Physics 499P/Astronomy 499P - Spring 2015
Particle Astrophysics
Tuesday- Thursday 2-3:15
Professors Julie McEnery & Jordan Goodman

Course Description: A contemporary review of the field of Particle Astrophysics

Specific objectives are:

This course aims to learn about:

1. The most energetic non-thermal processes in the Universe;
2. The current observations of cosmic gamma rays and high-energy particles (cosmic rays and neutrinos);
3. Evidence for and efforts to detect cosmic dark matter;
4. The interactions of particles with matter and how these are used to build instruments to detect high-energy particles from astrophysical sources (gamma rays, neutrinos and cosmic rays);
5. The mechanisms by which particles can be accelerated to high energies in astrophysical environments;
6. identify and describe those classes of astrophysical objects that provide such an environment, in particular supernovae and gamma ray bursts, pulsars and supernova remnants, and active galactic nuclei;
7. The remaining open questions and future prospects in the field of particle astrophysics.

Text: *Malcolm Longair, High Energy Astrophysics 3rd edition, Cambridge University Press (*2011) Note: Longair is a radio astronomer, and the emphasis in this text is different from that in the course, so don't be too put off by the level of the mathematics. It is available in paperback or electronically.

Assignments and Grading: During the semester you will be given several homework assignments and two projects. For the first project each student will study a specific type detector used in PA experiments or object class (e.g. Silicon strips, CCDs, NaI, Calorimeters, AGN, PWNs etc.) and produce a short report and give a short (5-10 minute) presentation to the class. The second project will involve each student studying a specific experimental technique in PA and giving a longer talk (15-20 minutes) describing the detector, the physics of the measurement technique, the science they study with it and summary of recent results. There will be also a final exam.

Grades will be based on the following:

First project	20%
Second Project	30%
Homework	15%
Class Participation	15%
Final Exam	20%

Contact Information:

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Important Dates:

First Class	Tuesday January 27, 2015	
Spring break	Saturday March 14, 2015	Sunday March 22, 2015
Last Class	Tuesday May 12	

Notes: We will post .pdf versions of material used in the seminar on the course web site.

Academic Integrity: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/whatis.html.

Disabilities: If you have a documented disability and wish to discuss accommodations, please contact the professor as soon as possible.

Tentative Schedule:

Week	**Topic**
1	Intro to Particle Astrophysics (big questions, things we won't cover in detail – Cosmology, Dark energy, Solar ν's etc.)
2	Cosmic Rays, Gamma Rays and Neutrinos
3	The High Energy Universe
4	A little Particle Physics
5	Particle Acceleration
6	Sources (AGN, GRBs, PWNs, etc.)
7	Detectors I (Scintillators, calorimeters, PMTs, etc).
8	Gamma Ray Satellites (Fermi, Swift)
9	IACTs (VERITAS, HESS, Magic, CTA)
10	EAS detectors (HAWC, Auger)
11	Neutrino Experiments
12	Dark Matter
13	Gravitational waves
14	Student Presentations