T 19: Flavourphysik (Theorie) 2

Convenor: Tobias Hurth

Zeit: Montag 16:45–19:05 Raum: WIL-B122

T 19.1 Mo 16:45 WIL-B122

Large Neutrino Mixing from Large Discrete Symmetries — •Thomas Neder, Stephen F. King, and Alexander J. Stuart — School of Physics and Astronomy, University of Southampton

Several finite groups that are candidates for a flavor symmetry of leptons are investigated. Promising candidates are amongst others the groups $\Delta(150)$ and $\Delta(600)$. The group theory of these groups as well as results for the lepton mixing parameters resulting from these groups are presented.

T 19.2 Mo 17:00 WIL-B122

Lepton Mixing Patterns from a Scan of Finite Discrete Groups — •Kher Sham Lim — Max-Planck Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Deutschland

Recent discovery of non-zero θ_{13} has ruled out tri-bimaximal mixing as the correct lepton mixing pattern generated by some discrete flavor symmetry. In this work we perform a general scan of all finite discrete groups with order less than 1536 to obtain their predictions for lepton mixing angles. In this approach, only the structure of symmetry groups and their unbroken subgroups to the charged lepton sector and the Majorana neutrino sector are assumed. The scan of over one million groups only yields 3 interesting groups that give lepton mixing patterns which lie within 3-sigma of the current best global fit values. A systematic way to categorize such groups and the implications for flavor symmetry will be discussed.

T 19.3 Mo 17:15 WIL-B122

Ruling out a fourth fermion generation — •Otto Eberhardt[1], Geoffrey Herbert[2], Heiko Lacker[2], Alexander Lenz[3], Andreas Menzel[2], Ulrich Nierste[1], and Martin Wiebusch[1] — [1]KIT — [2]HU Berlin — [3]IPPP Durham

Up to now, the experimental results of the LHC perfectly agree with the predictions of the Standard Model of particle physics (SM). On the other hand, they give us the possibility to strongly constrain physics models beyond the SM. One of those theories is the extension of the SM particle content by a sequential perturbative fourth fermion generation (SM4). (The number of fermion generations is not related to any of the principles the SM relies on, and thus not necessarily equal to three.) In the context of the SM4, we interpret the LHC discovery of a bosonic particle as the SM-like Higgs particle. Combining ATLAS and CMS Higgs data with electroweak precision observables in a global fit, we can exclude the SM4 at 5σ. Hence, the SM4 is the first popular model ruled out by the LHC.

Gruppenbericht T 19.4 Mo 17:30 WIL-B122

Minimal Flavour Violation and Anomalous Top Decays — •Sven Faller[1], Thomas Mannel[1], and Stefan Gadatsch[2] — [1]Theoretische Physik 1, Department Physik, Universität Siegen, D-57068 Siegen, Germany — [2]Nikhef, National Institute for Subatomatic Physics, P.O. Box 41882, 1009 Amsterdam, Netherlands

Any experimental evidence of anomalous top-quark couplings will open a window to study physics beyond the standard model (SM). However, all current flavour data indicate that nature is close to "minimal flavour violation", i.e. the pattern of flavour violation is given by the CKM matrix, including the hierarchy of parameters. In this talk we present results of the conceptual test of minimal flavour violation for the anomalous charged as well as flavour changing top-quark couplings. Our analysis is embedded in two-Higgs doublet model of type II (2HDM-II). Including renormalization effects, we calculate the top decay rates taking into account anomalous couplings constrained by minimal flavour violation.

T 19.5 Mo 17:50 WIL-B122

Room for new physics in inclusive B-Decays — •Fabian Krinner[1], Alexander Lenz[2], and Thomas Rauh[1] — [1]TUM, Munich, Germany — [2]IPPP, Durham, Great Britain

The dimuon-asymmetry was measured at the DØ-experiment to be 3.9σ above the standard model expectation.

As one explanation different models of new physics in B-mixing were discussed. It was shown that new physics in M_{12} alone does not suffice to explain the large difference. Therefore effects of new physics should also occur in the absorptive part.

A change in the absorptive part, however, would also influence B-decay modes, since it involves real intermediate states.

To determine to what extent this might be possible a re-analysis of inclusive B-decays was performed, where special attention was given to the charm-multiplicity and the semileptonic branching ratio which we find to be $n_c = 1.23 \pm 0.02$ and $\mathcal{B}_{Sl} = 0.114 \pm 0.010$ respectively, which has to be compard with the current experimental values: $n_c = 1.20 \pm 0.06$ and $\mathcal{B}_{Sl} = 0.107 \pm 0.003$.

T 19.6 Mo 18:05 WIL-B122

BR($B_s \to \mu^+\mu^-$) to NNLO in QCD — •Thomas Hermann and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruher Institut für Technologie (KIT)

The recently measured rare decay $B_s \to \mu^+\mu^-$ is very sensitive to physics beyond the Standard Model (SM). Therefore, it is important to reduce the SM uncertainties. NNLO QCD corrections to this branching ratio reduce current uncertainties due to the dependence on the matching scale.
In this talk, we present the calculation of the Wilson coefficient C_1 to NNLO in QCD, which includes corrections to W-boson box and Z-boson penguin contributions. In particular, we provide details on the matching procedure and the calculation of the coefficient function of the evanescent operator.

T 19.7 Mo 18:20 WIL-B122

NNLO corrections to the decay $B \to D\pi$ — •Susanne Kränkl and Tobias Huber — Universität Siegen/Germany

Hadronic decays of B mesons provide an essential contribution in testing the CKM structure of the Standard Model. It is therefore mandatory to increase the precision of their branching ratios as much as possible, both experimentally and theoretically. In this talk we investigate the decay $B \to D\pi$ at NNLO in QCD factorization, a framework which disentangles perturbative from non-perturbative effects in the heavy-mass limit. We present the first results for the two-loop correction to the hard scattering kernel, including calculational techniques such as the Laporta reduction to master integrals.

T 19.8 Mo 18:35 WIL-B122

Form factor for semi-leptonic $B \to \pi\ell\nu$ decays — •Felix Bahr[1], Fabio Bernardoni[1], John Bulava[2], Rainer Sommer[1], Hubert Simma[1], and Alberto Ramos[1] — [1]NIC, DESY Zeuthen — [2]CERN, Geneva

The CKM-Matrix element $V_{\rm ub}$ is currently insufficiently well known; there exist differences between its value obtained from different methods of determination, inclusive $B \to X_u\ell\nu$, exclusive $B \to \pi\ell\nu$ and exclusive $B \to \tau\nu$ decays. To investigate these, as well as to match improved experimental data, high precision lattice QCD calculations are required, keeping systematic errors under control. To this end, we simulate semi-leptonic $B \to \pi\ell\nu$ decays of pseudoscalar B mesons made up of a b and a light u or d quark. The hadronic matrix element $\langle\pi(p_\pi)\,|\bar{u}\gamma_\mu b|\,B(p_\pi+q)\rangle = (p_B+p_\pi)\,f_+(q^2) + (p_B-p_\pi)\,f_-(q^2)$, $q^2 = (p_B-p_\pi)^2$, can be parametrised by the form factors f_+, f_-. We work on an $L^3 \times 2L$ hypercubic lattice with finite lattice spacing a and $N_{\rm f} = 2$ seaquark flavours. To keep finite size effects under control, we require pion masses to fulfill $Lm_\pi \gtrsim 4$, which for lattice spacings of $a \approx 0.05 \ldots 0.08\,\mathrm{fm}$ and sizes $L = 32, 48, 64$ corresponds to $m_\pi \approx 190 \ldots 450\,\mathrm{MeV}$. Having simulated for various a and m_π, we will eventually extrapolate to the physical point, $a \to 0$, $m_\pi \to m_\pi^{\rm phys}$. The b quark is treated in Heavy Quark Effective Theory, where in leading order the b quark is static and one then performs an expansion in $1/m_b$. We use a model independent parametrisation for the q^2 dependence of $f_+(q^2)$ to perform a combined fit of experimental and theory data to obtain $V_{\rm ub}$.

T 19.9 Mo 18:50 WIL-B122

Correlations between Flavour Observables in New Physics scenarios — •Jennifer Girrbach — Institute for Advanced Study (IAS), Technische Universität München (TUM)

The coming flavour precision era will allow to uncover various patterns

of flavour violation in different New Physics scenarios. We discuss three classes of them. First, a simple extension of the Standard Model (SM) that generally introduces new sources of flavour and CP violation as well as right-handed currents: the addition of a $U(1)$ gauge symmetry to the SM gauge group. In such Z' models correlations between various flavour observables emerges that could test and distinguish different Z' scenarios. We analyse $\Delta F = 2$ observables in $K^0 - \bar{K}^0$ and $B^0_{s,d} - \bar{B}^0_{s,d}$ systems and rare K and B decays including both left-handed and right-handed Z'-couplings to quarks. Next, concrete models with flavour violating Z' couplings are 331 models based on the gauge group $SU(3)_C \times SU(3)_L \times U(1)_X$ are presented. We identify a number of correlations between various observables that differ from those known from constrained minimal flavour violating (CMFV) models. Finally we discuss a special class of models with an approximate global $U(2)^3$ flavour symmetry ($MU(2)^3$ models). While the flavour structure in K meson system is the same for CMFV and $MU(2)^3$ models, CP violation in $B_{d,s}$ system can deviate in $MU(2)^3$ models from CMFV. We point out a triple correlation between $S_{\psi\phi}$, $S_{\psi K_S}$ and $|V_{ub}|$ that can provide a distinction between different $MU(2)^3$ models.