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

Renormalisation of spontaneously broken gauge theories and related phenomenological aspects

G. Weiglein

Course Description:

Spontaneously broken gauge theories play a key role in the description of the fundamental interactions of nature. Renormalisation is required for their investigation at the quantum level. The renormalisation procedure and the physics behind it will be explained, with a particular emphasis on aspects related to unstable particles. Examples of phenomenological applications in the Standard Model of particle physics and supersymmetric extensions of it will be discussed. Specifically the following topics will be covered:

- Quantum Field Theory (QFT): in- and out-states, S matrix, LSZ formalism; the problem of treating unstable particles in QFT
- The complex pole and the mass of an unstable particle
- On-shell, $\overline{\rm MS}$ and $\overline{\rm DR}$ renormalisation
- Renormalisation group equations
- Field renormalisation of unstable particles
- Finite wave function normalisation factors
- Vacuum expectation values and tadpoles
- Examples of applications

Prerequisites:

Basic knowledge in Quantum Field Theory at the level of the courses "Quantum Field Theory I" or "Advanced Particle Physics".

Literature:

M. Böhm, A. Denner, H. Joos, Gauge Theories of the Strong and Electroweak Interaction (Teubner)
J. Collins, Renormalization (Cambridge Monographs on Mathematical Physics)

Date and Place: Mon, 11:15 – 12:45, SR 2, Building 2a

Starting on: 1 April 2019