Advanced Nuclear Physics — PHY8800
Syllabus - Pruneau — Winter 2015

Prerequisites:
Successful completion of PHY7070, PHY7110, PHY7410, or equivalent

Intended audience:
Physics and Astronomy Graduate students

Synopsis:
This course is an advanced course in nuclear physics, it covers a wide range of topics and techniques of interest for professional nuclear and particle physicists with a particular emphasis on the study of the Quark Gluon Plasma via heavy ion collisions. Topics covered include collision kinematics, definition, calculation, and measurement of cross sections, nuclear geometry, thermodynamics and statistical physics applied to relativistic heavy ion collisions, data modeling, basic concepts in QCD and the description of hadronization.

Instructor
Professor Claude A. Pruneau, B.S., M.S., Ph.D.
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Office hours: Any afternoon, by appointment

Textbook
No textbook purchase is required in this class.
I will use materials from a variety of books, most particularly those by Ramona Vogt (Ultra-relativistic Heavy-ion Collisions) and Asis K. Chaudhuri (A Short Course on Relativistic Heavy Ion Collisions) and my own (in preparation).

Evaluation and Assessment of learning

Homework (about one per week):	50%
Project and presentation:	50%
Total	100%

Homeworks will be assigned on Monday and due 7 days later. Late work will not be accepted. They will consist of problem solving in areas covered in class.

Each student is to conduct a research on a specific topic of their choice in nuclear physics. The research may NOT be on the thesis topic and should cover a breadth and depth commensurate with the 8000 level of this class. Research projects are to be

reported in writing (following the style of APS journals) in a paper from 5 to 10 page long, and in oral presentation of 30 minutes at the end of the semester.

Final grades letters will be attributed according to the following table.

A	95 - 100 %
A-	90 - 94
B+	85 - 89
B	80 - 84
B-	75 - 79
C+	70 - 74
C	65 - 69
C-	60 - 64
D	<60

Course outline

1. Intro/Background. (1 week)
    1. Why study the QGP?
    2. Collision kinematics review.
    3. Invariants
    4. Definition of cross sections.
    5. How to measure cross sections.
2. Calculation of elementary cross sections. (1 week)
3. Nuclear Geometry. (1 week)
    1. Glauber Model.
    2. MC Glauber..
4. Thermodynamics and Statistical Physics and Kinetic Theory of HIC (2-3 weeks).
5. Phenomenological Models. (1 week)
    1. Power law, blast wave model, Tsalis
6. Hydrodynamic Modeling. (1 week)
7. Transport Models (1 week)
8. QCD, EoS of QGP. (2 weeks)
9. Measurements of correlation functions. (1 weeks)
10. Measurements of jets (1 week)

Learning Outcomes

- Basic understanding and mastery of the basic concepts and tools used in the study of the Quark Gluon Plasma.

Religious holidays

Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

Students with Disabilities

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTY: telecommunication device for the deaf; phone for hearing impaired students only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

See the SDS website for more information: http://studentdisability.wayne.edu/

Academic Dishonesty

Plagiarism and Cheating (edited statement from the DOSO's web site):
Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (http://www.doso.wayne.edu/student-conduct-services.html).

Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

Cheating:
Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student's test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.

Fabrication:
Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

Plagiarism:
To take and use another's words or ideas as one's own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student's access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b)

enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

Course Drops and Withdrawals:

In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: http://reg.wayne.edu/pdf-policies/students.pdf