

PHYS 481L

Spring 2017

Sections: Mon 2:30-5:30; Tues 1:30-4:30

Tom Browder

Teaching assistant: Kevin Croker

Working in teams of 3 or 4 persons,
you will perform the following experiments in the course of the semester:

- [Muon Decay](#) (Jan)
- [Muon Counter Solid Angle Calculation \(.pdf format\)](#) used for the muon flux determination
- [Correction to the muon telescope solid angle calculation \(derived by Kevin Croker\)](#) needed for the case in which counter B has a non-zero area.
- [Spherical law of cosines for a triangle on the surface of a sphere](#) This result is used in the derivation of the muon telescope solid angle
- [Rebinning a histogram](#) (code in C by K. Croker)
- [Instructions for rebinning code](#) (code in C by K. Croker)
- [Cosmic Ray History and Survey from Wikipedia](#)
- [Review of Cosmic Ray Properties \(.pdf format\)](#) from the Particle Data Group

- [X-ray Diffraction](#) (Feb)
- [X-ray Diffraction Spectra and Schematic of Apparatus](#)
- [Nickel Filter absorption curve](#) (Taken from the manual for the apparatus)
- [A short discussion of X-ray Diffraction from crystals such as NaCl](#)
(Taken from a Standard Textbook, HRK)
- [Bragg Diffraction from crystals such as NaCl](#)
- [NaCl](#) Crystal Structure
- [LiF](#) Crystal Structure
- [X-ray Crystallography](#) Wikipedia review

- [Relativistic Kinematics and Particle Physics](#)
(Computer Experiments, Measurement of π^0 Mass resolution)
- [Computer Experiments](#) Relativistic Kinematics (.pdf file)
- [Computer Experiments](#) Detector Simulation (.pdf file)

- [NMR Problem Set](#) (***) Required before starting experiments)
- [Nuclear Magnetic Resonance Apparatus](#) Teachspin Introduction
- [NMR Experiment](#) Teachspin Brochure and Typical Data (.pdf file)
- [NMR Manual Chapter 1](#) (Introduction)
- [NMR Manual Chapter 2](#) (The Instrument)
- [NMR Manual Chapter 3](#) (Getting Started)
- [NMR Manual Chapter 4](#) (Experiments)
- [NMR Manual Chapter 5](#) (Specifications)

- [NMR Manual Chapter 6](#) (Conceptual Tour)
- [NMR/MRI Simulations](#) (from the PheT project)
- [Spin echo simulations](#) (illustrates the T_2 measurement)

- [High \$T_c\$ SQUID Experiment](#) (Under construction)

- [Mossbauer Effect](#) (Dates TBA)
- [Mossbauer s700s single-channel-amplifier](#) (.pdf file)
- [Mossbauer Linear Motor](#) (.pdf file)
- [Mossbauer s700a \(setup for constant velocity mode\)](#) (.pdf file)
- [Description, introduction, example data for Mossbauer experiments](#) (.pdf file)
- [Rudolf Mossbauer's Nobel Prize Lecture](#)
- [Measurement of Gravitational Redshift with the Mossbauer Effect by Pound and Rebka, Phys. Rev. Lett. paper](#) (.pdf file)
- [Measurement of Mossbauer Effect in Iron by Kistner and Sunyar, Phys. Rev. Lett. paper](#) (.pdf file)

- [Open program to find new particles in Belle data](#)

This is a writing-intensive (WI) course (90% of the course grade).

For each experiment you will turn in a Physical Review Letters style paper reporting the results.

The due dates for the 4 reports (first drafts) in Spring 2015 will be:

- 1st draft of muon report (TBA)
- Final draft of muon report (TBA)
- 1st draft of x-ray diffraction (TBA)
- Final draft of x-ray diffraction (TBA)
- Results of computer exercise (π^0 mass resolution in MC) (TBA)
- 1st draft of NMR report
- 2nd draft of NMR report
- 1st draft of Chaos Experiment
- 2nd draft of Chaos Experiment

You will work on each experiment for about 4 scheduled lab periods. This is a 2 credit hour lab but you will in general not be able to complete the experiments and data analysis in the scheduled lab periods. Your team may have to arrange to come in at other times for additional data taking. I am generally available to let you in to the lab (my office is WAT 233, down the hall) and there will also be a key with Peter Huang in Rm 235 that you can borrow. Note that you will have to make arrangements with me for use of radioactive sources at non-scheduled times.

Scheduling items:

Jan 9-13, Kevin Croker will substitute, JPARC PAC

Jan 16, Martin Luther King Day (no class)

Feb 3-15, Belle II General Meeting and BPAC review

March 14, Belle II Roll-in, PI Day

April 2-days, US Belle II review, PNNL

Last modified: January 10, 2017

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