Universität Hamburg
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CHAMPP
CENTER IN HAMBURG FOR ASTRO-, MATHEMATICAL AND PARTICLE PHYSICS

LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

Summer Term 2019

Theoretical Cosmology

V. Domcke, G. Servant

Course Description:

- **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:** Motivations 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, 9:15 – 10:00, SR 2, Building 2a, Bahrenfeld
Problem Classes:	Fri, 10:00 – 10:45, SR 2, Building 2a, Bahrenfeld
Starting on:	2 April 2019