PHYS 481L

Spring 2016

Instructor: Shige Matsuno, *e-mail: shige.at.phys.hawaii.edu*, office: wat331, tel: x62966
Teaching assistant: TBD

Working in teams of 2 or 3 persons, You will perform the following experiments in the course of the semester: (months noted below are just for guidelines.)

Cosmic Ray Muons (Jan)

- Muon Decay Instruction
- 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 ; Instructions , 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 Instruction
- 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 (Mar)

- 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)

Nuclear Magnetic Resonance (Apr)

- 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 (May)

- High T_c SQUID Experiment (Under construction)

Find a new particle in Bell (optional)

- 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 reports typically are 2 weeks after finishing the experiment.

- 1st draft of muon report
- Final draft of muon report
- 1st draft of x-ray diffraction
- Final draft of x-ray diffraction
- Results of computer exercise (π^0 mass resolution in MC)
- 1st draft of NMR report
- 2nd draft of NMR report
- 1st draft of SQUID Experiment
- 2nd draft of SQUID 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 and there will also be a key with Peter Huang in wat235 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:

Feb 8-12, out of town

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