RICE UNIVERSITY

Impulsive Heating in the Solar Atmosphere

by

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Master of Science

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ABSTRACT

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This will be the abstract for my thesis.

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Chapter 1

Introduction

Intro to the first chapter Give a nice history of solar observations and discuss current observing efforts as well as modeling efforts, but briefly

1.1 Structure of the Solar Atmosphere

This section will discuss the structure of the solar atmosphere including the different layers of the Sun and how they are connected. This will help to introduce the solar corona

1.2 The Solar Corona

This section will discuss the solar corona, including its structure, temperature, observational characteristics etc. End with outline of the rest of the thesis: in ch. such and such we will discuss such and such

Chapter 2

Coronal Loops

This chapter will discuss the discrete nature of corona in terms of coronal loop structures Need a section on general plasma dynamics of loops to discuss energy transfer/loss/gain through heating/enthalpy/radiation/draining/filling Also discuss general structure and how they are formed Give some general characteristics about them like length, temperature, density, through what layers they extend etc. Show nice schematic

2.1 Observations

Discuss some observations of loops and what has been learned about them, what constraints, multi-stranded versus single stranded Show some pretty pictures

2.2 Modeling

Discuss modeling approaches, hydrodynamics versus magnetohydrodynamics, etc.

Chapter 3

Emission Diagnostics

This chapter will discuss emission measure (EM), differential EM (DEM), line intensities etc. and how they are interpreted in observational and modeling contexts Discuss how this is how we know anything about plasma in the solar atmosphere Can discuss forward modeling as well; this sets us up for the rest of the thesis

Chapter 4

Numerical Modeling

This chapter will outline our numerical approach to studying the solar corona

4.1 One-dimensional Hydrodynamics

List the 1D hydrodynamic equations and briefly discuss their origin (i.e. how they were derived) and how they differ from MHD approach Include plasma β justification of why we don't include the magnetic field Emphasize terms that are "non-standard" hydrodynamic terms (e.g. radiation, heat flux, ad-hoc heating, enthalpy transfer) Bring up HYDRAD model and discuss speed limitations

4.2 The EBTEL Model

Derive the EBTEL equations from the 1D hydrodynamic equations and discuss the physics behind the EBTEL model; what physics is left out? what physical insight can we still gain from this model? Say why EBTEL is important (i.e. large parameter sweeps that can't be done with HYDRAD) Discuss 0D nature, maybe include discussion of previous 0D models and why EBTEL is better Show comparisons between EBTEL and HYDRAD

4.3 The Two-fluid EBTEL Model

Discuss importance of two-fluid effects in hydrodynamic models of the solar corona; include some quick calculations to show how electron and ion fluids can become decoupled Derive two-fluid EBTEL equations from 1D hydrodynamic equations Show several comparisons between HYDRAD and two-fluid EBTEL to justify its use in this study If there is time, discuss speed comparison between EBTEL and HYDRAD

Chapter 5

Results

This chapter will include the results of our numerical study Here we will also describe how the study was performed and what tools were used to perform the study It is best not to introduce any new tools here; just pool from those that have already been discussed and show how they were applied Show lots of plots and tables

Chapter 6

Conclusions

This chapter will discuss the conclusions that we can draw based on the results in the results section. What do these results mean? What are the implications in the context of loops in active region cores? May include some topics for future work in this section as well or just wait and put it in a different chapter