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Particle Physics Group

Group structure (today):

- Prof. Dr. André Hoang (Head)
- Ass. Prof. Dr. Massimiliano Procura

} permanent

- Dr. Simon Plätzer (Uni.Assistant, postdoc)
- Dr. Peter Stoffer (Uni. Assistant, postdoc)
- Dr. Daniel Samitz (FWF postdoc)
- Guest Professor: Prof. Diogo Boito (Sao Paolo, at UniVienna until Feb. 2022)
- 7 PhD students
- 3 Master students

$\int dk \prod$ Doktoratskolleg Particles and Interactions

Network participations:

- Particleface (Cost Action 16201)
- VBSCan (Cost Action - 16108)
- MCNet (EU-ITN)
- LHC Top Quark Working Group
- LHC Higgs Working Group
- Muon *g*–*2* Theory Initiative

particleface

VBSCan COST Network

MCnet Monte Carlo net

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André Hoang
Current main interests

Top Quark Physics: (+bottom and charm)

Aims:
- Systematic treatment of electroweak and finite lifetime effects
- High precision top quark mass determinations (also bottom and charm quarks)
- Top mass sensitive (analytic+factorized) distributions for high-p_T top quark production
- Top mass from boosted top production (grooming) ⟶ Monte-Carlo top mass m_t^{MC}

News:
- NNNLL factorization for top-pair 2-jettiness distribution in e^+e^- 2012:12304
- Groomed top jet mass distribution 1906:11843
- Massive quark SCET jet function at 2 loops 1904:12839
- Review: What is the Top Quark Mass? 2004:12915
- REvolver: C++ library for automatic running and matching of QCD couplings and masses 2102:01085

Hadronic Tau Decays:

Aims:
- Development of new OPE formalism to incorporate Wilsonian cutoff and dim reg
- Elimination of difference between CIPT and FOPT approaches
- Novel high precision determinations of α_s and the SVZ condensates

News:
- Quantitative understanding of the origin of the difference of CIPT and FOPT (concept of “asymptotic separation”) 2008:00578

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Massimiliano Procura

Current main interests

Physics of hadronic jets

Aims:
- Understand interplay between perturbative and non-perturbative jet features
- Precision calculations for jet substructure studies
- Interfacing analytic calculations with Monte Carlo event generators
- Novel resummation techniques for multidifferential distributions

Low-energy hadron physics

Aims:
- Control hadronic uncertainties in precision flavor observables, e.g. the muon *g–2*
- Develop methods based on EFTs and dispersion relations for low-energy QCD

News:
- Improved constraints on hadronic light-by-light contribution to the muon *g–2* 2006.00007
- Muon *g–2* Theory Initiative White Paper 2006.04822

Physics beyond the Standard Model

Aims:
- Exploit the complementarity of different dark matter searches
- Improve constraints on New Physics models with non-trivial flavor structure

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Simon Plätzer

Current main interests

Parton branching and resummation algorithms

Aims:
- Systematic approach to QCD resummation using parton branching algorithms
- Evolution in colour and spin space using (infrared) RGE methods
- Improve parton showers to NLL/NLC across global and non-global observables

News:
- Decisive statements and improvements on existing shower algorithms 2003.06400,…
- Resummation of non-global observables beyond leading colour 2007.09648
- Two-loop and one-loop/one-emission contributions to soft gluon evolution 2012.15215
- Novel Monte Carlo algorithms 1912.02436

Monte Carlo event generators and non-perturbative models

Aims:
- Understand interplay between perturbative and non-perturbative variations
- Disentangle effects swept under the carpet of colour reconnection models
- Maintenance and development of Herwig 7 (NLO, showers, hadronization)

News:
- A first attempt to hadronize IP-Glasma predictions 2012.08493

Precision phenomenology

Aims:
- Fully exploit NLO(+PS) simulation for VBF/VBS and Top Quark physics
- New observables and strategies based on colour connections and jet tagging

News:
- (Soft) QCD effects in VBF and VBS final states 2003.12435, 2103.xxxxx

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Peter Stoffer

Current main interests

Low-energy hadron physics

Aims:

- Model-independent description of non-perturbative QCD effects at low energies
- Controlling hadronic uncertainties in SM prediction of low-energy observables
- Relating different observables with dispersion relations
- Matching calculations providing bridge to lattice-QCD input
- Context: muon *g*–*2*, neutron EDM, lepton-flavor-violating processes

News:

- Hadronic light-by-light scattering in muon *g*–*2* — 1910.13432, 2004.06127
- Hadronic vacuum polarization and pion vector form factor — 2010.07943
- Muon *g*–*2* Theory Initiative White Paper — 2006.04822
- Neutron EDM: matching calculation for *CP*-odd three-gluon operator — 2004.03576

Effective field theories for physics beyond the Standard Model

Aims:

- Model-independent parametrization of heavy BSM physics
- Resummation of large logarithms
- Connecting low-energy precision experiments with high-energy constraints

News:

- Complete SMEFT – LEFT matching at one loop — 1908.05295
- EFT description of electron and muon *g*–*2* and EDM — 2102.08954