

Chapter 1

INTRODUCTION

The cycle of life and death of stars baffled astronomers for many years. The study of stellar structure and evolution continue to be of paramount importance up to this date, since it is crucial to our understanding of various branches of astronomy, e.g. the structure of galaxies, and chemical history of the Universe.

A detailed coverage of the principles of stellar evolution is beyond the scope of this thesis. Moreover, for the interested reader, there are excellent classical textbooks (??) covering almost every aspect in the field of stellar astrophysics. Nevertheless, for the sake of completeness, a small introduction to several fundamental notions, tailored to our needs, will be attempted in the next few paragraphs.

1.1 Helium stars

A brief explanation of what a helium star is

1.1.1 Formation of Helium stars

A small section explaining how helium stars are being formed

1.1.2 Evolution of single Helium stars

A small section explaining the evolution of single helium stars

Mixing mechanisms

convection, overshooting, thermohaline

Effects of rotation

Rotational mixing

Transportation of angular momentum

Eddington-Sweet circulation etc

Winds and mass loss

Importance of mass loss in the evolution of stellar winds and Wolf-Rayet stars + magnetic braking → connection to angular momentum losses.

1.2 Evolution of binary systems

Few words about how most stars form in binary systems, detached, semi-detached and contact binaries

1.2.1 Interaction and orbital parameters

Cases A/B/C etc

1.2.2 Mass transfer

Few words about mass transfer in binary systems (wind mass accretion + Roche lobe overflow)

1.2.3 Common envelope

Explain a little bit in more detail the basics of CE

1.2.4 Angular momentum transfer

Effects of angular momentum transfer + magnetic braking

1.2.5 Gravitational waves

The very basics for GWs and their impact on binary mergers

1.3 Stellar transients

Couple of words for the different types of stellar transients and how can we observe them

1.3.1 Classification of Supernovae

Explain in details the difference between core collapse SNe and type Ia and different subdivision

1.3.2 Type Ib/c Supernovae

Explain in details this particular branch

1.3.3 X-ray binaries

HMXB, LMXB, UCXB