

Physics/Astronomy 589
Topics in Theoretical Astrophysics
(Spring 2015)

Lecture: 2:00 -3:15pm Tuesdays and Thursdays

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Office hours: by appointment

GRADING: Grading will be based on oral presentations on a current research topic related to the topics covered in the course (in consultation with the instructor).

There will be no single textbook for this class. I will use selected chapters and review articles as well as the most recent research papers on each of the topics covered. This course is suitable for first year graduate students as well as for more advanced students.

Selected Topics to be covered

History of the Universe; Big Bang Cosmology

Friedman Equations

Thermal Equilibrium

Neutrino Decoupling

Recombination

Big-Bang Nucleosynthesis

Baryogenesis

Dark Energy

Thermal Relics and Dark Matter

Motivation for studying particle astrophysics:

What have we historically learned about particle physics from astrophysics and visa versa (solar neutrinos, supernova neutrinos, AGN gamma rays, GRB gamma rays, recent FERMI and IceCube "signals" for new physics, Cosmic Rays, etc.)

Astrophysical Sources of Gamma Rays and Neutrinos

Detection of Astrophysical Gamma Rays and Neutrinos

Neutrino Interactions in the Standard Model

Microscopic Black Hole Production (predicted in Theory of Large Extra Dimension) and its Signals in High Energy Hadronic Collisions and in Cosmic Rays

Microscopic Black Hole Production in Neutrino Interactions and its Detection
Review of Neutrino Telescopes (IceCube, ANITA, ARIANA, OWL, EUSO, RICE, ANTARES, etc.)
Recent Observation of Positron Excess with FERMI (New Physics?)
Recent Observation of Ultra-High Energy Neutrinos with IceCube (Astrophysical Neutrinos or Dark Matter?)
Supernova Neutrinos and New Particle Physics
Dark Matter Review
Dark Matter Signals with Gamma Rays and Neutrinos
The Effects of Dark Matter on Properties of Neutron Stars

This class will focus on review of each topic with special attention to current research problems in each area.

Students with disabilities who require reasonable accommodations to fully participate in course activities or meet course requirements are encouraged to register with the Disability Resource Center (<http://drc.arizona.edu>) and contact me to discuss accessibility issues.

Code of conduct: Students are expected to understand and follow the Student Code of Conduct, which is available at <http://w3.arizona.edu/~studpubs/policies/ppmainpg.html>.