ASTR 498N Spring 2014

Special Problems in Astronomy: **Stellar Evolution**

(TuTh 3:30 - 4:45 CSS 2416)

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Office Hours: Wednesday 12:00 – 2:00

Prerequisites: This is a course for advanced physics and astronomy majors. It is assumed that students have completed the Physics 171, 272, 273 sequence and the math sequences Math 140, 141, 241, and 246 (Calculus I, II, III and differential equations). We will make extensive use of simple differential equations.

TEXT: The required text is:

"The Physics of Stars" by A.C. Phillips

John Wiley & Sons, 2nd edition, 1999 — ISBN-13: 978-0471987987 (paperback)

Other References:

Another excellent book that was a strong contender for the text for this course:

"An Introduction to the Theory of Stellar Structure and Evolution" by Dina Prialnik
(Cambridge University Press, 2nd edition, 2010 — ISBN-13: 978-0521866040)

The following are classic textbooks, but they are more advanced (or just too big):

"An Introduction to Modern Stellar Astrophysics", 2nd edition, D. A. Ostile and B. W. Carroll (2007)

"Stellar Interiors", C. Hansen, S. Kawaler and V. Trimble (2004)

"Stellar Structure and Evolution", R. Kippenhahn and A. Weigert (1990)

"Principles of Stellar Evolution and Nucleosynthesis", D. Clayton (1968)

"Structure and Evolution of the Stars", M. Schwarzschild (1958)

"Stellar Structure", S. Chandrasekhar (1939)

GRADING: Grades will be based on the exams (two mid-terms and the final) and on homework (problem sets and a couple of computational projects). Weighting will be: Final, 34%; each mid-term, 18%; homework, 30%.

Date		Topic	Text Ref
Jan	28	Overview; Gravitational Contraction & Hydrostatic Equilibrium	Chapt 1
	30	Star Formation & The Virial Theorem	
Feb	4	Thermonuclear Fusion & Stellar Life Cycles	
	6	The H-R Diagram & Stellar Clusters	
	11	Physics of Ideal Gases	Chapt 2
	13	Electron Degeneracy & Degenerate Pressure	
	18	Radiation Pressure; The Saha Equation	
	20	Stellar Atmospheres	
	25	Heat Transfer in Stars; Convection	Chapt 3
	27	Conduction; The Cooling of White Dwarfs	
Mar	4	*** First Mid-Term Exam ***	
	6	Thermonuclear Fusion in Stars	Chapt 4
	11	Hydrogen “Burning” in Stars; Solar Neutrinos	
	13	Helium Burning & Advanced Stages of Burning	
	18	*** SPRING BREAK ***	
	20	*** SPRING BREAK ***	
	25	The Equations of Stellar Structure & Simple Models	Chapt 5
	27	Polytropic Models; The Chandrasekhar Mass Limit	
Apr	1	Computation of Models; The Solar Model	
	3	The Computation of Models of Evolving Stars	
	8	Stellar Rotation & Close Binary Stars	
	10	*** Second Mid-Term Exam ***	
	15	Advanced Evolution of Low & Intermediate Mass Stars	
	17	Advanced Evolution of Low & Intermediate Mass Stars	
	22	The Endpoints of Stellar Evolution; White Dwarfs	Chapt 6
	24	Evolution of Massive Stars – Supernovae	
	29	Neutron Stars & Pulsars	
May	1	Black Holes	
	6	Helioseismology & Astroseismology	Chapt 7
	8	Helioseismology & Astroseismology	
	13	Review	
May	21	*** FINAL EXAM: 10:30 AM - 12:30 PM ***	