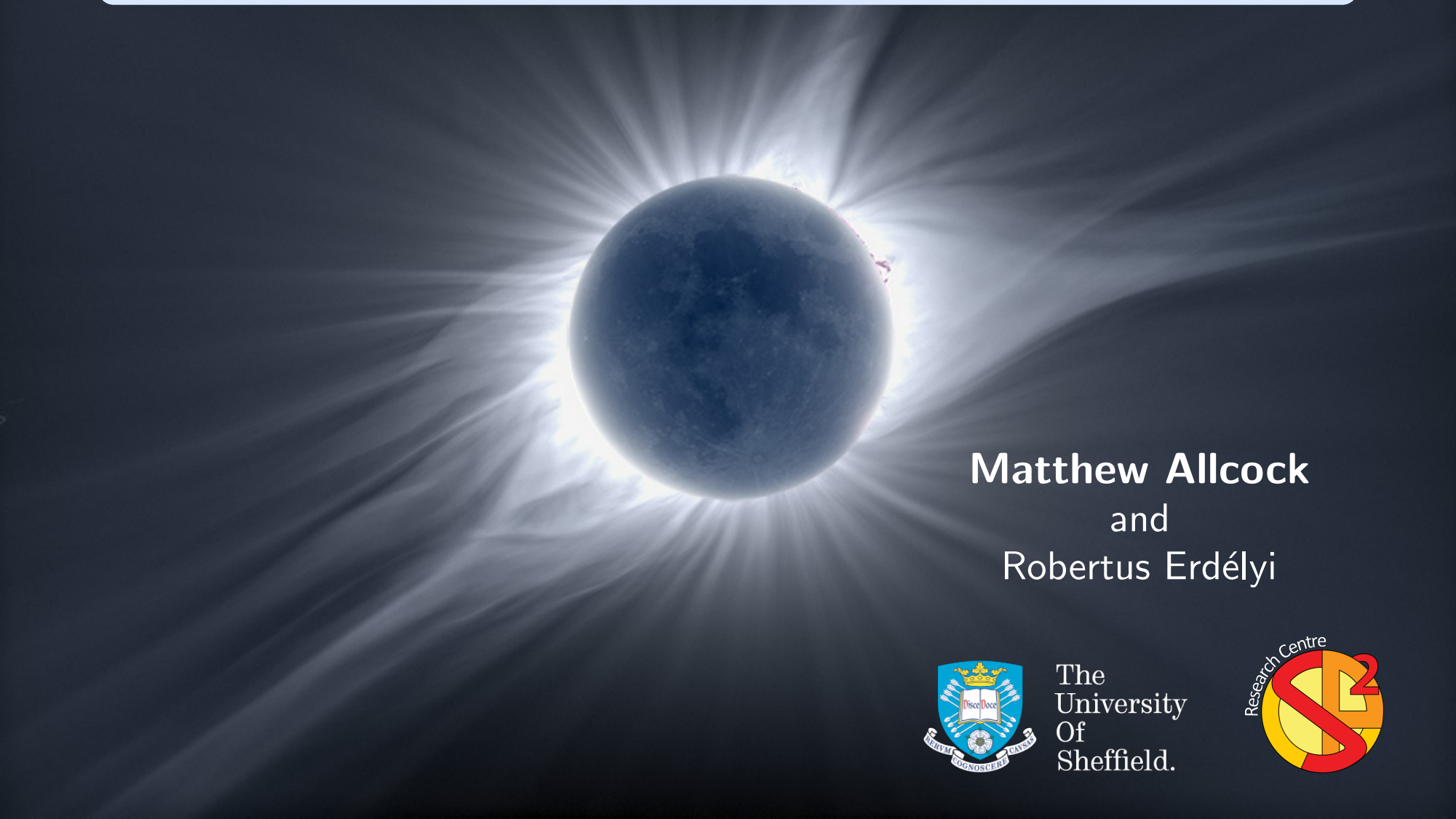
Magneto-acoustic waves in an asymmetric magnetic slab

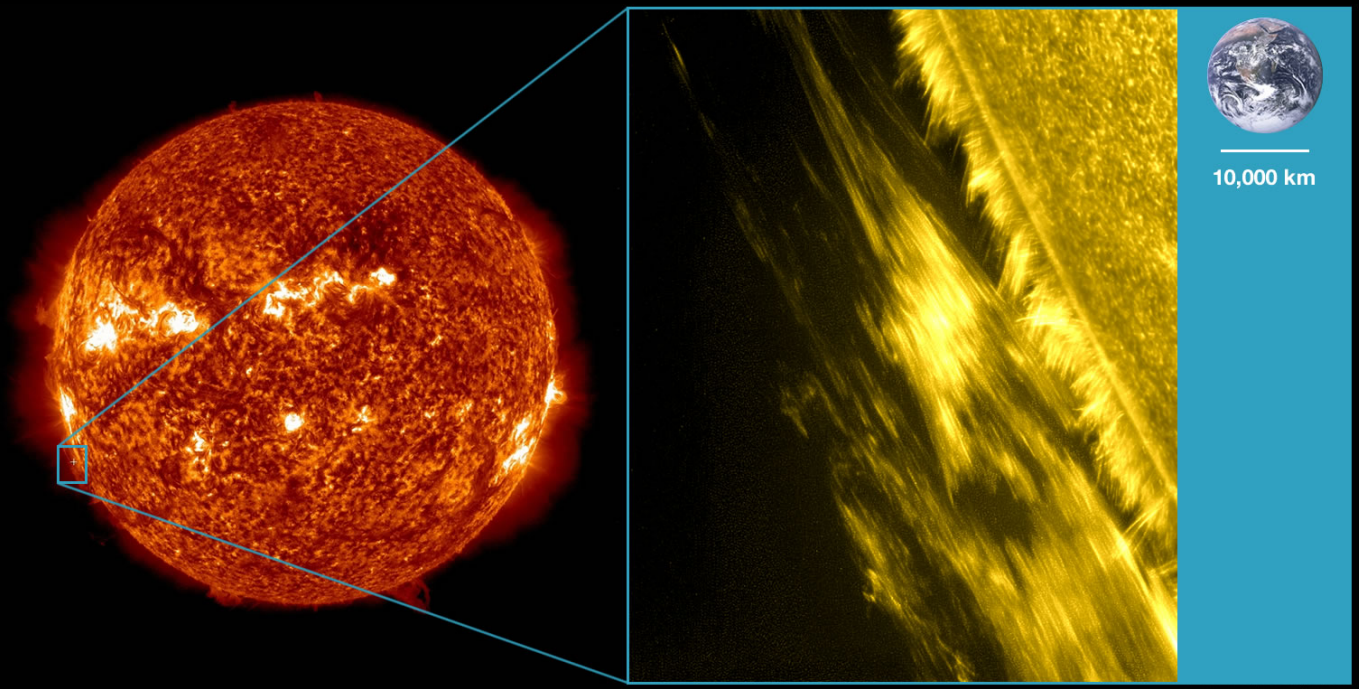


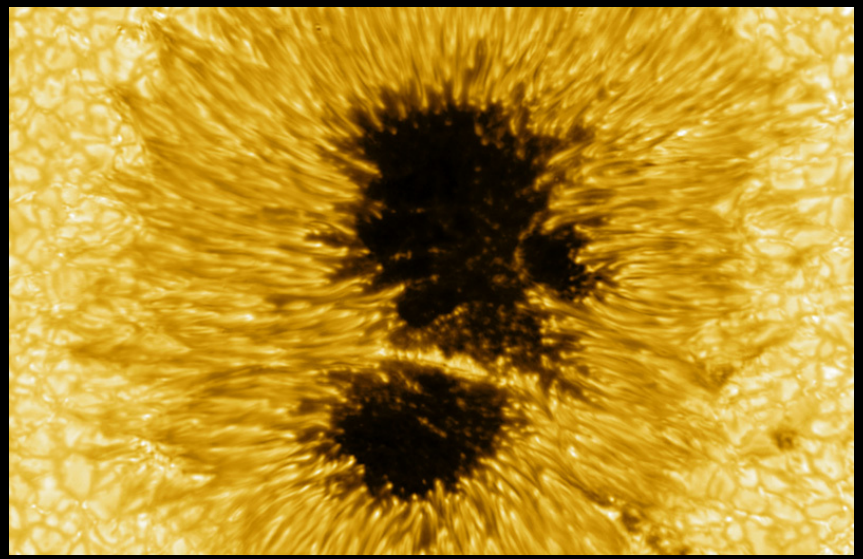
Matthew Allcock
and
Robertus Erdélyi

The University Of Sheffield.

Research Centre

Motivation





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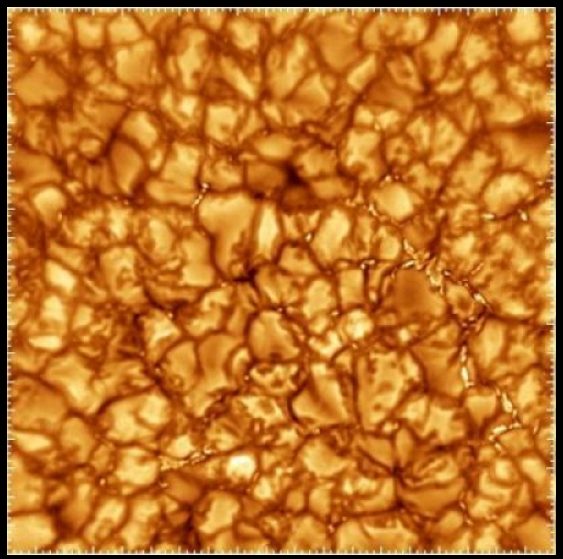

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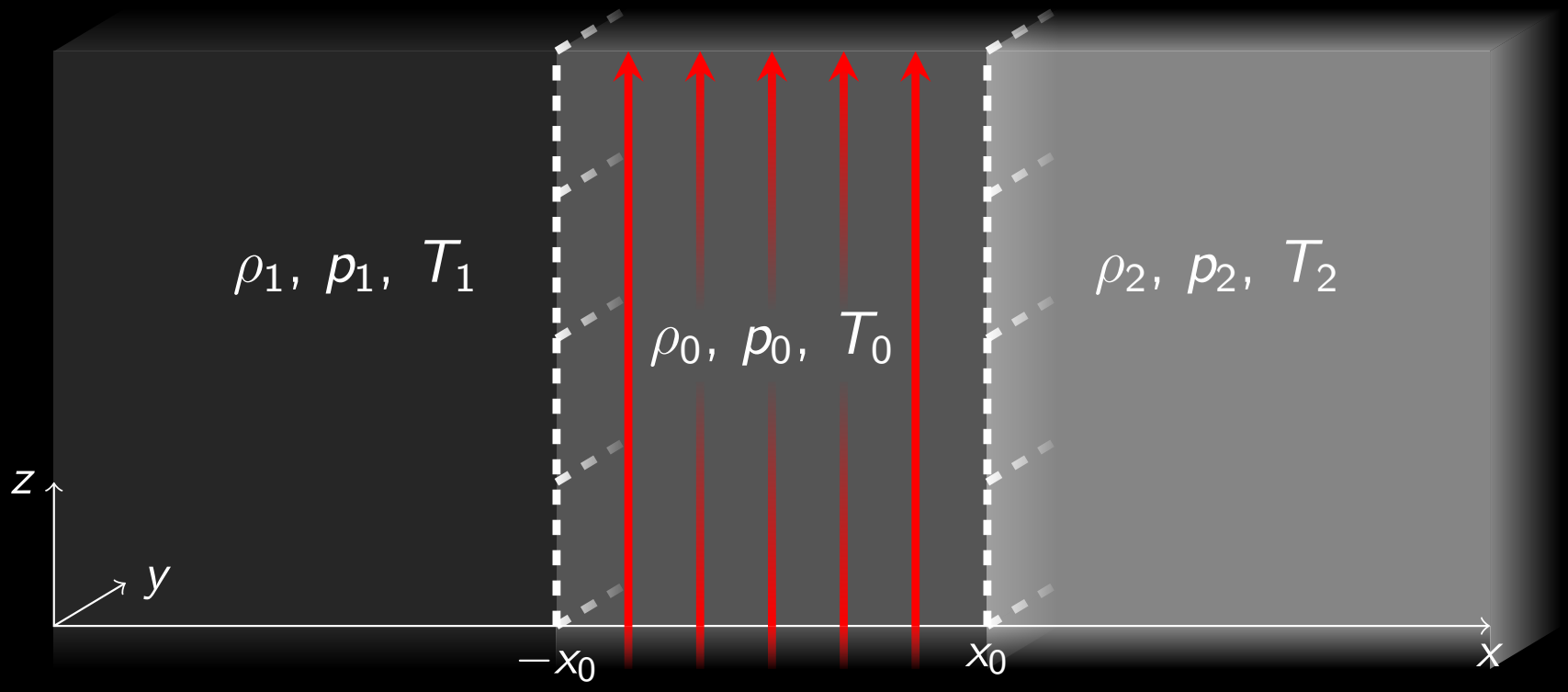
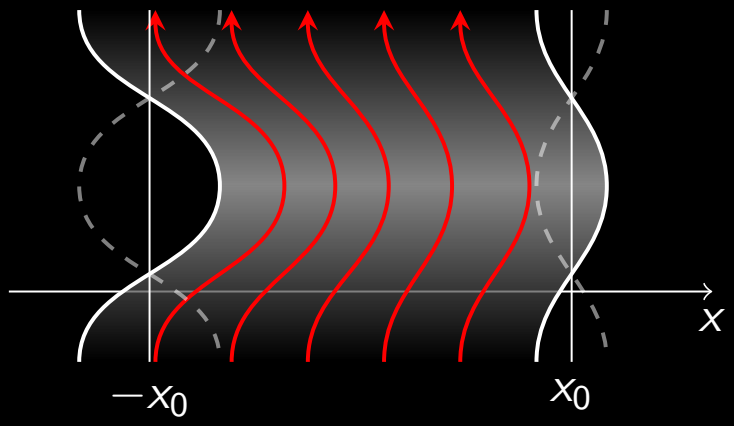
Equilibrium conditions - Asymmetric slab

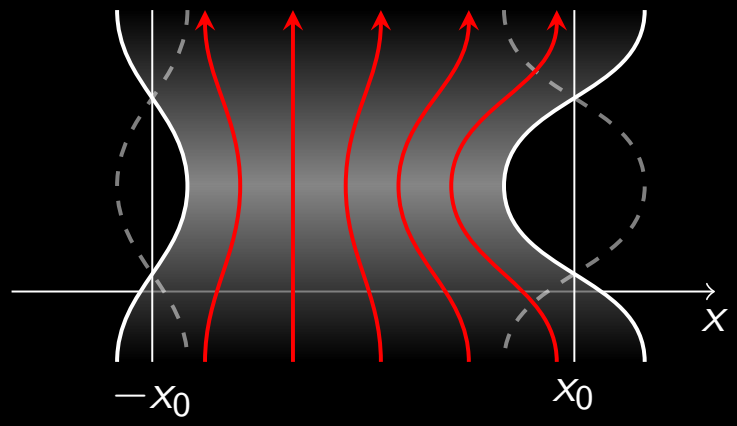


- Uniform magnetic field in the slab.
- Field-free plasma outside.
- Different density and pressure on each side.

Asymmetric slab eigenmodes

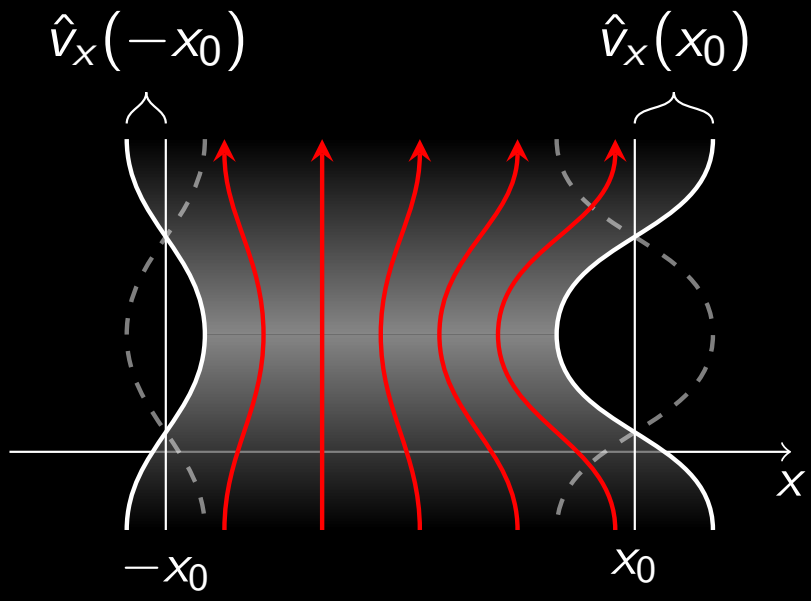


Quasi-kink



Quasi-sausage

Amplitude ratio

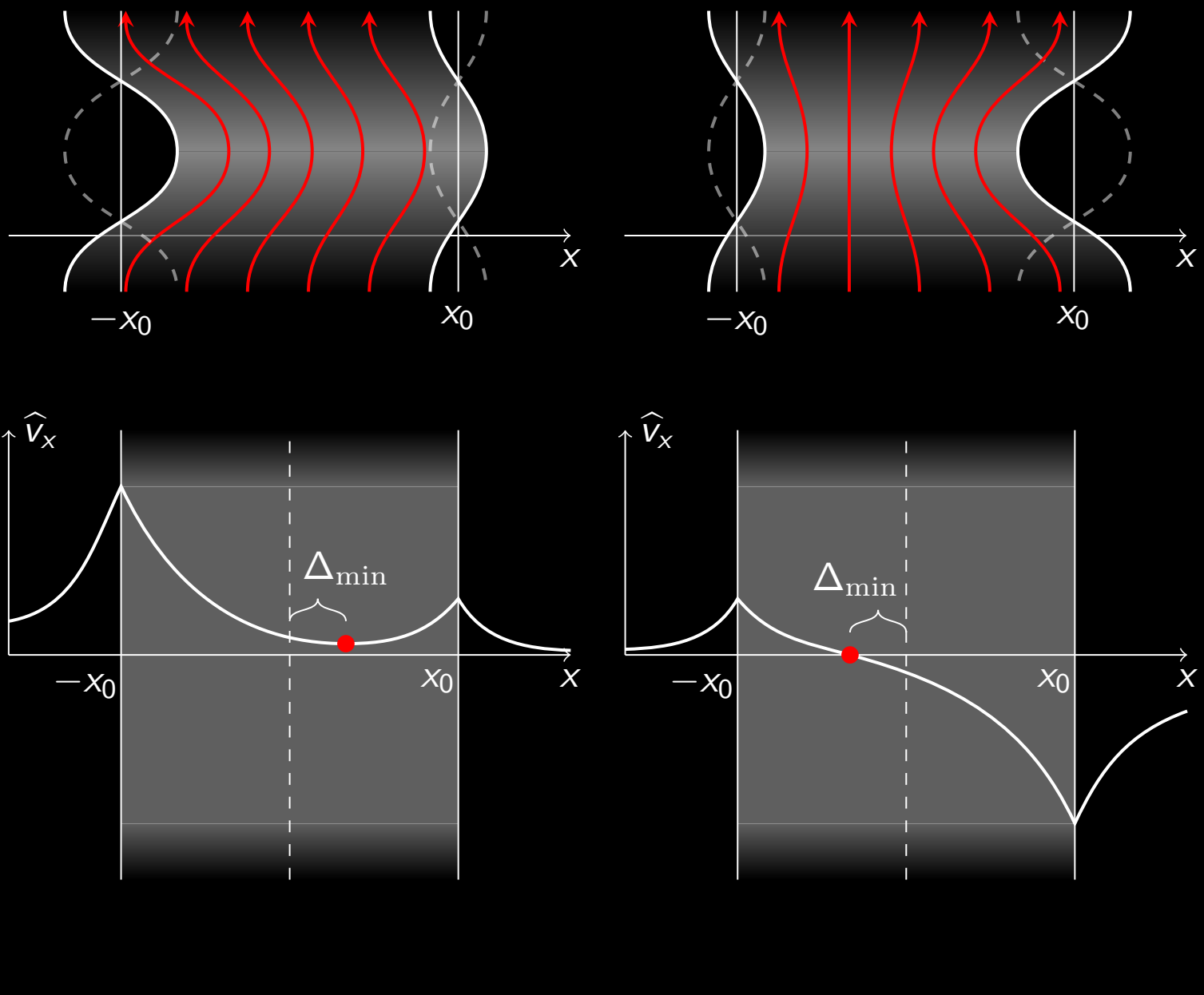


Amplitude ratio

$$R_A := \frac{\hat{v}_x(x_0)}{\hat{v}_x(-x_0)} \qquad \left(\begin{matrix}\text{Top} = \text{quasi-kink} \\ \text{Bottom} = \text{quasi-sausage}\end{matrix}\right)$$

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

Minimum perturbation shift



Minimum perturbation shift

Quasi-sausage:

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

Quasi-kink:

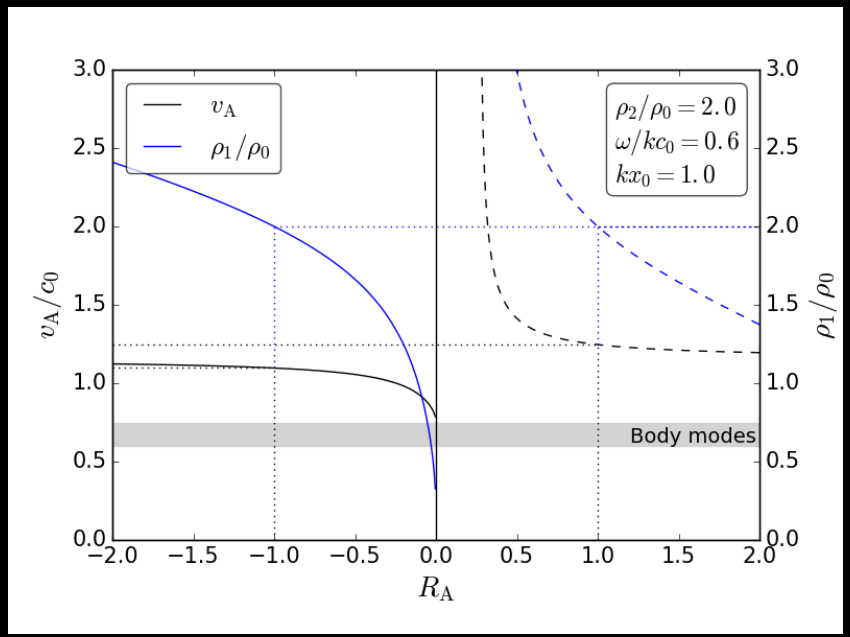
$$\Delta_{\min} = \frac{1}{m_0} \tanh^{-1}(D)$$

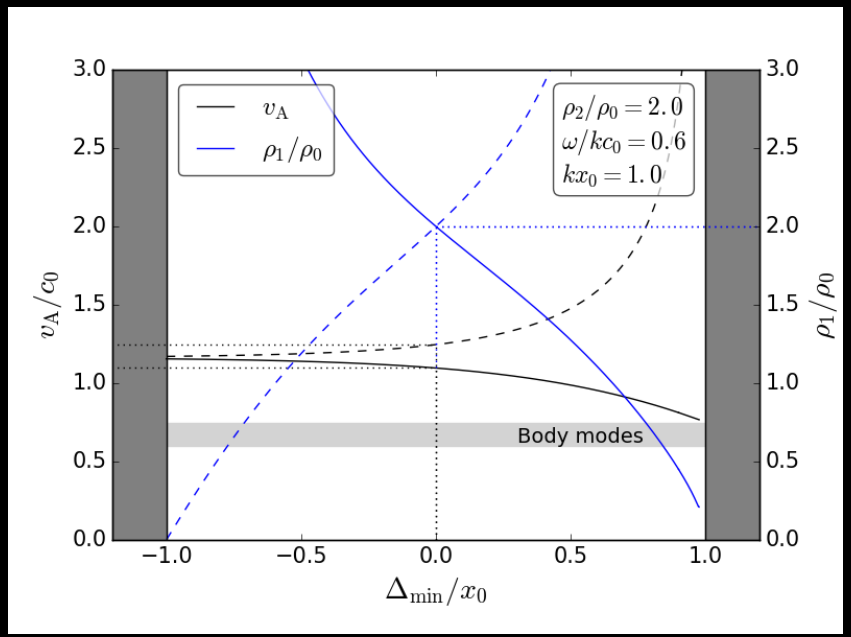
where $$D = \frac{(k^2 {v_A}^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} \tanh(m_0 x_0) - \omega^2 m_0}{(k^2 {v_A}^2 - \omega^2) m_2 \frac{\rho_0}{\rho_2} - \omega^2 m_0 \tanh(m_0 x_0)}$$

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

The University Of Sheffield.