Degree: **M.Sc. in Astrophysics (PO von 2014)**

Module No.:	astro820
Credit Points (CP):	12
Category:	Required
Semester:	2.

Fachgruppe Physik und Astronomie Universität Bonn

Module: Compulsory Astrophysics II

Module Elements:

Nr.	Course Title	Number	CP	Type	Workload	Sem.
1.	Astrophysics of Galaxies	astro821	6	Lect. + ex.	180 hrs	ST
2.	Physics of the Interstellar Medium	astro822	6	Lect. + ex.	180 hrs	ST

Requirements for Participation:

Form of Examination:
written examination

Content:
This module presents both, theoretical aspects, as well as the detailed properties of the major building blocks of cosmic structure, viz. galaxies. The fundamentals of the physics of the interstellar medium are conveyed, along with the tools used to study its properties

Aims/Skills:
The student shall acquire knowledge about the properties of galaxies, including their formation and their evolution, based on knowledge of the constituent matter (stars, gas, dark matter). The fundamentals of stellar dynamics are also conveyed. Physical processes relevant for the study of the interstellar medium have to be understood including the basic methods of measurements and their interpretation of the fundamental phases of the ISM

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

Module: Compulsory Astrophysics II

Module No.: astro820

Course: Astrophysics of Galaxies

Course No.: astro821

Category	Type	Language	Teaching hours	CP	Semester
Required	Lecture with exercises	English	3+1	6	ST

Requirements for Participation:

Preparation:
Introductory astronomy as well as a good understanding of stars and their evolution as well as of the interstellar medium

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

Length of Course:
1 semester

Aims of the Course:
The student shall acquire deep knowledge of the structure of the Milky Way and of other galaxies including their evolution.
This must enable them to understand and evaluate new publications in the field. It should provide the student a quick entry into the research phase of the study programme

Contents of the Course:
Review of stars and stellar evolution, review of the interstellar medium. Solar neighbourhood: observables, differential galactic rotation, Hyades, Goulds Belt, Local Bubble. The Galaxy: size, dynamics of objects, rotation curve, disk and z-distribution. Stellar dynamics: Boltzmann, Jeans drift, Schwarzschild ellipsoid, scale length and height, density wave, mass distribution, age of populations, dark matter concept, evolution. Satellites: the Magellanic Clouds, their structure and evolution, Magellanic Stream, Dwarf spheroidals, Local Group galaxies. Star clusters: stellar dynamics, binary and multiple stars, energy exchange, star-cluster birth and death, origin of galactic field population. Active galactic nuclei: observables, jets, accretion, black holes. Structure and shape of spirals and ellipticals, surface brightness, globular cluster systems. Galaxy clusters: distances, statistics, luminosity function, X-ray halos, virial theorem. Galaxy evolution: chemical enrichment, galactic winds, infall, observables. Galaxy collisions: relaxation, mergers, birth of dwarf galaxies

Recommended Literature:
J. Binney; B. Merrifield; Galactic Astronomy (Princeton University Press 1998)
J. Binney, S. Tremaine; Galactic Dynamics (Princeton University Press 1988)
L. S. Sparke; J. S. Gallagher; Galaxies in the Universe (Cambridge University Press, 2000)
Write-up of the class

Module: Compulsory Astrophysics II

Module No.: astro820

Course: Physics of the Interstellar Medium

Course No.: astro822

Category	Type	Language	Teaching hours	CP	Semester
Required	Lecture with exercises	English	3+1	6	ST

Requirements for Participation:

Preparation:
Introductory astronomy

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

Length of Course:
1 semester

Aims of the Course:
The student shall acquire a good understanding of the physics and of the phases of the ISM. The importance for star formation and the effects on the structure and evolution of galaxies is discussed.

Contents of the Course:
Constitutens of the interstellar medium, physical processes, radiative transfer, recombination, HI 21cm line, absorption lines, Stroemgren spheres, HII regions, interstellar dust, molecular gas and clouds, shocks, photodissociation regions, energy balances, the multi-phase ISM, gravitational stability and star formation.

Recommended Literature:
B. Draine; The Physics of the Interstellar and Intergalactic Medium (Princeton Univ. Press 2010)
J. Lequeux; The Interstellar Medium (Springer 2005)