Coronal Seismology
ASTR 598

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Spring 2016

Overview

The body of the frame
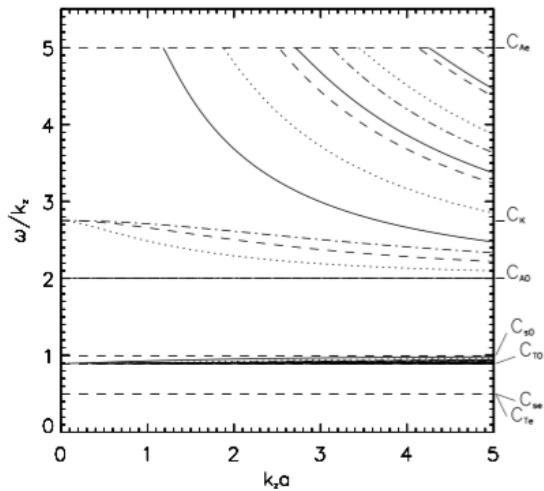
Motivation/Main Scientific Question

- The coronal heating problem

Basic MHD

Types of waves/oscillations:

- Alfvén: $V_A = \frac{B}{\mu_0 \rho}$
- Magnetoacoustic: $C_s = \sqrt{\frac{\gamma P}{\rho}}$
  - Fast $C_{A_0} < C_{fast} < C_{A_e}$
  - Slow $C_{T_0} < C_{slow} < C_{s_0}$

MHD equations

$$\xi(x) = \xi(r)e^{i(kz+m\phi)}$$

MHD modes

- Kink
- Sausage
- Acoustic
- Propagating acoustic modes
- Propagating fast modes
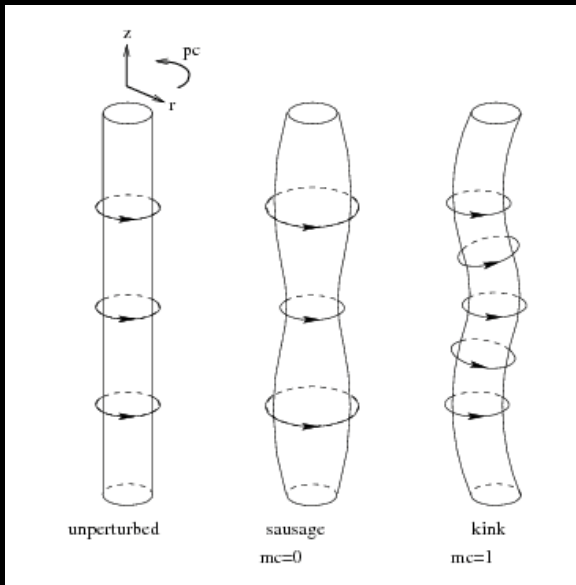- Torsional modes (aka. Alfvén waves)

Kinks and Sausages

image credit: $https://inspirehep.net/record/1088737/files/figures_instab_locations.png$

Kink

Coronal loop oscillations observed with the *Transition Region And Coronal Explorer (TRACE)*

- ▸ Gaussian vs. exponential
- ▸ Plasma motions around footpoints of coronal loops

Kink

Excitation and damping of broadband kink waves in the solar corona

Sausage

Observations of sausage modes in magnetic pores

Sausage

Sausage waves in transversely nonuniform monolithic coronal tubes

Acoustic oscillations

Propagating acoustic waves

Propagating fast waves

Torsional modes

Mixed modes

Important Properties

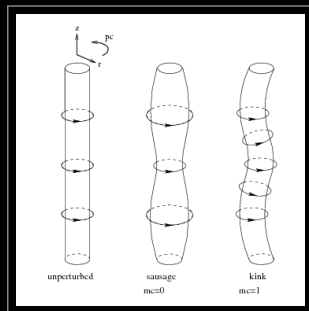|	timescale	sizescale	obs. method
kink osc	value	value	value
sausage osc	value	value	value
acoustic osc	value	value	value
acoustic waves	value	value	value
fast waves	value	value	value
torsional modes	value	value	value
mixed modes	value	value	value

Example Table

		Condition (Gold standard)	
		True	False
Test outcome	Positive	True Positive	False Positive
	Negative	False Negative	True Negative

Example of Two Column Output

Practical TeX 2005
Practical TeX 2005
Practical TeX 2005

My Research