

# Practical Data Analysis

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*All science is data science.*

Performing research in experimental physics involves acquiring, processing, analyzing and interpreting data with much higher proficiency than typically required during undergraduate studies. In particular, a rigorous treatment of measurement uncertainties is crucial for a proper validation of the hypotheses motivating the experiments. We aim to bridge this gap both at the theoretical and the practical level, so each session will consist of a lecture to introduce the concepts and a computer-based practical part where they will be applied. We will discuss the following topics:

- Probabilities: random variables, distribution laws, moments
- Sampling and statistics
- Error and uncertainty: definitions, error propagation and composition
- Linear fitting: weighting, parameter uncertainty. Confidence intervals
- Nonlinear fitting: algorithms, constraints, difficulties
- Introduction to Bayesian theory

Due to space constraints, attendance will be limited to **15 participants, who should bring along their laptop computers with the data treatment software they expect to use during their PhD work**. The course will be given in **English**.

**Pre-requisites:** The practicals involve a fair amount of programming, so all participants should be able to perform simple tasks (e.g. reading data from a file, doing simple manipulations and implementing mathematical functions) in a programming environment such as Python, MATLAB, Igor Pro etc. If you are uncertain about your programming level, please contact the lecturer before registering.

Eight four-hour sessions (two-hour lecture and two-hour practicals)

**Schedule:** from **13:30 to 17:30** every Tuesday from **February 28 to April 11** and on **May 9 2023**.

**Location:** Nouvelle salle de Conseil (room E282, 2<sup>nd</sup> floor), Institut Charles Sadron (on the Cronenbourg campus of the CNRS).

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