First slide

My goal in this presentation is to give an overview of the thesis, and I will focus on explaining my aims and how I went about trying to achieve these aims.

Structure:

In this talk I intend to summarise the thesis chapter by chapter. The thesis has 5 chapters and 1 appendix. The chapters can be split into 1 introductory chapter, 3ish research chapters (depending on whether you class chapter 2 as a research or introductory chapter) and 1 conclusion chapter. I will talk about each chapter (excluding the conclusions chapter) in order. However, I will only speak briefly about the introductory chapter, and I will spend most of this time talking about the three research chapters.

Chapter 1: Introduction

In the introductory chapter, my goal is to introduce the main equations and terminology I will use throughout the thesis.

More specifically, my goal is to introduce:

* The terminology which relates to the solar atmosphere. I want to make sure the reader knows what I mean when I say words like chromosphere, active region, quiet sun etc.
* The coronal heating problem as in the third chapter of this thesis, I talk a lot about a specific heating mechanism, namely, phase mixing, so I thought it would be good here to have a brief overview of the coronal heating problem here, so I am ready to talk about a more specific heating mechanism in the third chapter.
* MHD equations and some of the critical assumptions needed for the plasma to be modelled as collisional. It was particularly important to show when the length scales are too short for the plasma to be modelled as collisional because, in the later chapters, very short length scales form due to phase mixing.
* I also go into quite a lot of detail describing the viscosity tensor, probably more detailed than most theses. I do this because, in chapter 3, I make strong claims about phase mixing as a heating mechanism. My claims are heavily reliant on modelling the resistivity and viscosity correctly.
* I also talk a little about thermodynamics. This thesis mostly ignores the thermodynamics for simplicity, and I usually model the loops as isothermal. My goal here is to clarify that I don’t think modelling the loop as isothermal is necessarily a good approximation, but it makes the calculations significantly easier.
* Dispersion relation. My goal here is to introduce the terminology and point out some basic facts about linear fast waves and Alfven waves. I do this by deriving their dispersion relations in a uniform medium. I don’t talk much about slow waves as I model the plasma beta equal to zero throughout most of this thesis.
* Finally, I talk about the observed power spectra of waves in the corona and how power spectra, in general, is calculated. I introduce the power spectrum here because I refer to it later in Chapter 2 when I look at footpoint driven waves where the driver is noisy. I also use it in Chapter 3 to calculate the heat produced by multiple harmonics of standing phase-mixed Alfven waves. I go into how the maths of how power spectra are calculated a lot more than I would in a paper. Still, since this is an introductory chapter, I thought it is worth going into detail so the reader knows precisely how the power spectra are defined.

Chapter 2: Ideal footpoint driven Alfven waves

In this chapter, my goal was to introduce some facts about footpoint driven Alfven waves relevant to this thesis. I think this chapter reads like a cross between an introductory chapter and a research chapter. I talk about lots of results that are already quite well known, so I think I would struggle to write a paper based on this content. However, I think I the way I derive many of the results is original so it could perhaps make it in to some sort of review paper.

More specifically, my goal in this chapter is to calculate:

* Closed loop: general solution using d’Alambert formula. I start Chapter 2 by showing how to calculate general solution for linear ideal Alfven waves in a uniform, straight closed field line with a footpoint driver using a method of images approach combined with d’Alamabert’s formula. The main reason is I derive this formula is that I make use of it in Chapter 3 when we calculate the solution for linear, resistive phase-mixed Alfven waves in a leaky loop. It’s really easy to include leakage with this formula. It also has
* Closed loop: sinusoidal solution (resonant, nearly resonant, non-resonant)
* Closed loop: broadband driver solution
* Leaky loop: Reflection coefficient
* Leaky loop: steady-state solution
* Open loop: phase mixed solution