Programming in Physics and Astronomy with C++ or Python (E/A) - physics718

Course	Programming in Physics and Astronomy with C++ or Python (E/A)
Course No.	physics718

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	2+1	4	ST

Requirements for Participation:

Preparation: Basic knowledge of programming and knowledge of simple C/C++ or Python constructs.

Form of Testing and Examination:

C/C++ part: Requirements for the examination (written or oral): successful work with the exercises.

Python part: Requirements for examination: successful implementation of the scientific projects in Python during the semester.

Length of Course: 1 semester

Aims of the Course:

C++ part: In-depth understanding of C++ and its applications in particle physics. Discussion of advanced features of C++ using examples from High Energy Physics. The course is intended for students with some background in C++ or for advanced students who wish to apply C++ in their graduate research.

Python part: Effective and flexible program solving with the easy-to-learn, high level programming language Python. The course addresses master and PhD students with prior Python-programming knowledge as taught in the bachelor course physics131.

Contents of the Course:

C++ part: - Basic ingredients of C++, - Object orientation: classes, inheritance, polymorphism, - How to solve physics problems with C++, - Standard Template Library, - C++ in data analysis, example: the ROOT library, - C++ and large scale calculations, - How to write and maintain complex programs, - Parallel computing and the Grid, - Debugging and profiling

Python part: - In-depth introduction to Python based on prior programming experience, - Introduction to numpy arrays (primary Python data structure for scientific computing), - Introduction to scientific-Python modules (scipy, astropy), - Interactive work / development with Python (ipython), - Web interaction with Python (jupyter notebooks, web and database queries), - Plotting with Python (the matplotlib module)

Recommended Literature:

Eckel: Thinking in C++, Prentice Hall 2000.

Lippman, Lajoie, Moo: C++ Primer, Addison-Wesley 2000.

Deitel and Deitel, C++ how to program, Prentice Hall 2007.

Stroustrup, The C++ Programming Language, Addison-Wesley 2000.

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