Objective	This lecture gives a general introduction to main topics in modern astronomy. The lecture provide a basis for the more advanced lectures in astrophysics.
Content	Planeten, Sonne, Sterne, Milchstrasse, Galaxien und Kosmologie.
Lecture notes	Astronomie. Harry Nussbaumer, Hans Martin Schmid vdf Vorlesungsskripte (8. Auflage)
Literature	Der Neue Kosmos. A. Unsöld, B. Baschek Springer

► Further Courses Suitable for the Second Year

Number	Title	Type	ECTS	Hours	Lecturers
402-2203-01L	**Classical Mechanics**	**W**	**7 credits**	**4V+2U**	**R. Renner**
Abstract	A conceptual introduction to theoretical physics: Newtonian mechanics, central force problem, oscillations, Lagrangian mechanics, symmetries and conservation laws, spinning top, relativistic space-time structure, particles in an electromagnetic field, Hamiltonian mechanics, canonical transformations, integrable systems, Hamilton-Jacobi equation.				

► Seminars

Number	Title	Type	ECTS	Hours	Lecturers
401-3650-63L	**Numerical Analysis Seminar** *Does not take place this semester.*	**W**	**4 credits**	**2S**	to be announced
401-3350-63L	**Introduction to Minimal Surfaces**	**W**	**4 credits**	**2S**	**M. Struwe**
401-3050-63L	**Student Seminar in Combinatorics: Theory of Oriented Matroids**	**W**	**4 credits**	**2S**	**K. Fukuda**
Abstract	The main objective of this seminar is to study and to appreciate the power of the oriented matroid theory by reading some important papers and manuscripts.				
Objective	The notion of oriented matroids was first introduced in 1974-75 by three mathematicians, Robert Bland, Michel Las Vergnas and Jim Lawrence, independently. It is a combinatorial abstraction of vector subspaces of the real space R^n. Many fundamental theorems on convex polyhedra, arrangements of hyperplanes, configurations of points in R^n, directed graphs and linear optimization can be generalized to this abstract setting. Quite amazingly, this rich framework is defined by a simple set of combinatorial axioms. The seminar is to study and to appreciate the power of this notion by reading some important papers and manuscripts.				
Literature	Here is a document containing articles and scheduling for the seminar: http://www.inf.ethz.ch/personal/fukudak/lect/omsemi/omseminar2013_ref.pdf (last update on 2013-11-25). It will get updated as the seminar progresses. Please check the revised dates frequently. For the general introduction, please go to the homepage of oriented matroids: http://www.om.math.ethz.ch/?p=home . The doctoral thesis of Lukas Finschi is available there and those interested in the seminar are suggested to look at Chapter 0 which gives an excellent introduction to the theory. Final reports submitted by registered students will be uploaded in: http://www-oldurls.inf.ethz.ch/personal/fukudak/lect/omsemi/2013/reports/ .				
Prerequisites / notice	Basic knowledge of linear algebra, graph theory and linear optimization (linear programming).				
401-3000-63L	**Renormalization**	**W**	**4 credits**	**2S**	**H. Knörrer**
Abstract	Renormalization is an important technique in mathematical physics. We intend to study various aspects in quantum field theory and quantum statistical mechanics.				
Content	Basic field theory, Evaluation of Gaussian Integrals, Feynman Graphs, Polymer Systems, The renormalization group for Φ^4_2, Hopf algebras and renormalization,				
Literature	Manfred Salmhofer: Renormalization. Springer 1998 Kreimer, Dirk: New mathematical structures in renormalizable quantum field theories. Ann. Physics 303 (2003) and others				
Prerequisites / notice	"Complex Analysis. Basic quantum mechanics and quantum field theory help undestanding and are recommended Talks can be given in German or English.				
401-3910-63L	**Information Theoretic Methods for Portfolio Construction**	**W**	**4 credits**	**2S**	**W. C. Strong**
Abstract	Standard portfolio theory as taught in financial economics and mathematics is plagued by overly complex market models. When the parameters of these models are naively fit to historical data, the out-of-sample performance tends to be poor - a sign of overfitting. Information theory provides some tools to avoid this problem, which we will explore in this seminar.				
Objective	To learn about the contributions of information theory to portfolio construction and to generate ideas for future paths forward.				
Content	No prior knowledge of information theory is assumed, so we will start by covering substantial material on it. We will apply this knowledge to understanding Universal Portfolios. These portfolios asymptotically achieve the same growth rate as the best constant-weight portfolio in hindsight (which is not an implementable strategy). Their strengths and weaknesses will be critiqued. From there we will cover the maximum entropy principle and its use in statistical physics via Gibbs distributions. This approach is adaptable to optimization problems, but a crucial temperature parameter must be supplied. Whereas the temperature is usually a readily measurable quantity of a physical system, in optimization problems it's not obvious how it should be chosen. Choosing it well is equivalent to balancing between overfitting and underfitting on the historical data. A temperature may be chosen with as few as n=2 data points by using the approximation set coding method developed by Prof. Buhmann at ETH. This allows for using Gibbs distributions as a tool in portfolio construction while balancing between overfitting and underfitting.				