



# Advanced Scientific Programming in Python

a Summer School by the G-Node and

the Institute of Experimental and Applied Physics, Christian-Albrechts-Universität zu Kiel

Scientists spend more and more time writing, maintaining, and debugging software. While techniques for doing this efficiently have evolved, only few scientists actually use them. As a result, instead of doing their research, they spend far too much time writing deficient code and reinventing the wheel. In this course we will present a selection of advanced programming techniques, incorporating theoretical lectures and practical exercises tailored to the needs of a programming scientist. New skills will be tested in a real programming project: we will team up to develop an entertaining scientific computer game.

We use the Python programming language for the entire course. Python works as a simple programming language for beginners, but more importantly, it also works great in scientific simulations and data analysis. We show how clean language design, ease of extensibility, and the great wealth of open source libraries for scientific computing and data visualization are driving Python to become a standard tool for the programming scientist.

This school is targeted at Master or PhD students and Post-docs from all areas of science. Competence in Python or in another language such as Java, C/C++, MATLAB, or Mathematica is absolutely required. Basic knowledge of Python is assumed. Participants without any prior experience with Python should work through the proposed introductory materials before the course.

**Date and Location:** September 2–7, 2012. Kiel, Germany

## Preliminary Program

### Day 0 (Sun Sept 2) — Best Programming Practices

- Best Practices, Development Methodologies and the Zen of Python
- Version control with git
- Object-oriented programming & design patterns

### Day 1 (Mon Sept 3) — Software Carpentry

- Test-driven development, unit testing & quality assurance
- Debugging, profiling and benchmarking techniques
- Best practices in data visualization
- Programming in teams

### Day 2 (Tue Sept 4) — Scientific Tools for Python

- Advanced NumPy
- The Quest for Speed (intro): Interfacing to C with Cython
- Advanced Python I: idioms, useful built-in data structures, generators

### Day 3 (Wed Sept 5) — The Quest for Speed

- Writing parallel applications in Python
- Programming project

### Day 4 (Thu Sept 6) — Efficient Memory Management

- When parallelization does not help: the starving CPUs problem
- Advanced Python II: decorators and context managers
- Programming project

### Day 5 (Fri Sept 7) — Practical Software Development

- Programming project
- The Pelita Tournament

Every evening we will have the **tutors' consultation hour**: Tutors will answer your questions and give suggestions for your own projects.

## Applications

You can apply on-line at <http://python.g-node.org>

Applications must be submitted before **23:59 UTC, May 1, 2012**. Notifications of acceptance will be sent by **June 1, 2012**.

No fee is charged but participants should take care of travel, living, and accommodation expenses.

Candidates will be selected on the basis of their profile. Places are limited: acceptance rate last time was around 20%.

**Prerequisites:** You are supposed to know the basics of Python to participate in the lectures. You are encouraged to go through the introductory material available on the website.

## Faculty

**Francesc Alted**, Continuum Analytics Inc., USA

**Pietro Berkes**, Enthought Inc., UK

**Valentin Haenel**, Blue Brain Project, École Polytechnique Fédérale de Lausanne, Switzerland

**Zbigniew Jędrzejewski-Szmek**, Faculty of Physics, University of Warsaw, Poland

**Eilif Müller**, Blue Brain Project, École Polytechnique Fédérale de Lausanne, Switzerland

**Emanuele Olivetti**, Neuroinformatics Laboratory, Fondazione Bruno Kessler and University of Trento, Italy

**Rike-Benjamin Schuppner**, Technologit GbR, Germany

**Bartosz Teleńczuk**, Unité de Neurosciences Information et Complexité, Centre National de la Recherche Scientifique, France

**Stéfan van der Walt**, Helen Wills Neuroscience Institute, University of California Berkeley, USA

**Bastian Venthur**, Berlin Institute of Technology and Bernstein Focus Neurotechnology, Germany

**Niko Wilbert**, TNG Technology Consulting GmbH, Germany

**Tiziano Zito**, Institute for Theoretical Biology, Humboldt-Universität zu Berlin, Germany

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