PHY 711 Classical Mechanics and Mathematical Methods
10-10:50 AM MWF Olin 103

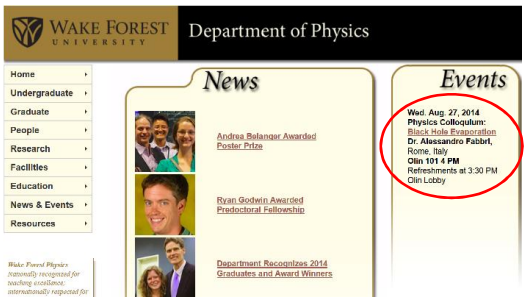
Plan for Lecture 1:

1. Welcome & overview
2. Class structure & announcements
3. Introduction to algebraic manipulation software – Maple and Mathematica

➢ Start reading Chap. 1 for next time

Comment about Physics Colloquia

http://physics.wfu.edu



WFU Physics Colloquium

TITLE: Analog of Black Hole Evaporation in Bose-Einstein Condensates

SPEAKER: Dr. Alessandro Fabbri,

Centro Studi e Ricerche Enrico Fermi,
Rome, Italy

TIME: Wednesday August 27, 2014 at 4:00 PM

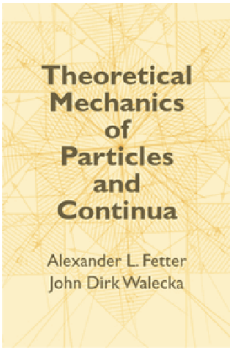
PLACE: Room 101 Olin Physical Laboratory

Refreshments will be served at 3:30 PM in the Olin Lounge. All interested persons are cordially invited to attend.

ABSTRACT

The Hawking effect from black holes is a milestone in modern Theoretical Physics, but its detection in the astrophysical context is unlikely. William Unruh showed that it is possible to look for the analog of the Hawking effect in condensed matter systems. We shall review the status of ongoing experiments and focus on the possibility of observing it in Bose-Einstein condensates through correlation measurements.

Textbook:



SIGNIFICANT NAMES IN MECHANICS AND MATHEMATICAL PHYSICS'

Isaac Newton (1642–1727)
Daniel Bernoulli (1700–1782)
Leonhard Euler (1707–1783)
Jean Le Rond d'Alembert (1717–1783)
Joseph Louis Lagrange (1736–1813)
Pierre Simon de Laplace (1749–1827)
Adrien Marie Legendre (1752–1833)
Jean Baptiste Joseph Fourier (1768–1830)
Karl Friedrich Gauss (1777–1855)
Siméon-Denis Poisson (1781–1840)
Friedrich Wilhelm Bessel (1784–1846)
Augustin-Louis Cauchy (1789–1857)
George Green (1793–1841)
Carl Gustav Jacob Jacobi (1804–1851)
William Rowan Hamilton (1805–1865)
Joseph Liouville (1809–1882)
George Gabriel Stokes (1819–1903)
Hermann Ludwig Ferdinand Helmholtz (1821–1894)
Gustav Robert Kirchhoff (1824–1887)
William Thomson (Lord Kelvin) (1824–1907)
Georg Friedrich Bernhard Riemann (1826–1866)
John William Strutt (Lord Rayleigh) (1842–1919)

Topics

Classical Mechanics

- Scattering theory
- Accelerated reference frames
- Calculus of variation
- Lagrangian formalism
- Hamiltonian formalism
- Small oscillations
- Wave equations
- Rigid rotations
- Physics of fluids
- Sound waves
- Surface waves
- Heat conduction
- Viscous fluids

Math Methods

- Solutions methods for differential equations
- Matrix properties; eigenvalues and eigenvectors
- Contour integration
- Fourier transforms
- Laplace transforms
- Use of Maple and/or Mathematica

Course webpage: http://www.wfu.edu/~natalie/f14phy711

PHY 711 Classical Mechanics and Mathematical Methods

MWF 10 AM-10:50 PM	OPL 103	http://www.wfu.edu/~natalie/f14phy711/

Instructor: Natalie Holzwarth	Phone:758-5510	Office:300 OPL	e-mail:natalie@wfu.edu

- General information
- Syllabus and homework assignments
- Lecture Notes

Last modified: Tuesday, 26-Aug-2014 03:22:47 EDT

Course webpage: http://www.wfu.edu/~natalie/f14phy711

PHY 711 Classical Mechanics and Mathematical Methods

MWF 10 AM-10:50 PM OPL 103 http://www.wfu.edu/~natalie/f14phy711/

Instructor: Natalie Holzwarth Phone:758-5510 Office:300 OPL e-mail:natalie@wfu.edu

General Information

This course is a one semester survey of Classical Mechanics and Mathematical Methods at the graduate level, using the textbook: **Theoretical Mechanics of Particles and Continua** by Alexander L. Fetter and John Dirk Walecka (McGraw-Hill, 1980) (now published by Dover) -- **F&W**.

It is likely that your grade for the course will depend upon the following factors:

Problem sets*	40%
Computational project	20%
Exams	40%

*In general, there will a new assignment after each lecture, so that for optimal learning, it would be best to complete each assignment before the the next scheduled lecture. According to the honor system, all work submitted for grading purposes should represent the student's own best efforts.

Course webpage: http://www.wfu.edu/~natalie/f14phy711

Computational Project

The purpose of this assignment is to provide an opportunity for you to study a topic of your choice in greater depth. The general guideline for your choice of project is that it should have something to do with classical mechanics, and there should be some degree of computation associated with the project. The completed project will include a short write-up and a ~20min presentation to the class. You may design your own project or use one of the following list (which will be updated throughout the term).

- Consider a scattering experiment in which you specify the spherically symetric interaction potential V(r). Write a computer program (using your favorite language) to evaluate the scattering cross section for your system. (Depending on your choice, you may wish to present your results either in the the center-of-mass or lab frames of reference.)
- Consider the Foucoult Pendulum. Analyze the equations of motion including both the horizontal and vertical motions. You can either solve the equations exactly or use perturbation theory. Compare the effects of the vertical motion to the effects of air friction.
- Consider a model system of 3 or more interacting particles with appropriate initial conditions, using numerical methods to find out how the system evolves in time and space.
- Examine the normal modes of vibration for a model system with 3 or more masses in 2 or 3 dimensions.
- Analyze the soliton equations beyond what was covered in class.

Course webpage: http://www.wfu.edu/~natalie/f14phy711

PHY 711 - Assignment #1

08/27/2014

1. Use maple or mathematica to plot the function

$$f(x)=e^{-x^2}$$

and to evaluate the integral

$$\int_0^5 f(x)\,dx.$$

Fall 2014 Schedule
for N. A. W. Holzwarth

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-10:00	Lecture Preparation/ Office Hours	Office Hours	Lecture Preparation/ Office Hours	Office Hours	Lecture Preparation/ Office Hours
10:00-11:00	Classical Mechanics PHY711	Physics Research	Classical Mechanics PHY711	Physics Research	Classical Mechanics PHY711
11:00-12:30	Office Hours		Office Hours		Office Hours
12:30-2:00	Condensed Matter Theory Journal Club		Physics Research		Physics Research
2:00-3:30	Physics Research				
3:30-5:00			Physics Colloquium		

Brief assessment exercise.

Comments and introduction to algebraic manipulation software