



Lecture Course in the Integrated Research Training Group (IRTG)
of the SFB 676 "Particles, Strings and the Early Universe"

Summer Term 2018

Theoretical Cosmology

A. Westphal and G. Servant

Course Description:

The course will cover topics in the following areas:

- **Thermodynamics in the Early Universe:** Particle Decoupling, Big Bang Nucleosynthesis, Recombination and Photon Decoupling, Boltzmann Equation, Cold Dark Matter Freeze-Out, hot Dark Matter;
- **Dark Matter:** Evidence and Candidates, WIMP Phenomenology and Constraints, Alternatives to thermal Freeze-Out;
- **Baryogenesis:** Criteria and Mechanisms, Baryon Number Violation in the Standard Model, Sphalerons, Out-of-Equilibrium Decay, Leptogenesis, Electroweak Baryogenesis, Higgs effective Potential at high Temperature, Electroweak Phase Transition, Sources of CP Violation, Calculation of Asymmetry;
- **Inflation:** Motivation and Models;
- **Theory of Perturbations:** Scalar and Metric Fluctuations;
- **Cosmic Microwave Background:** Sachs-Wolfe Effect, Anisotropies, Delayed Recombination, Determination of Cosmological Parameters;
- **Theory of Large Scale Structures:** N-body Simulations, Standard Perturbation Theory and Advanced Techniques;
- **Gravitational Waves:** Theory, Binary Systems, Pulsars & Black Holes, Cosmological Sources.

Prerequisites:

Basic knowledge in General Relativity and Quantum Field Theory.

Date and Place: Tue, 9:15 – 10:45, SR 2, Building 2a, Bahrenfeld
Fri, 11:00 – 12:30, SR 2, Building 2a, Bahrenfeld

Starting on: 10 April 2018