Laurea Magistrale Interateneo - Physics
Academic year 2016/17
INFORMATION AND COMMUNICATION TECHNOLOGY ABILITIES
(ABILITA' INFORMATICHE E TELEMATICHE)
(update: February 16, 2017)

To the students of the "Laurea Magistrale" in Physics, with priority to those of the **II year of the training tracks of: Condensed Matter Physics, Theoretical Physics, Environmental Physics**, who have this activity planned in their "plan of studies" (3 credits).

Students are invited to choose **at least 4 among the 10 activities proposed** in the following (5 IN EACH SEMESTER). Then, they have to contact a supervisor, agree and **work on a project** (of about 60 hours of workload). At the end, the supervisor will judge the work and certificate that the student has obtained/not obtained the 3 credits. Prof. Pastore is in charge of the registration on the Esse3 system. Other activities can be also accepted. Contact in advance prof. Pastore and the referent person of the training track.
IMPORTANT: Since these activities will consist in practical lab sessions (Lab. POROPAT), students must subscribe to the selected activity at least 1 week in advance using Doodle: http://doodle.com/poll/hvqhudt83ku9kv33.

1. Bash scripting for dummies (Friday 21 Oct 2016; 9:00-12:00)
(Giorgio Pastore - pastore@ts.infn.it)
Productivity tools, available in unix operative systems and unix-like emulators, and how to integrate them using the popular bash shell. A hands-on session, discussing bash shell variables, I/O, instructions etc. but also make, sed, awk, bc, paste, user program and how to make all of them cooperating.
Approach "hands-on", based on a couple of case studies analyzed step by step.
Required: some programming experience (whatever language).

2. Mathematica (Friday 28 Oct 2016; 9:00-12:00)
(Matteo Carlesso - carlesso.mat@gmail.com)
- Introduction to Mathematica
- Symbolic computation
- Graphical representation

3. and 4. Introduction to ROOT (Friday 18 Nov 2016 AND Fri 25 Nov 2016; 9:00-12:00)
(Stefano Piano - stefano.piano@ts.infn.it, Lea Ramona - ramona.lea@ts.infn.it)
ROOT is a software framework for data analysis and I/O. Its prominent features are an advanced graphical user interface, an interpreter for the C++ programming language, a powerful library of mathematical functions and a persistency mechanism for C++ objects. These introductory lectures illustrate the main features of ROOT, which are relevant for the typical problems of a Master Thesis data analysis in experimental physics: input and plotting of data from measurements and fitting of analytical functions.

5. Why is my code taking so long?!? A practical introduction to optimization (Friday 2 Dec 2016; 14:00-17:00)
(Paolo Giannozzi - paolo.giannozzi@uniud.it)
This mini-course will provide an overview of the main factors affecting the performances, in terms of speed, of codes on modern computer architectures, in particular for floating-point-dominated computations. A few general rules and practical recipes that may lead to significant speed

enhancements will be described. In particular, the importance of choosing the correct algorithm and optimized mathematical libraries will be stressed. Although the focus is on modern Fortran (90/95/2003), these rules and recipes are typically valid independently upon the specific language used.

6. And now that I learned a programming language, what could I make? Elements of software design for physics (Monday 6 March 2017 ; 14:00-17:00)
(Giorgio Pastore - pastore@ts.infn.it)
A quick tour of software engineering, through explicit case studies, tuned for physicists and including the building of graphic interfaces, of the evolution of the analysis and design of software. From the "structured programming" to "design patterns" passing through object oriented analysis. Approach "hands-on", based on a few case studies analyzed step by step.
Required: some programming experience (whatever language).

7. Introduction to Mathematica (Monday 20 March 2017 ; 14:00-17:00)
(Edoardo Milotti - milotti@ts.infn.it)
Mathematica is a multiplatform programming environment for both symbolic and numerical calculations. Mathematica has nearly 5000 built-in functions covering all areas of technical computing, and draws from the experience of a large number of mathematicians and scientists. This extensive set of functions is also supported in the latest hardware systems, with the ability to utilize high-performing GPU's. In this seminar I shall give a brief overview of Mathematica, with examples of application. The examples shall be tuned to the specific fields of study of the participants.

8. Fast Fourier Transforms and a parallel implementation (Monday 27 March 2017 ; 14:00-17:00)
(Pierluigi Monaco - monaco@oats.inaf.it)
Fast Fourier Transforms are one of the most used techniques in physics, because they allow to solve equations like the Poisson equation, or compute spatial derivatives of a field on a grid, with high accuracy and a scaling like N log N. After illustrating the technique and the organization of data in memory, I will introduce the fftw package (http://www.fftw.org/) and its parallel implementation. As an example, we will work out a simple application of this technique in cosmology, the generation of initial conditions for a cosmological simulation.

9. Introduction to LabView (Monday 3 April 2017 ; 14:00-17:00)
(Edoardo Milotti - milotti@ts.infn.it)
LabVIEW is a widely-used integrated development environment (IDE) designed specifically for engineers and scientists building measurement and control systems. The main features of LabVIEW are a native graphical programming language, built-in tools for data analysis and signal processing, and an open architecture that enables integration of any hardware device and any software approach. In this seminar I shall give a brief overview of LabView, with examples of application. The examples shall be tuned to the specific fields of study of the participants.

10. Open source tools for scientific visualization: examples with Gnuplot, Jmol, VMD… (Monday 10 April 2017 ; 14:00-17:00) (Maria Peressi - peressi@ts.infn.it, Virginia Carnevali - cavirgi@gmail.com)
Scientific visualization allows fast and effective analysis and interpretations. An image is able to convey the results of a simulation in a more effective and immediate way than a numerical tabulation and to communicate it efficiently. We will explore some well know tools, such as Gnuplot for 2D e 3D plots, fits, animation...; Jmol and VMD for molecular structure visualization.