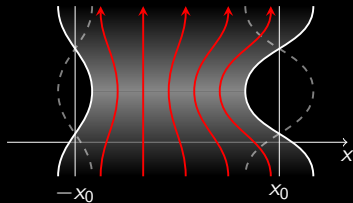


- Uniform magnetic field in the slab.
- Field-free plasma outside.
- **Different** density and pressure on each side.

Asymmetric slab eigenmodes

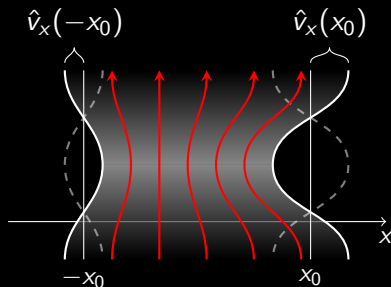


Quasi-kink



Quasi-sausage

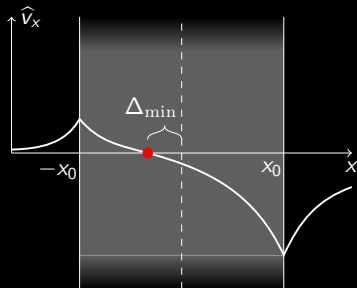
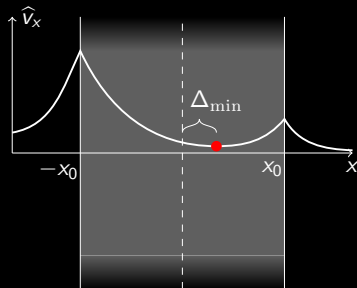
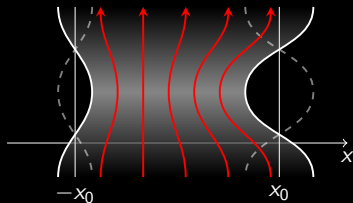
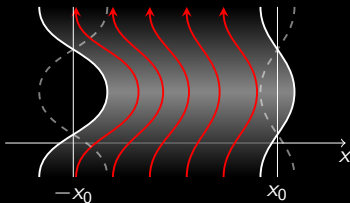
Amplitude ratio



Amplitude ratio

$$\begin{aligned}
 R_A &:= \frac{\hat{v}_x(x_0)}{\hat{v}_x(-x_0)} && \left(\begin{array}{l} \text{Top} = \text{quasi-kink} \\ \text{Bottom} = \text{quasi-sausage} \end{array} \right) \\
 &= \left(\begin{array}{c} + \\ - \end{array} \right) \frac{\rho_1 m_2}{\rho_2 m_1} \frac{(k^2 v_A^2 - \omega^2) m_1 \frac{\rho_0}{\rho_1} - \omega^2 m_0 \left(\begin{array}{c} \text{tanh} \\ \text{coth} \end{array} \right) (m_0 x_0)}{(k^2 v_A^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} - \omega^2 m_0 \left(\begin{array}{c} \text{tanh} \\ \text{coth} \end{array} \right) (m_0 x_0)}
 \end{aligned}$$

Minimum perturbation shift



Minimum perturbation shift

Quasi-sausage:

$$\Delta_{\min} = \frac{1}{m_0} \tanh^{-1} \left(\frac{1}{D} \right)$$

Quasi-kink:

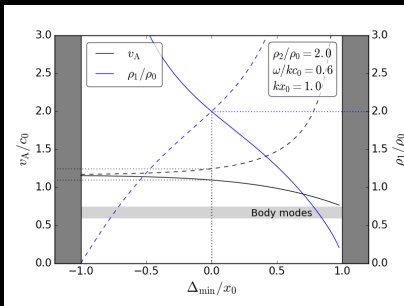
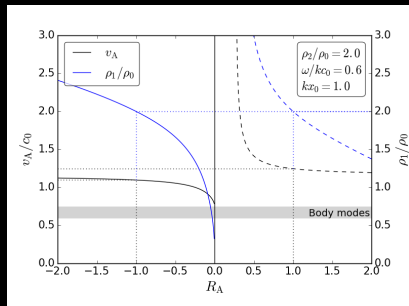
$$\Delta_{\min} = \frac{1}{m_0} \tanh^{-1}(D)$$

$$\text{where } D = \frac{(k^2 v_A^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} \tanh(m_0 x_0) - \omega^2 m_0}{(k^2 v_A^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} - \omega^2 m_0 \tanh(m_0 x_0)}$$


Solar magneto-seismology

Parameter inversion

- **Observe:** ω , k , x_0 , T_i , and R_A or Δ_{\min} .
- **Solve** to find: v_A and hence B_0 .



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

 matthew_allcock



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