Module: Astrophysics
Module No.: MN-P-SP-Astro, MN-P-PN-Astro, MN-P-WaMa
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Course: Data Analysis

Lecturers: Markus Röllig
Email: roellig@p1.uni-koeln.de

Requirements for participation:
Astrophysics I, Mathematics for Physicists I+II, Statistical Mechanics
(Some hands-on exercises require computer access and he 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)