

Module: Astrophysics

Module No.: MN-P-SP-Astro, MN-P-PN-Astro, MN-P-WaMa

Version: 29.01.2014 PS

Course: Data Analysis

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	2+1	4.5	SuSe
Specialized Course	Lecture	English	2	3	SuSe

Requirements for participation:

Astrophysics I, Mathematics for Physicists I+II, Statistical Mechanics
(Some hands-on exercises require computer access and the basic understanding of a computational data analysis software of your choice (Excel, Matlab, Mathematica, R), or a programming language like python.

Type of module examinations:

One oral examination at the end of the module

Duration of the course:

1 semester

Aims of the course:

Understanding of fundamental concepts of statistical methods and data analysis.

Contents of the course:

The lecture introduces the basic aspects of data analysis and the application of statistical methods to data in astronomy and other physical sciences.

The course covers the following topics:

Descriptive statistics, uncertainties and errors, error propagation, probability distributions, statistical inference, data smoothing, interpolation, regression, multivariate analysis, least-squares fitting, correlation analysis, hypothesis testing, correlation and testing fits. We will also cover practical aspects, such as plotting and presenting data, data formats, and work with real data. If time allows additional topics like image processing, astronomical data reduction, and others.

The course will often use real astronomical data or applications from astronomy, but the contents of the course are of course applicable to all physical sciences.

Recommended literature:

Bevington and Robinson, Data Reduction and error analysis for the physical sciences (McGraw-Hill)
Taylor, An Introduction to error analysis (Springer)
Feigelson and Babu, Modern Statistical Methods for Astronomy (Cambridge University Press)
Wall and Jenkins, Practical Statistics for Astronomers (Cambridge University Press)