Module Name **Data Analysis and Fourier Transform**						
Type of Module Advanced Module				**Module Code** AM-FTDA		
Identification Number MN-CS-FTDA	**Workload** 270 h	**Credit Points** 9 CP	**Term** 1. – 3. Semester	**Offered Every** 2 years	**Start** Summer semester only	**Duration** 1 Semester

1	**Course Types**	**Contact Time**	**Private Study**	**Planned Group Size**
	a) Lectures	30 h + 30 h	45 h + 45 h	30 Students
	b) Exercises	15 h + 15 h	45 h + 45 h	

2 Module Objectives and Skills to be Acquired

The Module consists of two courses offered by the Department of Physics.

Data Analysis:

Understanding of fundamental concepts of statistical methods and data analysis.

The Fourier Transform and its Applications:

Strengthen inside into how the mathematical principles of Fourier Theory as a common principle affects many areas of physics (optics: diffraction/interference; QM: Heisenberg principle; statistics of noise and drifts; data acquisition: sampling) and other applications (data compression, signal processing).

3 Module Content

Data Analysis:

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.

The Fourier Transform and its Applications:

- Introduction to the principles of Fourier Transform mathematics
- Delta-function and more general distributions
- Diffraction optics and interferometry
- Uncertainty principle in QM as application of FT
- Theory of noise, drifts and their statistics
- Intro to wavelet analysis and data compression.

4	**Teaching Methods** Lectures and Exercises
5	**Prerequisites (for the Module)** Formal: None
6	**Type of Examination** Oral Exam
7	**Credits Awarded** The module is passed and credit points are awarded if the oral examination is passed.
8	**Compatibility with other Curricula** The course is part of the Master of Science Physics
9	**Proportion of Final Grade** 9/114
10	**Module Coordinator** J. Stutzki, M. Röllig
11	**Further Information** Data Analysis: 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) The Fourier Transform and its Applications: Bracewell: The Fourier Transform and its Applications