Class Discussion Page

Particle Physics Primer

Homework Assignments Posted Here:

- **First Homework (Due Jan 22)**
- **Second Homework (Due Feb 5)** (note an egregious error in problem 1; 15 billion should be 15 million).

Course Structure

This course will be an exploration of current topics in astrophysics that can be addressed with an assumed student background of first year physics and first year calculus. The issues will be explored both from a theoretical and observational point of view and the chosen topics will tie in somewhat to actual astrophysical research being done at the UO.

There will be no assigned text book. However, there are copies of *Modern Astrophysics* (Carroll and Ostlie) on reserve at the Science Library. This book is also available at the bookstore but it is horribly overpriced.

Bi-Weekly problem sets will be assigned. While some of these problems may be standard cookbook physics problems in an astrophysics context, other problems will involve the use of real data and will require data analysis.

Lectures will be a mix of computer based presentations and standard blackboard lectures and derivations. Extensive notes for each lecture will appear on the course web site:

http://zebu.uoregon.edu/2004/astr321.html

Course Grading will occur around the following guidelines:

- Homework Assignments: 30%
• Midterm Exam: 30%

• Final Exam: 40%

Finally, note that there are two instructors in this course and the course will be taught in a true team manner. In general, both instructors will be present for each topical lecture and both will be making contributions so as the leverage each others expertise. Usually, one of the two professors will be the lead lecturer for the topic of the week. This is indicated in the lecture schedule below.

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**Course Content**

The first half of this course will be related to the structure of stars and their evolution. We will focus on topics such as:

- The Observational Characterization of Stellar Evolution
- Stellar structure and stability
- Energy generation in Stellar Cores
- Degenerate Matter in Stellar Remnants
- Supernova

The second half of the course will focus on more cosmological issues such as dark matter and dark energy as well as the standard big bang model. Topics will include:

- The observational foundation of the big bang model
- The Cosmological Redshift and Space-Time
- The thermal history of the universe from the particle physics point of view
- The evidence for dark matter
- The evidence for dark energy

A Rough schedule of weekly topics is given below.
Weekly Topics:

Week 1: Astrophysical Units, Sizes and Scales in the Universe/Observational Stellar Properties Bothun

Week 2: Stellar Structure and Stability: Bothun/Frey


Week 4: Degenerate Matter in Stellar Cores/Black Holes: Frey

Week 5: Supernova and exotic processes: Bothun/Frey

Week 6: Review of Material: Midterm Feb 12

Week 7: Cosmological Redshift and Standard Big Bang Model: Frey/Bothun

Week 8: Inflation, Quark-Gluon Fluid, Big Bang Nucleosynthesis: Frey

Week 9: The Evidence for Dark Matter/Particle Dark Matter: Bothun/Frey


Lecture Notes:

If your accessing the course notes and the JAVA Web Start environment is not loading. Visit java.com and download the latest JAVA. This will work best using Internet Explorer on the PC platform

Lec 01 Jan 06 Introduction to making the HR Diagram

Lec 02 Jan 08 Basic Stellar Properties: Mass Luminosity Relation
Lec 03 Jan 13 🔄 Modelling a Stellar Interior

Lec 04 Jan 15 🔄 Energy Generation I.

Lec 05 Jan 20 🔄 Energy Generation II

Lec 06 Jan 22 🔄 Energy Generation III (Bothun)

Lec 07 Jan 27 🔄 Neutrino Astrophysics and Non-relativistic Degeneracy.

Lec 08 Jan 29 🔄 Post Main Sequence Stellar Evolution.

Lec 09 Feb 02 🔄 Supernova Explosion Physics

Lec 10 Feb 05 🔄 Observational aspects of Supernova, Supernova detection, etc

Lec 11 Feb 10 🔄 Review of Material

Lec 12 Feb 12 🔄 Midterm

Lec 13 Feb 17 🔄 Observational Foundation of the Big Bang