Astronomy 16 – Modern Astrophysics

Fall 2014

Week 11, 12

Stellar evolution leads naturally to the topic of stellar remnants – what's left behind when a star's life is over. And the end-state of stars leads naturally to a discussion of the ISM – where the gas ejected by dying stars goes…to form new stars!

Topics:

Degeneracy pressure
White dwarfs
Neutron stars
Black holes
Dust in the ISM
Detection of gas in the ISM
H II regions
Heating, cooling, and the multi-component ISM

Reading:

Tuesday we are having/had our second exam in class. And next Thursday is thanksgiving. So these notes cover the Thursday of week 11 and the Tuesday of week 12.

We will finish our discussion of end-states of stellar evolution, seeing the important role degeneracy pressure plays. So you should review Ch. 18, and especially the part at the very beginning where the expression for degeneracy pressure (eq. 18.11) is derived.

We'll discuss the implications of degeneracy pressure for white dwarf structure, the physics of the helium flash in red giants, and how the differences between neutron and electron degeneracy pressure lead to neutron stars being even more compact than white dwarfs.

We'll briefly discuss pulsars and black holes, including how we know their properties.

Then we'll move on/back to Ch. 16, which you should start reading. We'll likely only get to the first concept in the chapter on Thursday – dust. Please focus on the twin phenomena of dust extinction and reddening, and see how extinction can be incorporated into the distance modulus.

On Tuesday of week 12, we'll discuss the various ways we can detect gas in the interstellar medium, including the famous 21 cm line of atomic hydrogen. And we'll discuss H II regions – ionized regions surrounding hot stars. And we'll discuss the dominant heating and cooling mechanisms in the interstellar medium (ISM) and see how considerations of pressure equilibrium lead us to a "multi-component" picture of the ISM, in which hot and low density regions can coexist with cold and higher density regions.