Physics 1140 Fall 2012

Prof. Markus B. Raschke

Lecture #1:
1. Introduction to Course

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Format of Physics 1140

- This is a 1 unit lab class
  - We have restructured the course from the past to bring work load in line with a 1 credit class.
  - Coursework is “frontloaded.” More work at beginning, but all work is done well before finals week

- Weekly 2 hr lab session
  - Lab work in G2B66 area
  - Expect to spend some time outside lab session to prepare for the lab (pre-lab) and complete your writeup
  - First week: Orientation to MathCAD
  - Then: 6 labs over 12 weeks, (one week for lab, second week for writeup)
- 7 lectures, weekly
  - Mo or Tu 4-5pm
  - Homework due Tuesdays by 4 pm, in G2B66

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Prof. Markus Raschke

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- Office Hours:

M: 9:00 – 10:00, and 3:00 – 4:00 pm

Tu: 3:00 – 4:00

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Grading

- The course consists of two components:
  - 1. error analysis lectures, and HW (25% of the total grade).
  - 2. labs (75% of the total grade).
- 5 homework sets on error analysis
  - 25% of grade on HW.
- The labs have two parts to the grade:
  - A) The prelab questions (15% of total grade).
  - B) The lab report (60% of total grade).
- Your 6 labs are chosen from a total of 15 different labs
  - Lab 1 in week 2 must be Lab M1 on the **Simple Pendulum**
  - Lab 4 in week 8 must be Lab E1 on **Circuits**
  - the other 4 labs need to be chosen by you. Your TA will discuss more with you on this issue.

A few words about deadlines:

- Homework due Tuesday 4:00 pm
  - HW score is 25% of grade (but is a much larger part of spread in final grades).
  - Take it seriously: you need the material for successful lab reports.

- Prelabs due before you begin a lab.

- Lab report due 4:00 pm, seven working days after each lab

- **All materials to be turned-in to G2B66 box for your TA.**

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Lab books and lab report

- We supply your lab books.

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Lab report

Physics 1140 laboratory Grading Guide

DATA PRESENTATION:

Criteria	Not Addressed	Novice	Intermediate	Proficient
Data Presentation: Introduction	0 points	0.33 points	0.66 points	1 point
1-2 sentences describing what is measured in the lab and why. This may exist for each part of the lab if there are multiple parts.	• An introduction does not exist	• An introduction is written but is not descriptive of what is measured. • The description does not describe why these particular measurements are being made	• The introduction is descriptive of the measurements and why they are taken but is poorly written and/or formatted.	• The introduction is descriptive of the measurements and why they are made for this experiment • The introduction is well written and formatted (has proper spelling and grammar)
Data Presentation: Data Tables/Arrays	0 points	2 points	3 points	4points
Measurements are displayed in tables/arrays with proper sig figs and uncertainties. Units are clearly and correctly stated for every measurement and each set of measurements have a short caption describing what the measurements are.	• The data is not presented at all • The data is presented in an incoherent and/or illegible manner • Data in the report does not match data on the written data sheet that should be attached to the lab report	• Data is presented but is hard to understand what it represents • Units, sig figs, and/or uncertainties are not present or incorrectly stated • Captions are missing or not informative	• Data is presented in a coherent manner so the reader knows what it represents • Most units, sig figs and/or uncertainties are present and correctly stated • Captions are mostly informative but could use some improvement • A description of how the error is estimated for each measurement is included	• Data is presented in a very coherent manner so it is clear what each set of measurements represents • Units, sig figs, and uncertainties are all stated correctly • Captions are concise but informative leaving no question what each set of measurements represents in the lab • A description of how the error is estimated for each measurement is included
Data Presentation: Graphs	0 points	1 point	2 points	3 points
If appropriate, graphs and figures should represent the data in an understandable and concise manner. Graphs should show the entire range of the data without	• Graphs and/or figures that are necessary to convey the data in an understandable way are not present or incoherent.	• Graphs and figures are present but missing appropriate titles, axis labels, units etc… • Graphs do not	• Graphs and figures have appropriate titles, axis labels, units etc… • Graphs represent the data well, so that the	• Graphs and figures have appropriate titles, axis labels, units etc… • Graphs represent the data well, so that the

Complete guide on website

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Format of the lab

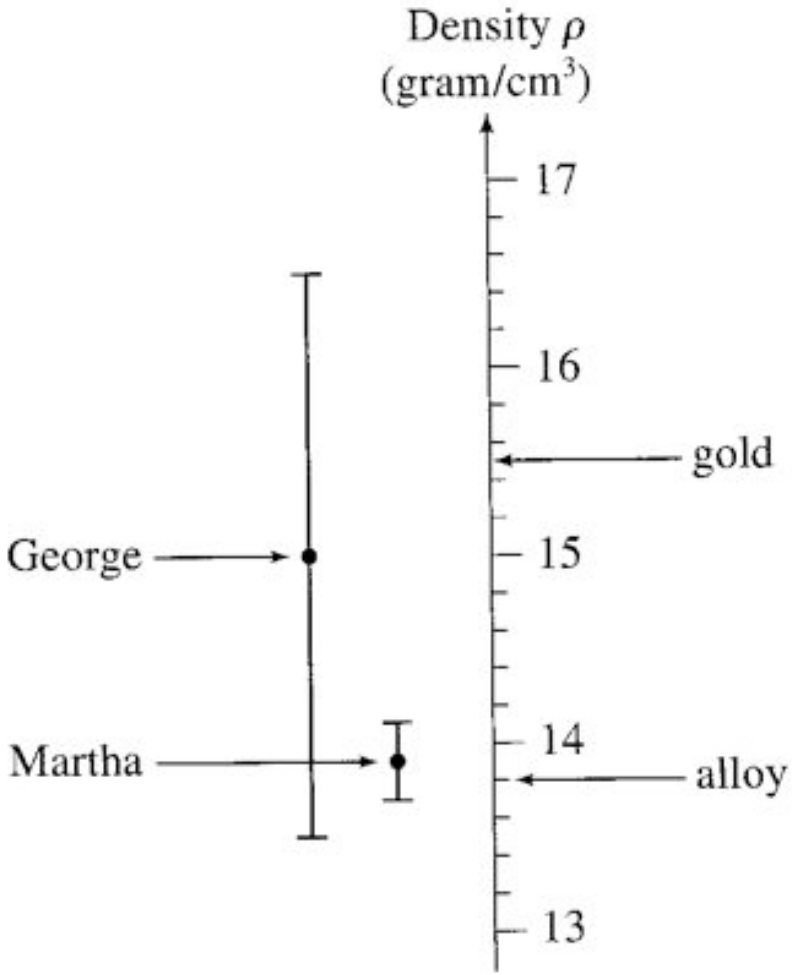
- In this lab, you will make simple measurements that you can relate, *quantitatively*, to the physics you learn in 1110/1120.
  - Measurements of length, force, mass, time for mechanics labs
  - Measurements of voltage, current for electromagnetism
  - Pressure, wavelength, etc..

Why we measure – what you'll be doing in lab

- Scientists like measuring things ☺
  - But, that's not just because we like writing down digits
- We measure to make ***decisions***, or to test a ***hypothesis***.
- Example: Archimedes

Is the crown pure gold?

- Density
  - Gold– 15.5 g/cm^3
  - "diluted" gold (alloy) 13.8 g/cm^3
- George measures 15 g/cm^3
- Martha measures 13.9 g/cm^3
- Who's right?
  - Depends on estimated error



- George: 15±1.5 g/cm^3
- Martha: 13.9±0.1 g/cm^3

- The crown is not pure gold!!!

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Making Measurements and Calculating values

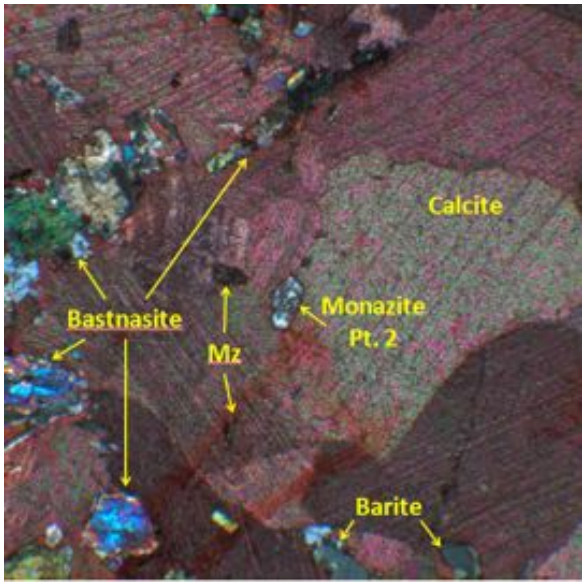
- Exact numbers
  - Counted; i.e., I have 4 apples
  - Unit conversions; i.e. 1 meter= 100 cm
- Measured Numbers
  - When you use a measuring tool it is used to determine a quantity such as your height or weight, the numbers you obtain are called *measured numbers*.
  - Measured numbers generally will have an ***uncertainty (error)*** associated with them.
- Derived Quantities
  - Quantities obtained by processing data are called *derived quantities.*

Another example: how old is this rock?

A geology student (*who took phys1140 before*) uses the U-Th-Pb dating technique to determine the age of different mineral grains in a rock sample (which should be of one single age). Here are his data:

Grain	Age	Error
M1 (a)	1361	425
M1 (b)	627	444
M1 (c)	569	388
M2 (a)	1543	366
M2 (b)	1967	1024
M3 (a)	1235	482
M3 (b)	660	389
Simple mean	1138	503

Table 7. U-Th-Pb age dates, error and simple mean (in millions of years).



He reports 1138 ± 503 Ma for the age of the rock in his "honerrs" thesis.

WHAT IS WRONG WITH THAT RESULT?