Theoretical Astrophysics - astro608

Module No.	**astro608**
Category	Required
Credit Points (CP)	7
Semester	1.

Module: Theoretical Astrophysics

Module Elements:

Nr	Course	Course No.	CP	Type	Teaching hours	Semester
1	Theoretical Astrophysics	astro608	7	Lect. + ex.	3+2	WT

Requirements for Participation:

Form of Examination: written examination

Content: Introduction into Theoretical Astrophysics

Aims/Skills: To provide the students with sound theoretical bases on a number of topics that have wide applications in astrophysics. They include general relativity, kinetic theory, plasma and fluid dynamics, stochastic and radiative processes, and radiative transfer.

Course achievement/Criteria for awarding cp's: successful work with exercises

Length of Module: 1 semester

Maximum Number of Participants: ca. 100

Registration Procedure: s. https://basis.uni-bonn.de u. http://bamawww.physik.uni-bonn.de

Note:

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Theoretical Astrophysics - astro608

Course	**Theoretical Astrophysics**
Course No.	astro608

Category	**Type**	**Language**	**Teaching hours**	**CP**	**Semester**
Required	Lecture with exercises	English	3+2	7	WT

Requirements for Participation:

Preparation: Theoretical courses at the Bachelor degree level

Form of Testing and Examination: Requirements for the examination (written): successful work with the exercises

Length of Course: 1 semester

Aims of the Course: The goal of this course is to provide the students with sound theoretical bases on a number of topics that have wide applications in astrophysics. They include general relativity, kinetic theory, plasma and fluid dynamics, stochastic and radiative processes, and radiative transfer.

Contents of the Course:

Introduction to General Relativity, Schwarzschild metric and gravitational waves.

Kinetic theory, Klimontovich equation, BBGKY hierarchy, Boltzmann and Vlasov equations, fluid limit, transport coefficients.

Basics of hydrodynamics, spherical flows, shock waves, Bondi accretion.

Random fields and stochastic processes, correlation and structure functions, power spectrum and multispectra, Langevin and Fokker-Planck equations.

Continuum radiation processes, synchrotron radiation, free-free radiation, Compton scattering.

Radiation from bound-free and bound-bound transitions.

Radiative transfer.

Concepts of plasma physics, Langmuir waves, Alfven waves, Faraday rotation, dispersion relations.

Recommended Literature:

Lecture notes

S. Carroll, Spacetime and Geometry (Addison Wesley 2004)

F.F. Chen, Introduction to Plasma Physics and Controlled Fusion (Springer 1984)

K. Huang, Statistical Physics (John Wiley & Sons 1987)

C.W. Misner, K.S. Thorne, J.A. Wheeler, Gravitation (Freeman 1973)

H. Risken, The Fokker-Planck Equation (Springer 1996)

G.R. Rybicky, A.P. Lightman; Radiative Processes in Astrophysics (John Wiley & Sons 1991)

F.H. Shu, The Physics of Astrophysics, Vol I & II (University Science Books 2010)

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