EuroPLEx Final Conference

Report of Contributions

https://indico.desy.de/e/38889

Contribution ID: **13** Type: **Poster**

D and D_s decay constants from $N_f = 2 + 1$ lattice QCD

The D and D_s decay constants are important inputs for the determination of the CKM matrix elements V_{cd} and V_{cs} and precision tests of the Standard Model. With lattice determinations of these quantities reaching the sub-percent level, it is important to demonstrate control over all sources of systematic uncertainty, and in particular, those arising from disretisation effects and the quark mass dependence. We present results obtained from 49 ensembles (including two ensembles at the physical point) which span 6 lattice spacings in the range 0.039 fm $\leq a \leq 0.1$ fm and lie on three trajectories in the quark mass plane.

Primary author: COLLINS, Sara (University of Regensburg)

Presenter: COLLINS, Sara (University of Regensburg)

Contribution ID: **22** Type: **Poster**

The chiral condensate at large N using volume reduction

We present preliminary results for the large-N limit of the chiral condensate computed from twisted reduced models.

Primary author: BONANNO, Claudio (UAM)

Co-authors: Prof. GONZALEZ-ARROYO, Antonio (UAM); Prof. ISHIKAWA, Ken-Ichi (Hiroshima U); Prof. GARCIA PEREZ, Margarita (UAM); Prof. OKAWA, Masanori (Hiroshima U); Dr BUTTI, Pietro (UAM)

Presenter: BONANNO, Claudio (UAM)

Contribution ID: **26** Type: **Poster**

Sphaleron Rate from Lattice Gauge Theory

The "Sphaleron Rate" (imaginary linear-in-frequency part of the topological density retarded Green's function) determines the real-time relaxation rate of axial quark number for light quarks in a hot medium, and is relevant in heavy-ion collisions and electroweak baryogenesis. We recently showed how it can be determined in pure-glue QCD via standard Euclidean simulations, via a novel saddlepoint method. We extend this work to find the sphaleron rate for (2+1)-flavor QCD with $N_\tau = 8-16$ and HISQ action at almost physical pion masses in the temperature range $0.2-3$ GeV or $1.2-18$ times the crossover temperature T_{pc}.
Similar to the pure gauge case, the QCD result is well described across the range of $1.6-8$ times T_{pc} as $\Gamma_s \simeq 20(\alpha_s T)^4$, where α_s is the MSbar coupling at $\overline{\mu} = 2\pi T$, determined using the gradient-flow technique.

Primary authors: Prof. MOORE, Guy (TU Darmstadt); WEBER, Johannes Heinrich (Humboldt University of Berlin); Mr BARROSO MANCHA, Marc (TU Darmstadt)

Presenter: WEBER, Johannes Heinrich (Humboldt University of Berlin)

Contribution ID: **27** Type: **Poster**

Provenance model for Lattice QCD

Workflow management has become an important topic in many research communities. Here, we focus on the particular aspect of provenance tracking. We follow the W3C PROV standard and formulate a provenance model for Lattice QCD that includes the ensemble-generation and the measurement parts of the Lattice QCD workflow. Since many important provenance questions in our community require extensions of this model, we propose a multi-layered provenance approach that combines prospective and retrospective elements.

Primary authors: AUGE, Tanja (University of Regensburg); BALI, Gunnar (University of Regensburg); KLETTKE, Meike (University of Regensburg); LUDÄSCHER, Bertram (University of Illinois); SÖLDNER, Wolfgang (University of Regensburg); WEISHÄUPL, Simon (University of Regensburg); WETTIG, Tilo (University of Regensburg)

Presenter: SÖLDNER, Wolfgang (University of Regensburg)

Contribution ID: **30** Type: **Poster**

Gradient Flow Scale from a Mixed Action with Twisted Mass Quarks

We carry out a scale setting procedure of a mixed action setup consisting of valence Wilson twisted mass fermions at maximal twist on CLS ensembles with ⍻⍻=2+1 flavours of ⍻(⍻)-improved Wilson sea quarks. We determine the gradient flow scale ⍻0 using pion and kaon isoQCD masses and decay constants as external input. We employ model variation techniques to probe the systematic uncertainties in the extraction of the ground state signals of lattice observables, as well as for the continuum-chiral extrapolations used to compute ⍻0 at the physical point.

Primary author: SAEZ-GONZALVO, Alejandro (UAM)

Presenter: SAEZ-GONZALVO, Alejandro (UAM)

Contribution ID: **31** Type: **Poster**

GPU-accelerated Higher Representations of Wilson Fermions with HiRep

We are improving one of the available lattice software packages HiRep by crucially adding GPU acceleration. This development is accompanied by an overall software quality improvement in the build system, testing, and documentation, adding features for both CPUs and GPUs. The software is available under https://github.com/claudiopica/HiRep in the branch HiRep-CUDA and will soon be merged into master.

Primary authors: PICA, Claudio (University of Southern Denmark); MOLINARO, Emiliano (University of Southern Denmark); KJELLGREN, Erik (University of Southern Denmark); MARTINS, Sofie (University of Southern Denmark); RAGO, Antonio (University of Southern Denmark)

Presenter: MARTINS, Sofie (University of Southern Denmark)

Contribution ID: **33** Type: **Presentation**

Opening

Monday 11 September 2023 13:50 (10 minutes)

Primary authors: DI RENZO, Francesco (Parma U); FORINI, Valentina (Humboldt U)

Presenters: DI RENZO, Francesco (Parma U); FORINI, Valentina (Humboldt U)

Contribution ID: **34** Type: **Presentation**

Lattice and string worldsheet

Monday 11 September 2023 14:00 (45 minutes)

Primary author: PATELLA, Agostino (Humboldt U)

Presenter: PATELLA, Agostino (Humboldt U)

Contribution ID: **35** Type: **Presentation**

Bootstrap for matrix models and lattice Yang-Mills theory

Monday 11 September 2023 14:45 (45 minutes)

I will speak about my work with Zechuan Zheng on the numerical bootstrap method for large N matrix models and lattice Yang-Mills theory. First I will demonstrate the method on analytically solvable one matrix model and an "unsolvable" two-matrix model, where this approach appears to be superior in efficiency over Monte Carlo. Then I explain how to study by this method the SU(Nc) lattice Yang-Mills theory in the 't Hooft limit Nc $\longrightarrow$ infinity, at dimensions D=2,3,4. It combines the Makeenko-Migdal loop equations, with the cut-off L on maximal length of Wilson loops, and the positivity conditions on certain correlation matrices. We thus obtain rigorous upper and lower bounds on the plaquette average at various couplings. The results are quickly improving with the increase of the cutoff L. In particular, for D=4 and L=16, the upper bound data in the most interesting weak-coupling phase are not far from the Monte-Carlo results and they reproduce well the 3-loop perturbation theory. We also attempt to extract the information about the gluon condensate from this data. Our results suggest that bootstrap can compliment the Monte Carlo approach, and for some quantities it can provide a tangible alternative to it.

Primary author: KAZAKOV, Vladimir (ENS, Sorbonne U)

Presenter: KAZAKOV, Vladimir (ENS, Sorbonne U)

Contribution ID: **36** Type: **Presentation**

Nucleon form factors from lattice QCD for neutrino oscillation experiments

Monday 11 September 2023 16:00 (30 minutes)

Excited state contamination is one of the most challenging sources of systematics to tackle in the determination of nucleon matrix elements and form factors. The signal-to-noise problem prevents one from considering large source-sink time separations. Instead, state-of-the-art analyses consider multi-state fits. Excited state contributions to the correlation functions are particularly significant in the axial channel. In this work, we confront the problem directly. Since the major source of contamination is understood to be related to pion production, we consider three-point correlators with a N operator at the source and a $N\pi$ interpolating operator at the sink, which allows studies of $N \to N\pi$ matrix elements. After discussing the challenges that arise when using a two-particle interpolating operator, like the projection onto the proper irreducible representation and on the isospin components, we present solutions of the Generalised Eigenvalue Problem for a matrix of two-point functions constructed using different bases of N and $N\pi$ operators. We adopt the GEVP results to present improved $N \to N$ axial and pseudoscalar matrix elements, where we remove directly the contamination from $N\pi$ states, on a $m_\pi \approx 420$ MeV ensemble.

Primary author: BARCA, Lorenzo (DESY)

Presenter: BARCA, Lorenzo (DESY)

Contribution ID: **37** Type: **Presentation**

ΔS=2 transitions beyond the standard model

Monday 11 September 2023 16:30 (30 minutes)

The low energy contribution to ΔS = 2 transitions beyond the standard model is described by five B-parameters. Lattice results from different research teams, as reviewed by FLAG, show tension between two of these parameters. After reviewing this situation, we describe an alternative proposal for a completely non-perturbative determination of these quantities, based on SF and χ-SF renormalisation schemes. In a first preparatory phase, we show results on the RG-running of dim-3 operators (pseudoscalar and tensor) in the χ-SF scheme.

Presenter: VLADIKAS, Anastassios (INFN, Rome Tor Vergata)

Contribution ID: **38** Type: **Presentation**

The B -> π π l \bar{\nu} transition

Monday 11 September 2023 17:00 (30 minutes)

is the smallest and least known of all CKM matrix elements; it's currently determined primarily through the exclusive process $B \to \pi \ell \bar{\nu}$, and additional channels to determine it are welcomed by the community. I will present progress toward a lattice QCD determination of the matrix from the $B \to \pi\pi\ell\bar{\nu}$ process, where the $\pi\pi$ system is in a P-wave and features the $\rho(770)$ resonance as an enhancement. After an overview of the theoretical framework, I will discuss some preliminary results.

Primary author: LESKOVEC, Luka (Ljubljana U)

Presenter: LESKOVEC, Luka (Ljubljana U)

Contribution ID: **39** Type: **Presentation**

Towards the understanding of the inclusive vs exclusive puzzles in the |Vxb| determinations

Monday 11 September 2023 17:30 (30 minutes)

The tension between the inclusive and exclusive determinations of |Vxb| (x=c or u) persists more than 10 years. I discuss what is needed to solve the problem including possible lattice calculation of the inclusive decay rate.

Primary author: HASHIMOTO, Shoji (KEK, Tsukuba)

Presenter: HASHIMOTO, Shoji (KEK, Tsukuba)

Contribution ID: **40** Type: **Presentation**

Lattice QCD input for neutrino-nucleus scattering

Tuesday 12 September 2023 09:00 (45 minutes)

Simulations of lattice QCD have emerged as the most reliable tool for making predictions of the low energy properties of hadrons and of quarks and gluons composing them with control over all systematic uncertainties. In this review, I will cover the status of the calculations of quantities that are needed in the analysis of neutrinos off nuclear targets. These include the axial charge and the form factors. A discussion of systematics—removing excited state contributions and obtaining results at the physical point will be included. Looking ahead, I will conclude with prospects of calculating transition matrix elements.

Primary author: GUPTA, Rajan (LANL)

Presenter: GUPTA, Rajan (LANL)

Contribution ID: **41** Type: **Presentation**

Status of hadronic contributions to the muon anomalous magnetic moment from lattice QCD

Tuesday 12 September 2023 09:45 (45 minutes)

After a brief introduction, I present the status of hadronic vacuum polarization (HVP) and light-by-light (HLbL) contributions to the muon anomalous magnetic moment. The focus will be on the most important piece, the connected light quark HVP, but all contributions will be covered. Comparisons with experiment and data-driven theory are also addressed.

Primary author: BLUM, Tom (Connecticut U)

Presenter: BLUM, Tom (Connecticut U)

Contribution ID: **42** Type: **Presentation**

Isospin breaking corrections to QCD observables

Tuesday 12 September 2023 11:00 (30 minutes)

The decreasing uncertainties in theoretical predictions and experimental measurements of several hadronic observables related to weak processes, which in many cases are now smaller than O(1%), require theoretical calculations to include subleading corrections that were neglected so far. Precise determinations of weak decay rates, including QED and strong isospin-breaking effects, can play a central role in solving the current tensions in the first-row unitarity of the CKM matrix. In this talk we review the recent progress on lattice calculations of isospin-breaking corrections to QCD observables, with a focus on leptonic decay rates of pseudoscalar mesons. We discuss recent lattice results for kaon and pion decays, the role of finite-volume effects in such calculations, along with prospects for future improvement.

Primary author: DI CARLO, Matteo (Edinburgh U)

Presenter: DI CARLO, Matteo (Edinburgh U)

Contribution ID: **43** Type: **Presentation**

Beyond the electroquenched approximation

Tuesday 12 September 2023 11:30 (30 minutes)

Lattice QCD determinations of hadronic matrix elements required for precision tests of the Standard Model are now approaching an accuracy where the electromagnetic interactions of the quarks can no longer be neglected. In particular, the electric charge of the sea quarks cannot be ignored a priori without introducing an uncontrolled systematic uncertainty. In this talk I will outline the challenges encountered in going beyond the electroquenched approximation, either when the QED effects are included perturbatively as in the RM123 method or when they are included in the Monte Carlo simulation. I will review the strategy of the RC*collaboration who are working towards implementing both approaches using C* boundary conditions.

Primary author: HARRIS, Tim (ETH Zürich)

Presenter: HARRIS, Tim (ETH Zürich)

Contribution ID: **44** Type: **Presentation**

Next challenges in semileptonic B decays

Tuesday 12 September 2023 14:00 (30 minutes)

Determination of the CKM matrix elements |Vcb| and |Vub| reached the stage that full lattice QCD calculations are available to compare with the experimental data including their kinematical distributions. I briefly summarize the situation and discuss the remaining problems to be understood/solved. That include $b \to c$, $b \to u$ as well as $b \to s$
decays such as $B \to K\ell\ell$.

Primary author: HASHIMOTO, Shoji (KEK, Tsukuba)

Presenter: HASHIMOTO, Shoji (KEK, Tsukuba)

Contribution ID: **45** Type: **Presentation**

B-physics observables in the continuum from a combination of static and relativistic results

Tuesday 12 September 2023 14:30 (30 minutes)

We discuss how to perform interpolations between relativistic and static computations in order to extract heavy-light B-physics observables in the continuum.
This strategy can be carried out entirely in large volume, but its predictivity is enhanced by the following step scaling approach.
Relativistic computations are carried out at the physical b-quark mass using the Schrödinger Functional in a $(0.5\ \mathrm{fm})^4$ box, where small am is accessible. They are connected to large volume observables through step scaling functions that trace the mass dependence between the physical charm region and the static limit, such that B-physics results can be obtained by interpolation. We discuss how this strategy applies to semileptonic form factors and other quantities of phenomenological interest. We present first numerical results for the b-quark mass and leptonic decays from CLS $N_f = 2 + 1$ ensembles at $m_u = m_d = m_s$, and with five values of the lattice spacing down to 0.039 fm.

Primary author: CONIGLI, Alessandro (UA Madrid)

Presenter: CONIGLI, Alessandro (UA Madrid)

Contribution ID: **46** Type: **Presentation**

Electric dipole moments: a gateway to new physics

Tuesday 12 September 2023 15:00 (30 minutes)

The observed baryon asymmetry in the universe cannot be reconciled with the current form of the Standard Model (SM) of particle physics. The amount of CP-violation stemming from the Cabibbo-Kobayashi-Maskawa matrix is not sufficient to explain the observed matter-antimatter asymmetry. Historically, one of the initial systems investigated in the search for discrete symmetries violations was the electric dipole moment (EDM) of the neutron. Nowadays, it offers a unique opportunity to discover physics beyond the SM due to its significantly suppressed CP-violating contribution from the SM.

After a brief summary of the current status for experimental searches of a neutron EDM, I delve into the various sources of CP-violation and the computational challenges associated with calculating the corresponding hadronic matrix elements using the lattice as a regulator. I then proceed detailing recent results obtained on the neutron EDM highlighting the primary theoretical and numerical tool employed: the gradient flow. By leveraging this approach, I showcase significant progress made in understanding the neutron EDM. I conclude outlining the near-term objectives, addressing the challenges lying ahead, and providing an optimistic outlook for the future of neutron EDM research.

Primary author: SHINDLER, Andrea (RWTH - Aachen University)

Presenter: SHINDLER, Andrea (RWTH - Aachen University)

Contribution ID: **47** Type: **Presentation**

Towards a high-precision description of the ρ and K* resonances

Tuesday 12 September 2023 16:00 (30 minutes)

We present preliminary results for the $K^*(892)$ and $\rho(770)$ resonances extracted from lattice QCD data using Lüscher's finite-volume formalism. We review the theory and techniques involved in our computation of correlation functions and extraction of energy levels from an RBC-UKQCD $N_f = 2+1$ domain-wall fermion lattice with a physical pion mass. We consider lattice irreducible representations with only leading P-wave contributions and use the corresponding finite-volume spectra to constrain the $K\pi$ and $\pi\pi$ scattering amplitudes. We study systematic errors resulting from the choice of fit ranges through a model-averaging technique.

Presenter: LACHINI, Nelson (Edinburgh U)

Contribution ID: **48** Type: **Presentation**

Reconstruction techniques for spectral densities and applications on BSM models

Tuesday 12 September 2023 16:30 (30 minutes)

In this talk we describe two frameworks for computing spectral densities from lattice correlators: Bayesian and Backus-Gilbert methods. We show that despite being built upon very different assumptions, they share many similarities. The resulting analogy can be exploited to improve aspects of the computation. We also show how smeared spectral densities can be used to compute hadronic masses.

Primary author: LUPO, Alessandro (CNRS Marseille)

Presenter: LUPO, Alessandro (CNRS Marseille)

Contribution ID: **49** Type: **Presentation**

Gauge field smearing and controlled continuum extrapolations

Tuesday 12 September 2023 17:00 (15 minutes)

When designing lattice actions, gauge field smearing is frequently used to define the lattice Dirac operator. One wants to avoid the situation when too much smearing leads to uncontrolled continuum extrapolations as the short distance behaviour of the lattice theory is modified. We focus on the gradient flow formalism as it allows to study both smearing and physical flow. We investigate the effect of smearing on the scaling towards the continuum limit in pure gauge theory on the example of Creutz ratios, which provide a measure of the physical forces felt by the fermions. For suitable smearing strengths we also investigate the change when the Wilson gradient flow is replaced by stout smearing.

Primary author: RISCH, Andreas (Zeuthen Particle PhysicsTheory)

Presenter: RISCH, Andreas (Zeuthen Particle PhysicsTheory)

Contribution ID: **50** Type: **Presentation**

Surprises on the way to the QCD phase diagram

Wednesday 13 September 2023 09:00 (45 minutes)

A strong fermion sign problem prohibits direct lattice simulations of QCD at finite baryon density, so that knowledge of the phase diagram is limited to small chemical potentials. On the other hand, the phase diagram is severely constrained by information on the chiral limit. I discuss recent lattice results at vanishing density, which show the chiral phase transition for Nf=2-7 degenerate chiral quarks to be of second order, contrary to the expectations based on the seminal paper by Pisarski and Wilczek from 1984. Together with growing information on fluctuations, this implies phenomenologically relevant bounds on a possible critical endpoint in physical QCD at finite density. In another development at zero density, a dynamically emergent chiral spin symmetry was discovered in correlator multiplet stuctures in a temperature window above the chiral crossover. I discuss two additional variables, screening masses and the pion spectral functions, which also show and confirm the existence of such an intermediate temperature window. These observables strongly suggest the effective degrees of freedom to be hadron-like, rather than partonic.

Primary author: PHILIPSEN, Owe (Frankfurt U)

Presenter: PHILIPSEN, Owe (Frankfurt U)

Contribution ID: **51** Type: **Presentation**

Universal properties of Yang-Lee edge singularity and QCD phase diagram

Wednesday 13 September 2023 09:45 (45 minutes)

Critical points are categorized based on the number of relevant variables. The standard critical point in systems like the Ising model involves two relevant variables, namely temperature and external magnetic field. On the other hand, a tricritical point is characterized by four such variables. The protocritical point, widely known as the Yang-Lee edge singularity (YLE), is the simplest form of criticality and has just one relevant variable.

Unlike conventional critical points, the YLE singularity occurs at complex values of thermodynamic parameters. When two YLE singularities merge and pinch the real axis of the corresponding thermodynamic variable, a critical point with associated critical scaling emerges. In other words, the location of the YLE singularity is continuously connected to the location of the critical point.

I will explain why conventional methods fail to accurately locate YLE singularity and demonstrate the success of the Functional Renormalization Group approach in determining the universal location of these singularities. I will discuss how we can learn more about QCD phase diagram by combining our findings with lattice QCD results.

Primary author: SKOKOV, Vladimir (NC State University)

Presenter: SKOKOV, Vladimir (NC State University)

Contribution ID: **52** Type: **Presentation**

Resurgent Extrapolation and QFT

Wednesday 13 September 2023 11:00 (45 minutes)

I describe some recent mathematical developments in the search for optimal methods of extrapolation and analytic continuation, based on ideas from the theory of resurgent asymptotics. I will illustrate some of the ideas with applications to examples in quantum field theory. The underlying goal is to be able to quantify errors precisely, and to devise flexible numerical schemes.

Primary author: DUNNE, Gerald (Connecticut U)

Presenter: DUNNE, Gerald (Connecticut U)

Contribution ID: **53** Type: **Presentation**

What we can learn about Lee-Yang zeros from lattice simulations of QCD

Wednesday 13 September 2023 11:45 (30 minutes)

Understanding phase transitions from limited data generated from finite volume simulations is one of the important challenges one faces today. Analysis of Lee Yang zeros in finite volumes has recently re-emerged as a promising tool in addressing this challenge. In this talk we will see two methods of extracting these zeros from lattice simulations of QCD, the Ising model and O(N) theories. The first method uses Pade approximants (rational functions) to approximate thermodynamic functions with the goal of understanding the singularity structure of these observables. It will be shown that the closest stable pole of such functions can be interpreted as being related to the Lee-Yang edge singularity (LYE). On the other hand there is another way in which the LYE can be estimated from lattice data. In this, a continuum extrapolation of lattice data is performed for 3d O(N) models (done in : F. Karsch et. al, *Phys.Rev.D* 108 (2023)). The goal is to extract the LYEs directly from parameterisations of the scaling function. Agreement of results with FRG, corresponding to the universal location of LYEs is observed.

Primary author: SINGH, Simran (Bielefeld U)

Presenter: SINGH, Simran (Bielefeld U)

Contribution ID: **54** Type: **Presentation**

Properties and uses of approximate trivializing maps in lattice QCD

Thursday 14 September 2023 09:00 (45 minutes)

While approximations of trivializing field transformations for lattice path integrals were considered already by early practitioners, more recent efforts aimed at ergodicity restoration and thermodynamic integration formulate trivialization as a variational generative modeling problem. This enables the application of modern machine learning algorithms for optimization over expressive parametric function classes, such as deep neural networks. After a brief review of the historical origins and current status of this research program, I will focus on spectral coupling flows as a particular parameterization of gauge-covariant field diffeomorphisms. The concept will be introduced by explicitly constructing a systematically improvable solution for SU(3) gauge theory in (1+1)d, followed by a presentation of recent results in (3+1)d. Specifically, I will discuss the application of machine-learned flow maps to parallel tempering of defects for the mitigation of topological freezing. To close the talk, I will comment on pressing issues such as the incorporation of dynamical fermions, and provide an outlook on future work.

Primary author: URBAN, Julian (MIT)

Presenter: URBAN, Julian (MIT)

Contribution ID: **55** Type: **Presentation**

AI/ML for Particle Physics

Thursday 14 September 2023 09:45 (45 minutes)

Primary author: HEINRICH, Lukas (TU Munich)

Presenter: HEINRICH, Lukas (TU Munich)

Contribution ID: **56** Type: **Presentation**

Generating configurations of increasing lattice size with machine learning and the inverse renormalization group

Thursday 14 September 2023 11:00 (30 minutes)

We present the implementation of inverse renormalization group transformations with the use of machine learning algorithms to generate, in absence of the critical slowing down effect, configurations of increasing lattice size. We conclude by discussing research directions, pertinent to computationally hard problems, which utilize the inverse renormalization group to obtain configurations for lattice volumes that, at the time of writing, are inaccessible by dedicated supercomputers.

Primary author: BACHTIS, Dimitrios (ENS Paris)

Presenter: BACHTIS, Dimitrios (ENS Paris)

Contribution ID: **57** Type: **Presentation**

Machine Learning Research in Industry

Thursday 14 September 2023 11:30 (45 minutes)

To understand how well online advertising works (or if it works at all), we design geographically-based randomized experiments in which ads are shown to people in some regions, but not in other regions. The design of these regions, which form the randomizable units of the experiments, can be seen as a process of unsupervised learning about the underlying geographical structure of a country, based on how people move about. We introduce a suitable target function to evaluate the usefulness of a geographic decomposition and use spectral clustering to solve the learning problem.

Primary author: BEST, Christoph (Google)

Presenter: BEST, Christoph (Google)

Contribution ID: **58** Type: **Presentation**

Responsible Analytics

Thursday 14 September 2023 14:30 (45 minutes)

[Slides available on request]
I discuss some trends, topics, open issues around Analytics, Privacy, Reliable AI with some potential business applications, e.g. in Anti Money Laundering.

Primary author: SCORZATO, Luigi (Accenture)

Presenter: SCORZATO, Luigi (Accenture)

Contribution ID: **60** Type: **Presentation**

Public Lecture - How Artificial Intelligence is Changing the Way We Do Science

Thursday 14 September 2023 16:00 (1 hour)

Primary author: TUNSTALL, Lewis (Hugging Face)

Presenter: TUNSTALL, Lewis (Hugging Face)

Contribution ID: **61** Type: **Presentation**

Future trends in lattice QCD simulations

Friday 15 September 2023 09:00 (45 minutes)

Primary author: FINKENRATH, Jacob (Bergische Universität Wuppertal)

Presenter: FINKENRATH, Jacob (Bergische Universität Wuppertal)

Contribution ID: **62** Type: **Presentation**

Resonances from lattice QCD using distillation

Friday 15 September 2023 09:45 (45 minutes)

To study QCD resonances within lattice QCD one needs as a first step correlation functions computed from a large basis of single- and multi-hadron interpolators. A particularly efficient method to compute these correlation functions is distillation. In this talk, I am presenting the state of the art of the distillation technique and will also cover recent new developments. As an outlook for the near future, I will discuss how one would use the technique to study semileptonic rare decays into resonant channels.

Primary author: ERBEN, Felix (Edinburgh U)

Presenter: ERBEN, Felix (Edinburgh U)

Contribution ID: **63** Type: **Presentation**

Hadrons: A lattice simulation workflow management system

Friday 15 September 2023 11:00 (45 minutes)

In this talk we give an overview of the open source C++ package Hadrons, which is a Grid-based workflow management system for lattice field theory simulations. Hadrons utilises the dataflow programming paradigm to break potentially large calculations into a series of composable elementary modules (e.g. Dirac operator inversions, contractions, IO, etc.). This gives the user the flexibility to design a computation as a graph of such modules, that is then serialised into a schedule and optimised for resource usage.

Primary author: HODGSON, Raoul (Edinburgh U)

Presenter: HODGSON, Raoul (Edinburgh U)

Contribution ID: **64** Type: **Poster**

Bootstrapping Perturbative and Non-perturbative Defect Correlators

The symmetries of a conformal system are sometimes enough to determine correlators without knowing the microscopic details of a theory. The analytic conformal bootstrap provides a consistent roadmap for this approach. This poster will go through this process and apply it to the case of defect correlators in holographic theories. In the case of the 1/2 BPS-Wilson-line defect theory, the displacement four-point correlator is bootstrapped to the third order in a strong coupling expansion, and the double-scaling limit of this correlator is computed at all loops. However, these results are only possible thanks to the input of localisation results for this supersymmetric theory. For theories with fewer or broken supersymmetries, could Lattice computations provide an alternative physical input to the conformal bootstrap process?

Primary author: BLIARD, Gabriel James Stockton (Humboldt U)

Presenter: BLIARD, Gabriel James Stockton (Humboldt U)

Contribution ID: **65** Type: **Poster**

Supersphere Non Linear Sigma Model on the Lattice

Two-dimensional O(N) non-linear sigma models are exactly solvable theories and have many applications, from statistical mechanics to their use as QCD toy models. I consider a supersymmetric extension, the non-linear sigma model on the supersphere~SN+2m−1|2m≡OSP(N+2m|2m)/OSP(N+2m−1|2m). I will show our implementation of the theory on the lattice and some preliminary results.

Primary author: COSTA, Ilaria (Humboldt U)

Presenter: COSTA, Ilaria (Humboldt U)

Contribution ID: **66** Type: **Poster**

Octet baryon charges with $N_f = 2 + 1$ non-perturbatively improved Wilson fermions

The axial charge of the nucleon, g_A, has been computed extensively on the lattice. However, the axial charges for other octet baryons (hyperons) such as the Σ and Ξ baryons are less well known experimentally and theoretically. Here we present results for the isovector axial, scalar and tensor charges, as well as for the second Mellin moments of isovector PDFs. The scalar charges are related to the difference between the physical up and down quark masses via the vector Ward identity which allows us to determine this splitting from our result of the scalar charge of the Σ baryon. Moreover, we compute the QCD contributions to baryon isospin mass splittings. Our calculations are performed on a large set of $N_f = 2 + 1$ CLS ensembles of non-perturbatively $\mathcal{O}(a)$ improved Wilson fermions with tree-level Symanzik improved gauge action.

Primary authors: WEISHÄUPL, Simon (University of Regensburg); BALI, Gunnar (University of Regensburg); COLLINS, Sara (University of Regensburg); SÖLDNER, Wolfgang (University of Regensburg)

Presenter: WEISHÄUPL, Simon (University of Regensburg)

Contribution ID: **67** Type: **Poster**

Lee-Yang edge singularities in QCD: From Fourier coefficients to parametrizations of the universal scaling functions.

We discuss the phase diagram of QCD and in particular the vicinity of the Roberge-Weiss transition, the chiral transition and the QCD critical end point. We argue that the universal location of the Lee-Yang edge singularity can be used to determine the exact locations of these transitions. In order to calculate the Lee-Yang edge from lattice QCD data we discuss two methods, which includes the calculations of Fourier coefficients of the (imaginary) baryon number density and the analytic continuation of the universal scaling function. For the latter, we use the Schofield parametrisation of the Widom-Griffiths form of the magnetic equation of state.

Primary author: SCHMIDT-SONNTAG, Christian (Bielefeld University)

Presenter: SCHMIDT-SONNTAG, Christian (Bielefeld University)

Contribution ID: **69** Type: **Poster**

Taming NSPT fluctuations in O(N) Non-Linear Sigma Model: simulations in the large N regime

The Non-Linear Sigma Model (NLSM) is an example of a field theory on a target space exhibiting intricate geometry. One remarkable characteristic of the NLSM is asymptotic freedom, which triggers interest in perturbative calculations. In the lattice formulation of NLSM, one would naturally rely on Numerical Stochastic Perturbation Theory (NSPT) to conduct high-order computations. However, when dealing with low-dimensional systems, NSPT reveals increasing statistical fluctuations with higher and higher orders. This of course does not come as a surprise and one is ready to live with this, as long as the noise is not going to completely kill the signal, which thing unfortunately in some model does take place. We investigate how, in the $O(N)$ context, this behaviour strongly depends on N. As expected, larger N values make higher order computation feasible.

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Contribution ID: **72** Type: **not specified**

Slides for the Discussion

Tuesday 12 September 2023 17:15 (45 minutes)