

## Course Project Ideas for LB/PHY 415      Spring 2011

An important objective of the course is to explore how certain mathematical techniques may be applied in order to quantitatively understand the physical world. Each student is therefore required to complete a course project consisting of **a 5-10 minute oral presentation and a 3'x4' poster**, as described in the syllabus. Students are encouraged to build upon material covered in other courses, discuss research projects they have participated in, or even analyze items from the news media.

Since the **project proposal** is due via e-mail at noon on February 4<sup>th</sup>, be sure to start a conversation about the ideas you have in mind with one of the instructors (in person or by e-mail) well in advance of that date.

Read the **grading rubric** (attached) in order to see what points must be included in the project. For example, clear statement of a central thesis or argument is important – and so is clear referencing of material drawn from the work of others.

### Here are a few sample ideas for course projects:

- Application of mathematical physics to a topic of current interest or in public events. Some examples: tsunami damage vs. distance and the propagation of waves in two dimensions; global heat balance and atmospheric warming.
- Application of mathematical physics to everyday life. E.g.: comparison of cooking methods (microwave, conventional oven, convection oven) traffic flow, stock market.
- Extension of a topic covered in another course using methods we discuss here. E.g.: PDEs in E&M or Quantum Mechanics, applications of the Maxwell relations in Thermodynamics, oscillations in Classical Mechanics. Students electing such a topic must go well beyond simply repeating standard lecture material from the other course.
- Numerical or computer applications or implementation of methods we discuss. Examples include using Mathematica to produce graphical illustrations and applications of normal mode analysis (eigenvalues/vectors) or implementing numerical methods to solve ODEs or PDEs. Detailed discussion of the implications must be included as well.
- A historical analysis of the development of a topic in mathematical physics, e.g. the development of the Fourier Series and its impact on mathematics, or Poincare and the development of chaos theory. Emphasize mathematics, not events or personalities.
- Mathematical models to describe phenomena in another scientific field. Examples include predator-prey models of ecosystems, the diffusion equation and the properties of biological or chemical systems, modeling reproductive strategies of species that can use both sexual and asexual reproduction.
- An extension of a method discussed in this course and a relevant application; e.g. going beyond Fourier series to Fourier transforms and their uses [spectroscopy, image processing, etc.] or introducing the use of Laplace transforms for analyzing circuits. Students electing this option must go significantly beyond standard textbook material to add originality and substance

**LB/PHY 415 Course Project Rubric\***

**Spring 2011**

**Student name:**

**Date:**

**Medium:** poster paper

Is the TOPIC appropriate (application of an LB/PHY 415 topic to understanding some aspect of the physical world)?	4 3 2 1 0  ---- ---- ---- ----
Does the project have a well-stated THESIS (a central argument, point, or assertion)? Is appropriate SUPPORT (reasoning and evidence) provided for the thesis?	4 3 2 1 0  ---- ---- ---- ----
Are the mathematical EQUATIONS CORRECT? Is each piece of mathematical NOTATION explained clearly?	4 3 2 1 0  ---- ---- ---- ----
Does the mathematics go significantly BEYOND either the topics or the examples covered in class?	4 3 2 1 0  ---- ---- ---- ----
Are the SCIENTIFIC (or historical) CONCEPTS correctly described?	4 3 2 1 0  ---- ---- ---- ----
Is a clear CONNECTION made between the mathematical and scientific (or historical) concepts presented?	4 3 2 1 0  ---- ---- ---- ----
Are appropriate REFERENCE MATERIALS used (books, newspapers, or journals)? Does the project clearly CREDIT OTHERS when their ideas, words, or images are used?	4 3 2 1 0  ---- ---- ---- ----
Does the finished product appear NEATLY and PROFESSIONALLY done? Is it well ORGANIZED?	4 3 2 1 0  ---- ---- ---- ----
Does the project exhibit SUBSTANCE and DEPTH, showing what the author has learned through his/her research?	4 3 2 1 0  ---- ---- ---- ----
Does the project exhibit ORIGINALITY in approach, examples, or presentation?	4 3 2 1 0  ---- ---- ---- ----

\*This is adapted from the LBC Communications Rubric.