Portorož 2017: New physics at the junction of flavor and collider phenomenology

Tuesday, 18 April 2017 - Friday, 21 April 2017

Book of Abstracts

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Towards a new paradigm for quark-lepton unification

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The quark and lepton mass patterns upset their naive unification. In this talk, a new approach to solve this problem is presented. Model-independently, we show that a successful unification can be achieved. A mechanism is identified by which the large top quark mass renders its third-generation leptonic partner very light. This state is thus identified with the electron. We then discuss a generic dynamical implementation of this mechanism, using tree-level exchanges of vector leptons to relate the quark and lepton flavor structures. In a supersymmetric context, this same mechanism splits the squark masses, and third generation squarks end up much lighter than the others. Finally, the implementation of this mechanism in SU(5) GUT permits to avoid introducing any flavor structure beyond the two minimal Yukawa couplings, ensuring the absence of unknown mixing matrices and their potentially large impact on FCNC.

Flavor / 4

Recent experimental results in flavour physics

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Flavour physics has a long track record of providing ground-breaking experimental results. There is a wealth of results based on recent LHC data, most notably from LHCb. In addition, measurements are still being published from the B factory experiments as well as from former and current charm threshold experiments.

The talk will review the latest set of anlyses as presented at the winter conferences and will cover CP asymmetry and rare decay measurements as well as tests of lepton flavour (universality) violation. The presentation will conclude with an outlook on future directions of experimental flavour physics.

Flavor / 5

B to D(*) tau nu anomaly and high-pT searches at the LHC

Author: Admir Greljo[1]

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I will discuss the implications of the long-standing anomaly in semi-tauonic B meson decays on direct searches for new physics with ATLAS and CMS detectors at the LHC. Collider signatures at high energies correlated with the anomaly at low energies are identified. Several representative models put forward to explain the anomaly are examined in details: color-neutral vector triplet, 2HDM, scalar, and vector leptoquark model. We find that in general di-tau searches impose a serious

challenge to new physics explanations of the anomaly. After recasting present 8 and 13 TeV analyses stringent limits are set on all the models. Future projections are also derived. This talk is mainly based on the recent publication Phys.Lett. B764 (2017) 126-134.

Flavor / 6

Tau polarizations in $B \to D\tau\nu$ decays from final-state kinematics

Authors: Susanne Westhoff[1]; Jorge Martin Camalich[2]; Rodrigo Alonso De Pablo[2]

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The semileptonic decays $B \to D^{(*)}\tau\nu$ have received lots of attention recently, due to an observed discrepancy between standard-model predictions and measurements. Experimentally, these processes are challenging due the fast decay of the tau lepton, which is indirectly observed through its decay products. From a theory perspective, the tau lepton is exactly what makes $B \to D^{(*)}\tau\nu$ decays interesting: The massive lepton offers the possibility to probe its polarization states individually and thereby learn about the details of its production process. I will show how to extract the tau polarizations from kinematics of the visible decay products in $\tau \to \pi\nu$, $\tau \to \rho\nu$, and $\tau \to \ell\nu\bar{\nu}$ decays. These new observables provide us with an analytical framework to fully explore the properties of $B \to D^{(*)}\tau\nu$ decays at BELLE II and LHCb.

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Highlights of the high-pT searches in LHC Run II

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This overview will present highlights of searches for high-pT physics at the ATLAS and CMS experiments, using data from the Run II of the LHC. The status of the traditional resonance searches will be discussed, as well as the recent reconstruction developments in searches for boosted topologies, long-lived particles and low-mass objects. Particular attention will be given to the searches for the production of Dark Matter at the LHC.

Neutrino / 9

Minimal Seesaw Model: Testable Leptogenesis & CP discovery potential

Author: Jacobo Lopez Pavon[1]

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I will discuss two remarkable aspects of the minimal Type-I seesaw model phenomenology. I will first show that for an inverted light neutrino ordering and O(GeV) scale heavy Majorana neutrinos, future measurements from SHiP and neutrinoless double beta decay could in principle provide sufficient information to predict the matter-antimatter asymmetry in the universe. Then, I will also discuss the CP discovery potential of SHiP and FCC in the context of the minimal model, and show that a 5σ discovery of leptonic CP violation would be possible in a very significant fraction of the parameter space.

BSM / 10

Redefining the Axion Window

Author: Luca Di Luzio[1]

[1] *IPPP, Durham*

A major goal of axion searches is reaching inside the parameter space region of realistic axion models. Currently, the boundaries of this region depend on somewhat arbitrary criteria, and it would be desirable to specify them in terms of precise phenomenological requirements. In this talk I put forth a definition for a phenomenologically preferred axion window as the region encompassing all axion models which i) do not give rise to cosmological issues, in the form of cosmologically stable strongly interacting relics; ii) do not generate Landau poles below the Planck scale.

Poster session / 11

The SHiP experiment at CERN

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SHIP is a new general purpose fixed target facility, whose Technical Proposal has been recently reviewed by the CERN SPS Committee and by the CERN Research Board. The two boards recommended that the experiment proceeds further to a Comprehensive Design phase in the context of the new CERN Working group "Physics Beyond Colliders", aiming at presenting a CERN strategy for the European Strategy meeting of 2019. In its initial phase, the 400GeV proton beam extracted from the SPS will be dumped on a heavy target with the aim of integrating 2×10^20 pot in 5 years. A dedicated detector, based on a long vacuum tank followed by a spectrometer and particle identification detectors, will allow probing a variety of models with light long-lived exotic particles and masses below O(10) GeV /c2. The main focus will be the physics of the so-called Hidden Portals, i.e. search for Dark Photons, Light scalars and pseudo-scalars, and Heavy Neutrinos. The sensitivity to Heavy Neutrinos will allow for the first time to probe, in the mass range between the kaon and the charm meson mass, a coupling range for which Baryogenesis and active neutrino masses could also be explained. Another dedicated detector will allow the study of neutrino cross-sections and angular distributions. $\nu\tau$ deep inelastic scattering cross sections will be measured with a statistics 1000 times larger than currently available, with the extraction of the F4 and F5 structure functions, never measured so far and allow for new tests of lepton non-universality with sensitivity to BSM physics.

Poster session / 12

The Belle II Experiment

Author: Christoph Schwanda[1]

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The Belle II experiment at the asymmetric e+e− SuperKEKB collider is a major upgrade of the Belle experiment, which ran at the KEKB collider at the KEK laboratory in Japan. The design luminosity of SuperKEKB is 8×10^{35} cm−2 s−1, which is about 40 times higher than that of KEKB. The expected integrated luminosity of Belle II is 50 ab−1 in five years of running. The experiment will focus on searches for new physics beyond the Standard Model via high precision measurements of heavy flavor decays, and searches for rare signals. To reach these goals, the accelerator, detector, electronics, software, and computing systems are all being substantially upgraded. In this talk we present the status of the accelerator and Belle II detector upgrades, as well as the expected sensitivity to new physics of the Belle II data set.

Higgs / 13

On the Higgs self-coupling modifications

Author: Ramona Groeber[1]

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A determination of the Higgs self-coupling allows the reconstruction of the Higgs potential. In this talk I will discuss which kind of deviations in the trilinear Higgs self-coupling can be expected taking into account theoretical arguments and indirect constraints.

Dark matter / 15

Displaced vertices from Pseudo-Dirac Dark Matter

Author: Thomas David Jacques[1]

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I will discuss a model of Pseudo-Dirac Dark Matter. This model proposes a new fermionic state with both Dirac and Majorana mass terms. In the limit where the Dirac mass dominates, a pair of dark particles appears with a small mass splitting, the lighter of which is a dark matter candidate. The dark states have both Dirac-like and Majorana-like features, evading direct detection constraints with a spin-dependent scattering rate and producing the correct relic density with an unsuppressed coannihilation rate. The heavier state can be produced at the LHC with a decay length of order the detector radius, offering a striking displaced vertex signal.

Dark matter / 16

Exceptional Composite Dark Matter

Author: Adrian Carmona Bermudez[1]

Co-authors: Mikael Chala [2]; Guillermo Ballesteros Martinez [3]

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Models of composite Higgs provide a natural explanation of the hierarchy problem and a beautiful rationale for the flavor puzzle. However, and contrary to what happens in other BSM scenarios, they typically lack a natural dark matter candidate unless non-minimal models with symmetric cosets are considered. Here, we will show an example of a non-symmetric coset which nevertheless provide a natural UV completion of the inert triplet model. We will show that the model is extremely predictive and that delivers a ˜ TeV WIMP that can provide most of the observed relic abundance while evading direct as well as indirect detection tests.

BSM / 17

Flavor without symmetries

Author: Alex Pomarol[None]

The approximate SM flavor symmetries could have emerged from dynamical scenarios in which the corresponding SM fermions couple to a strong sector, responsible for electroweak symmetry breaking, at different dynamical scales. Surprisingly, these scenarios are able to pass all flavor and CP-violating constraints.

Dark matter / 18

TeV scale MSSM Dark Matter and the electroweak Sommerfeld effect

Author: Martin Beneke[None]

For heavy MSSM dark matter with a dominant wino dark matter, resummation of large quantum corrections due to the electroweak force (the "Sommerfeld" effect) is imperative for a reliable calculation of the annihilation cross section. In this talk I first discuss how this is done within a non-relativistic EFT approximation to the full MSSM. It is then investigated whether dominantly wino dark matter with the correct thermally produced relic density remains viable in the light of strong constraints from the non-observation of cosmic ray and terrestrial dark-matter on nuclei scattering signals.

Poster session / 19

Effects of non-holomorphic terms in lepton decays

Author: Zofia Fabisiewicz[1]

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Lepton Flavor Violation (LFV) is strictly forbidden or extremely suppressed in the Standard Model (SM). Therefore, processes violating lepton flavor can serve as an indirect probe of new physics. In the Minimal Supersymmetric Standard Model (MSSM) LFV effects can appear through the diagonalization of the slepton mass matrix or coming from the Higgs-slepton-slepton vertex. I will present our study of the effects of the non-homomorphic terms on LFV decays. A newly developed calculation method will be shown which allows for systematic expansion of the amplitudes in terms of mass insertions.

BSM / 21

DsixTools, the SM Effective Field Theory code

Author: Avelino Vicente Montesinos[1]

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I will present DsixTools, a Mathematica package for the handling of the dimension six Standard Model Effective Field Theory. Among other features, DsixTools allows the user to perform the full 1-loop Renormalization Group Equations (RGEs) evolution of the Wilson coefficients in the Warsaw basis. This is achieved thanks to the SMEFTrunner module, which implements the full 1-loop RGEs previously derived in the literature. In addition, DsixTools also contains modules devoted to the matching to some low-energy effective operators (of common use in phenomenological studies) and their QCD and QED RGE running below the electroweak scale. After introducing the code, I will show some practical applications to illustrate its power and usability.

Higgs / 22

Assessing Higgs self coupling

Author: Christophe Grojean[1]

[1] *DESY (Hamburg) and Humboldt University (Berlin)*

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I'll review the constraints that can be inferred on Higgs self-coupling from double Higgs production as well as from differential distributions in single Higgs processes. I'll discuss the impact of possible large deviations of the Higgs self-coupling on the determination of the single Higgs couplings

BSM / 23

Aspects of 3-3-1 models

Author: Vicente Pleitez[1]

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We will review the main features of the 3-3-1 models. These sort of models are interesting proposals for the physics beyond the standard model because they are free of anomalies only if the number of families or generations is three. Usually, the models are classified according a parameter (denoted by β) appearing in the electric charge operator.

In particular, we show that the β parameter is not enough to differentiate models with different representation content. For instance, in some of them having the same β, but with different particle spectrum, an automatic Z_2 symmetry imply the existence of stable charged or neutral leptons and long lived hadronic resonance. We also comment on the possible existence of a Landau pole in one of the gauge couplings.

Higgs / 24

Controlled FCNC in Two Higgs Doublet Models

Author: Gustavo Branco[1]

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We analyse a class of Two Higgs Doublet Models (2HDM) where there are Flavour Changing Neutral Currents (FCNC) at tree level, but with their strength under control. We present a specific generalisation of BGL models in the context of 2HDM where there are FCNC both in the up and down sectors. Implications for baryogenesis are also analysed.

Dark matter / 25

Dark matter from dark gauge groups

Author: Christian Gross[None]

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Dark gauge groups, coupled to the Standard Model via the Higgs portal, can provide WIMP dark matter in a simple and appealing way. After reviewing the origin of dark matter stability in this framework, I discuss different mechanisms that lead to a natural suppression of direct detection rates below present-day limits, without a fine-tuning of parameters.

Collider / 26

Relating matter unification to LHC event rates

Author: Björn Herrmann[1]

[1] *LAPTh Annecy*

Unification of matter fields implies the existence of accidental permutation symmetries, which potentially remain immune to large quantum corrections up to the TeV scale. In this case, there is hope that they can be tested current colliders such at the LHC.

In this context, I will discuss the case of supersymmetric SU(5) grand unified theory, where such a permutation symmetry is present in the up-type squark sector. We present a variety of tests allowing to challenge the SU(5)-hypothesis based on the observation of squarks at the LHC. These tests appear as relations among observables involving flavour-violating or chirality-flipping decays of squarks. Moreover, they rely on top-polarimetry and charm-tagging.

After the discussion of relatively simple test relations in the framework of, e.g., natural or heavy supersymmetry, I will discuss the more general case where the SU(5)-hypothesis can be tested using Bayesian statistics.

Flavor / 27

Reassessing the exclusive determination of Vcb

Author: paolo gambino[1]

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The determination of Vcb from B->D*l nu is reviewed in the light of a recent Belle analysis, studying the dependence on the form factor parameterisation employed and the residual uncertainty. A long lasting discrepancy between the inclusive and exclusive determinations of |Vcb| has to be thoroughly reconsidered.

BSM / 28

Trilinear-Augmented Gaugino Mediation

Author: Joern Kersten[1]

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I will discuss the impact of the measured Higgs mass and of LHC searches on the parameter space of gaugino-mediated supersymmetry breaking. Including non-vanishing trilinear scalar couplings, which were originally thought not to be present in this model, allows to obtain the correct Higgs mass for superparticle masses that are accessible by the LHC. I will also comment on the effects of more accurate Higgs mass calculations, which tend to push the required superparticle mass scale to higher values than estimated earlier.

Flavor / 29

The ϵ' anomaly: consequences for supersymmetry and $K \to \pi\nu\bar{\nu}$

Author: Ulrich Nierste[1]

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The measure epsilon' of direct CP violation in K → ππ decays disagrees with the Standard-Model prediction by 2.8 standard deviations. It is possible to explain this discrepancy with supersymmetric contributions involving squarks and gluinos in the multi-TeV range. I discuss the footprint of this scenario on the rare decays K+ → π+ ν ν̄ and KL → π0 ν ν̄.

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Is there room for CP violation in the Higgs sector of the Standard Model EFT

Author: Jordy de Vries[1]

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The absence of anti-matter in our universe hints towards new sources of CP violation that are not present in the Standard Model. One possible source of such CP violation could hide in the interactions of the Higgs boson. I will discuss the framework of the Standard Model effective field theory in which such anomalous CP-violating Higgs interactions appear naturally. Footprints of Higgs CP violation can be found in a large variety of experiments at a wide range of energy scales. From low-energy atomic and molecular high-precision experiments, to medium-energy flavor experiments, up to the high-energy frontier at the Large Hadron Collider. I discuss a theoretical framework in which these very different searches can be compared showing that the different searches are complementary.

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Twin Higgs, naturalness and SUSY

Author: Andrey Katz [None]

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I will analyze the general structure of mirror symmetry breaking in the Twin Higgs scenario. A significant gain in fine tuning can be achieved if the symmetry is broken hardly. I will emphasize that weakly coupled UV completions can naturally accommodate this scenario. I will analyze SUSY UV completions and present a simple Twin SUSY model with a tuning of around 10% and colored superpartners as heavy as 2 TeV. I will also briefly comment on the phenomenology of this SUSY Twin Higgs proposal.

Dark matter / 32

Top-Flavoured Dark Matter beyond Minimal Flavour Violation

Author: Monika Blanke[1]

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We discuss a simplified model of top-flavoured dark matter, where the dark matter-quark coupling constitutes a new source of flavour and CP violation. The setup is experimentally constrained by LHC searches, by neutral D meson mixing data, by the assumption of dark matter being a thermal relic, and the cross-section limits from direct detection experiments. We take a look at the impact of the various constraints, and consider in particular their interplay. The model is quite stringently constrained already by the current data, and expected limits from future direct detection experiments will exclude a major fraction of its parameter space.

GUT / 33

SU(5) completion of the scotogenic neutrino model

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We are considering possible UV completions of the scotogenic neutrino model which is a bottom-up attempt to explain both neutrino masses and dark matter with additional weak scalar triplet, charged scalar singlet and 3 generations of vector-like lepton doublets. Neutrino masses are generated radiatively at the one-loop level (variation of the Zee model) while the neutral triplet component can serve as a dark matter candidate.
Preliminary studies show that while such scenario could easily be embedded into SU(5) framework, the GUT scale might be difficult to reconcile with the proton lifetime bounds.

Dark matter / 34

New Ideas for the Direct Detection of sub-GeV Dark Matter

Author: Josef Pradler[1]

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The direct detection of Dark Matter particles with mass below the GeV-scale is hampered by soft nuclear recoil energies and finite detector thresholds. We propose to bypass the kinematic limitations by considering the inelastic channel of photon emission in the nuclear recoil. Our proposed method allows to set the first limits on Dark Matter below 500 MeV in the plane of Dark Matter mass and cross section with nucleons. In a second part, the direct detection of mass-split SIMPs will briefly be discussed.

Higgs / 35

Higgs Sector of the Left-Right Symmetric Theory

Author: Alessio Maiezza[1]

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We perform an in-depth analysis of the Higgs sector in the Minimal Left-Right Symmetric Model and compute the scalar mass spectrum and associated mixings in the whole parametric space. A focus on the cubic potential couplings is provided in terms of the physical states and in the light of the (potentially large) quantum corrections. Then the deviations from the Standard Model prediction of the cubic Higgs doublet coupling are considered.
We evolve the parametric space through the RGE considering three energy benchmarks for the right-handed scale: LHC reach, next hadronic collider and very high energy relevant for grand unification; we discuss the possible implications concerning the stability of the potential. A particular attention is payed to the perturbativity of the model in the case of TeV right-handed scale.

Dark matter / 36

Radiative Standard Model Yukawa couplings from dark dynamics

Author: Martti Raidal[1]

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I discuss how the observed hierarchy in the Standard Model Yukawa couplings may radiatively originate from the dark sector dynamics. The associated dark photons and the mediator sector that transfers the dark hierarchy to the Standard Model offer distinguishing experimental tests at high and low energy experiments.

Flavor / 38

Z-mediated New Physics and Vector-Like Models

Author: Andrzej Buras[1]

[1] *TUM-IAS*

Z-mediated New Physics as seen from the point of view of Standard Model Effective Theory will be presented. The highlight is the generation of left-right operators
through renormalisation group effects involving Yukawa couplings. Model independent
analysis of K-meson and B-meson flavour physics will be presented. These methods
will be applied to a number of models with Vector-like quarks.

Flavor / 39

Explaining the flavour anomalies

Author: Andreas Crivellin[None]

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In this talk I review the various possibilities for explaining the current hints for the violation of lepton flavour universality in b->smumu, h->taumu, b->staunu and the anomalous magnetic moment of the muon.

Flavor / 40

Revisiting B→K∗(→Kπ)νν̄ decays

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The rare decay B→K∗(→Kπ)νν̄ is expected to play an important role in searches for physics beyond the Standard Model at the near future B-physics experiments. We investigate resonant and non-resonant backgrounds that arise beyond the narrow-width approximation for the K∗.

Neutrino / 41

Lepton Number Violation

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The violation of lepton number is predicted in many new physics scenarios and it is tightly connected to the potential Majorana character of neutrinos; searching for lepton number violation (LNV) therefore constitutes a crucial pathway to physics beyond the Standard Model. In my talk, I will provide a review of the theoretical aspects of LNV and Majorana neutrinos. I will try to illuminate what consequences the observation of LNV would have on new physics scenarios, specifically on neutrino mass and baryogenesis mechanisms. I will furthermore survey the phenomenology of relevant experimental searches, both at low energies and at high energy colliders such as the LHC. Here I will focus on the role of the nuclear process of neutrinoless double beta decay and its impact on neutrino physics.

Flavor / 42

b -> s tauˆ+ tauˆ- polarization observables for FCC-ee

Author: Luiz Vale Silva[1]

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While one of the main motivations for the construction of the next collider facilities is the production of new particles, the debates around the relevant New Physics (NP) cases would be incomplete without low energy flavor studies. In this context, a rich pattern of deviations in B meson decays with respect to the Standard Model (SM) has brought much attention in recent years. Apart from the neutral current transition $b \to s\mu^+\mu^-$, deviations have been seen in τ to light lepton ratios in

charged current $b \to c$ decays, thus suggesting possible sources of lepton flavor universality violation beyond the SM, also hinted at by the ratio R_K. Here, I consider the measurement of the rare bottom decay $b \to s\tau^+\tau^-$ by the electron-positron Future Circular Collider (FCC-ee), and discuss the short-distance physics information carried out by the $\tau^\pm$ polarizations.

Flavor / 43

(Semi)leptonic decays of light quarks in the LHC era: a model-independent analysis

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A global Effective-Field-Theory analysis of $d(s) \to u\ell\nu$ transitions will be presented. The interplay of the various processes (kaon, pion, nuclear and baryon decays) will be discussed, along with the results of a combined fit.
The framework contains the usual SM analysis as a specific case, and it allows to understand the implications of any given SM test, such as the the well-known $V_{ud}-V_{us}$ diagram.
Finally, I will discuss the synergy with searches at high-energy colliders, such as the LHC.

GUT / 44

Flavor structure in SO(10) SUSY GUT from effective operators

Authors: Vasja Susič[1]; Stefan Antusch[1]; Christian Hohl[1]

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We investigate the Yukawa sector of $SO(10)$ Grand Unified Theories by
using the real representations 45 and 210 of $SO(10)$ to construct a class of effective non-renormalizable $SO(10)$ operators of the form $16 \times 16 \times 10 \times 45^n \times 210^m$. The representations 45 and 210 acquire 2 and 3 independent VEV components, respectively. Assuming the overall VEVs of the 45 and 210 take well-defined directions with respect to the Pati-Salam or $SU(5) \times U(1)$ subgroups, one can obtain fermion mass ratio predictions at the GUT scale other than those from flavor models in $SU(5)$ GUTs.
Furthermore, we also investigate cases where the breaking sector of the model allows VEVs to align in arbitrary directions. In particular, we study in detail a scenario where we assume single operator dominance for the 22 and 33 Yukawa entries (operators with powers of 45 only). Requiring then for masses of the 3rd and 2nd family, which are run via RGE to low energies, to be consistent with their experimentally measured values, the model yields predictions for the size of threshold corrections at the SUSY scale, and thus constrains the MSSM spectrum.

Flavor / 45

Loop effects of heavy new scalars and fermions in b→sμ+μ−

Author: Lars Hofer[1]

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The measurements of b→sμ+μ− processes at LHCb and BELLE have revealed several tensions at the 2–3σ level. Combined fits to the available data suggest that these tensions might have their common origin in New Physics beyond the SM. In this talk I will discuss the impact of a generic class of models featuring new heavy scalars and fermions that couple to the SM fermions via Yukawa-like interactions. The models induce one-loop contributions to b→sμ+μ− as well as to the anomalous magnetic moment of the muon, and I will discuss the possibility of a simultaneous solution of the respective anomalies.

Flavor / 46

B Decays into multi-hadron final states

Author: Thomas Mannel[None]

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A large part of the branching fraction of bottom hadrons is due to decays with more than a single hadron in the final state. I will discuss the theoretical methods to describe semi-leptonic decays with two final-state hadrons as well as non-leptonic B decays with more than two hadrons in the final state. In particular with respect to CP violation such decays may give us additional insights.

Neutrino / 47

Lepton flavor violation at high and low energies

Author: Alexey Petrov[1]

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Lepton-flavor violating (LFV) effective Lagrangian at low energies contains over a dozen distinct operator structures. We discuss how to constrain Wilson coefficients of those operators from the data obtained in various LFV leptonic and radiative leptonic transitions of B/D/K mesons, LFV decays of various quarkonia, as well as from high energy LHC data.

Dark matter / 49

Cornering WIMP Dark Matter

Author: Thomas Schwetz[None]

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The old idea that Dark Matter is produced by thermal freeze-out in the early Universe is reviewed. Present advances in direct, indirect and collider searches are more and more constraining this type of Dark Matter. In this talk this statement is made explicit by considering a generic type of a simplified model for WIMP Dark Matter. We argue that the WIMP paradigm is pushed to "special" corners of the parameter space due to various experimental and theoretical constraints.

Higgs / 50

The Inert Doublet Model and its extensions

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Inert Doublet Model in light of LHC Run I and astrophysical data
Agnieszka Ilnicka, Maria Krawczyk, Tania Robens, Phys.Rev. D93 (2016) no.5, 055026,
IDMS: Inert Dark Matter Model with a complex singlet
Cesar Bonilla, Dorota Sokolowska, Neda Darvishi, J.Lorenzo Diaz-Cruz, Maria Krawczyk, J.Phys. G43 (2016) no.6, 065001

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The energy and accuracy frontier

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The large amount of data collected at the LHC and at its High-Luminosity extension will allow for accurate measurements of TeV-scale scattering processes that display enhanced indirect sensitivity to multi-TeV scale new physics. The power of those reasonably accurate and highly energetic"processes in probing heavy new physics is illustrated by showing that high-energy neutral and charged Drell-Yan cross-section measurements at the LHC will improve by one order of magnitude the LEP sensitivity to the W and Yoblique"parameters .

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Clockwork Flavor

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We will present the theory that explains the hierarchy of charged fermion masses through a clockwork mechanism and discuss its phenomenological implications.

Dark matter / 53

Chiral Effective Theory of Dark Matter Direct Detection

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The existence of dark matter is one of the few solid hints for physics beyond the standard model. If dark matter has indeed particle nature, then direct detection via scattering on atomic nuclei is one of the most promising discovery channels. In order to connect this nonrelativistic process with astrophysical and collider searches, as well as UV model building, a consistent setup of effective field theories for the different energy scales is necessary.

I will present our work on the explicit connection between these energy scales, from the UV down to the nuclear scale. I will, in particular, discuss previously neglected chiral effects that can change the cross section by an order of magnitude.

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Charged composite dark matter

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Charged composite dark matter

Higgs / 55

Spontaneous symmetry breaking in three-Higgs-doublet S3-symmetric models

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The talk will summarise work done by the author and collaborators consisting of a detailed study of the possible vacua in models with three Higgs doublets with S3 symmetry and without explicit CP violation. Different vacua require special regions of the parameter space which were analysed in our work. We establish the possibility of spontaneous CP violation in this framework and we also show which complex vacua conserve CP. In our work we discussed constraints from vacuum stability. The results are relevant for model building.

Dark matter / 56

The lower limit on the Fermionic Warm Dark Matter mass from the smallest dwarf spheroidal galaxies

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We reconsider the lower bound on the mass of a fermionic dark matter (DM) candidate resulting from the existence of known small Dwarf Spheroidal galaxies, in the hypothesis that their DM halo is constituted by degenerate fermions. By relaxing the common assumption that the DM halo scale radius is similar to the scale radius of the luminous stellar component and by marginalizing on the effects of the unknown stellar velocity dispersion anisotropy, we prove that present observations lead to rather weak constraints on the DM mass, that could be as low as tens of eV. In this scenario, the DM halos would be quite sizable. At the same time, we show that the strongest bound stems instead from the requirement that the time of orbital decay of these Galactic satellites due to dynamical friction in the hosting Milky Way DM halo is long at least as their lifetime. The smallest and nearest Dwarf galaxies lead to a final lower bound of m ⊠ 100 eV, still quite weaker than previous estimates, but robust and independent from the DM formation and decoupling mechanism.

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New physics in b->(u,c)tau nu transitions

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Measurements of B → D (*) τ ν transistions show presently a sizable deviation from the Standard Model (SM). Possible interpretations in terms of new physics (NP) are discussed, taking the most recent measurements from the Belle and LHCb experiments into account. This discussion focuses on the differentiation of not only the SM from NP, but also between different NP models.

GUT / 67

Theoretical Uncertainties in Proton Lifetime Estimates

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We shall briefly recapitulate the main sources of theoretical uncertainties plaguing proton decay calculations in classical GUTs and advocate a particular GUT scenario in which a reasonably robust proton lifetime estimate may be accessible.

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Thoughts on B-physics Anomalies

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Very recently, LHCb has reported measurements of new lepton-universality-violating (LUV) observables. I will explain the need for a modified, lepton-flavour-specific C10 Wilson coefficient to accommodate the data and propose three further LUV ratios which are precise probes of the ratio C10mu/C10e. I then will argue that although the global fit favours, in addition, a sizable BSM effect in C9, this can perfectly well be lepton-flavour-universal. I discuss an efficient mechanism for generating it from
b->c cbar s 4-fermion operators, which in turn contribute in a peculiar pattern to radiative decay and B meson lifetime observables. The scenario is entirely viable and provides model-independent connections, between rare B decays and lifetime observables, and the prospect to observe the same new physics in both.

BSM / 70

Probing new forces with isotope shift spectroscopy

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Neutrino / 73

Rôle of Sterile neutrinos in Flavour Physics

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TBA

Collider / 75

Partnerium physics - conspirative path to naturalness searches

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Neutrino / 76

One-loop neutrino mass in SU(5)

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TBA

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Left-Right symmetry and Keung-Senjanović process at the LHC

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Left-Right symmetric models, introduced to explain parity violation of weak interactions, also offer an appealing solution to the problem of neutrino masses by naturally embedding the seesaw mechanism, with the right-handed Majorana neutrinos being a crucial ingredient. Since current experimental searches set a lower limit on the left-right scale in a TeV range, accessible to the colliders such as LHC, there is a possibility to probe the Majorana nature of neutrinos using the so called Keung-Senjanović process, a high-energy analogue to the neutrinoless double beta decay.

Along with the brief description of the minimal Left-Right model and constraints, important features of Keung-Senjanović process and the sensitivity of the LHC inside the light window for right-handed neutrinos will be presented.