## Particle Astrophysics and Cosmology (E) - physics711

**Degree** - M.Sc. in Physics (PO von 2014)

| ***Module*** | **Elective Advanced Lectures: Experimental Physics** |
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| *Module No.* | physics70a |

| ***Course*** | **Particle Astrophysics and Cosmology (E)** |
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| *Course No.* | physics711 |

| **Category** | **Type** | **Language** | **Teaching hours** | **CP** | **Semester** |
|---|---|---|---|---|---|
| Elective | Lecture with exercises | English | 3+1 | 6 | WT |

**Requirements for Participation:**

**Preparation:** physics611 (Particle Physics), useful: Lectures Observational Astronomy

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

**Length of Course:** 1 semester

**Aims of the Course:** Basics of particle astrophysics and cosmology

**Contents of the Course:**

Observational Overview (distribution of galaxies, redshift, Hubble expansion, CMB, cosmic distance latter, comoving distance, cosmic time, comoving distance and redshift, angular size and luminosity distance); Standard Cosmology (cosmological principle, expansion scale factor, curved space-time, horizons, Friedmann-Equations, cosmological constant, cosmic sum rule, present problems); Particle Physics relevant to cosmology (Fundamental Particles and their Interactions, quantum field theory and Lagrange formalism, Gauge Symmetry, spontaneous symmetry breaking and Higgs mechanism, parameters of the Standard Model, Running Coupling Constants, CP Violation and Baryon Asymmetry, Neutrinos); Thermodynamics in the Universe (Equilibrium Thermodynamics and freeze out, First Law and Entropy, Quantum Statistics, neutrino decoupling, reheating, photon decoupling); Nucleosynthesis (Helium abundance, Fusion processes, photon/baryon ratio)

Dark Matter (Galaxy Rotation Curves, Clusters of Galaxies, Hot gas, Gravitational lensing, problems with Cold Dark Matter Models, Dark Matter Candidates); Inflation and Quintessence; Cosmic Microwave Background (origin, intensity spectrum, CMB anisotropies, Temperature correlations, power spectrum, cosmic variance, density and temperature fluctuations, causality and changing horizons, long and short wavelength modes, interpretation of the power spectrum)

**Recommended Literature:**

A. Liddle; An Introduction to Modern Cosmology (Wiley & Sons 2. Ed. 2003)

E. Kolb, M. Turner; The Early Universe (Addison Wesley 1990)

J. Peacock; Cosmological Physics (Cambridge University Press 1999)