

COMPUTATIONAL MODELLING OF PHYSICAL SYSTEMS

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Purpose of the Course

- This is ***not*** a programming course
 - ▣ Although you will need to program in order to do it (in a compiled language)
- This isn't "just" another physics course
 - ▣ Although you will need to do physics ***and*** mathematics in order to do the problems

This course is compulsory for theoretical physics students.

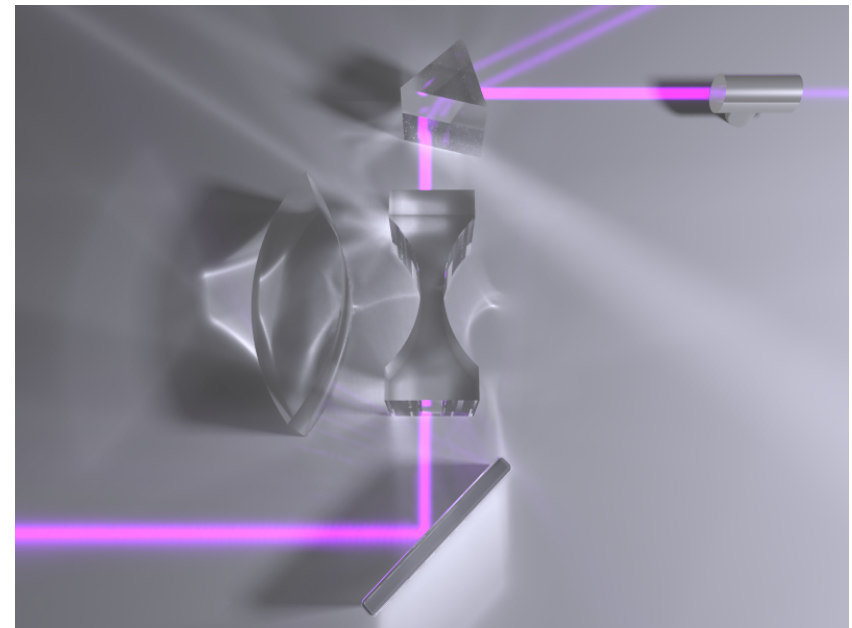
So what is it?



- This course will give you an introduction in to how to use the computer to find the answer to a physics problem **after** you have tried to understand it analytically.
- It will help you to understand the types of problems computers like; and how they like to have them presented to them.
- In other words, you will learn how to formulate a problem such that a computer solve it **numerically**. And you will learn to understand the results the computer provides.

Numerical Modelling

- What is numerical modelling? Often it means to compute **numerical output** from **numerical input** using some generic equations or relations.
- Numerical models are describing the behaviour of an actual setup rather than understanding general features of a principle system.



There is no exam!



- This course is continuously assessed, you will get 50% of your final mark from worksheets, 50% from a final project
- All work must be submitted via WebCT. A submission consists of source code and **one** report.
- Worksheets:
 - ▣ you must submit answer to all questions marked with a *
 - ▣ You may have demonstrator help on the boxed part of questions.

Course Timetable



- Timetable
 - ▣ 11am-1pm Thursday, SportEX-G84 (12-2pm on 7.11)
 - ▣ 1-4pm Friday, P9, (Only 2 hours required BUT unless you have a clash you should be here at 1pm for intro to worksheets).

- Please make sure you can access the course and let me know if you are not registered!

Deadlines



- Last lab session: 13.12.2013
- Deadlines:
 - ▣ Worksheet 1: 21.10.2013
 - ▣ Worksheet 2: 04.11.2013
 - ▣ Worksheet 3: 18.11.2013
 - ▣ Worksheet 4: 25.11.2013 (Yr4 only)
 - ▣ Project: 17.01.2014
 - Hand out project options : 07.11.2013
 - Submit project choice: 15.11.2013

Work flow



- The course is similar to an Yr3 experimental lab
- You have to deal with new tools, new methods and deliver scientific reports on the given tasks
- **Learning by doing** and **self learning** are important components of the course
- No `lectures' but very detailed worksheets and pointers on WebCT to get you started!

This/next week

Worksheet is on webct as well, and links are clickable from it

- To make sure you can access the UNIX system and export Xwindows to the PC
- To revise C++ and ensure you can compile on the unix command line
- Basic UNIX commands (see unix cheat on WebCT)
- You are running a bash shell
- To run a program you need to type e.g.: `./a.out`
- Start the problems...

Know your computer's limitations



- How big a number can your computer work with?
- Does it matter which order you add/multiply numbers together ?

Assessed question: Silver Ratio

- Silver ratio (also known as golden ratio conjugate): we will look at different calculation methods, investigate how errors can build up in a computer calculation.



<http://www.goldenmeangauge.co.uk>

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- ☐ Please sign the sheet that you are here!

HOW TO USE UNIX



I'm In, Now What?



- ❑ No “tour of Unix” like Windows has
- ❑ You’re pretty much on your own
- ❑ Unix assumes you know what you are doing
- ❑ You are given just enough leverage to either do everything well or really mess everything up
- ❑ Want to know about Unix/Linux?

http://www.sr.bham.ac.uk/~adf/teaching/unix_for_dummies

Files, Files Everywhere



- Unix treats almost everything as a file
 - ▣ Standard text files and binaries
 - ▣ Directories
 - ▣ Links
 - ▣ Even devices!
 - Your terminal is a file, your keyboard is a file, your hard drive is a file, everything is a file!

Navigating The Directory Structure

- You are always located at one location in the tree
- `pwd`
 - ▣ Shows the name of the current directory
- `ls`
 - ▣ Provides a listing of the current directory
- `cd`
 - ▣ Change directory
 - ▣ “`cd /`” Moves your current directory to /
 - ▣ `cd` without any arguments moves you to your home directory

Creating And Removing Directories



- mkdir

- Makes a directory
- “mkdir myDir”

- rmdir

- Removes an empty directory
- “rmdir myDir”

A Couple Of Notes



- Unix is case-sensitive
 - ▣ myDir is different from MyDir and mydir
- Not all files are shown with ls
 - ▣ “ls -a” will show all files
 - ▣ Hidden files in Unix always start with a .
 - Example: .hidden
 - .plan

Quick Demo



- ❑ Log in
- ❑ `xclock` & check windows working
- ❑ `pwd` where am I?
- ❑ `cp -r /tmp/unix_demo .` copy the example
- ❑ `cd unix_demo` change directory
- ❑ `ls` see whats there
- ❑ `g++ hello.cpp -o hello.out` compile
- ❑ `./hello.out` run prog
- ❑ `gedit hello.cpp` & edit file