Present and future perspectives in Hadron Physics

Report of Contributions

https://agenda.infn.it/e/hp24

Contribution ID: **1** Type: **not specified**

Welcome

Monday, 17 June 2024 09:20 (10 minutes)

Presenter: ERAZMUS, Barbara

Session Classification: Opening

Contribution ID: **2** Type: **not specified**

ALICE 3: a next-generation heavy-ion detector for LHC Run 5 and beyond

The ALICE Collaboration proposes a completely new apparatus, ALICE 3, for the LHC Runs 5 and 6 (arXiv:2211.02491). The detector consists of a large pixel-based tracking system covering eight units of pseudorapidity, complemented by multiple systems for particle identification, including silicon time-of-flight layers, a ring-imaging Cherenkov detector, a muon identification system, and an electromagnetic calorimeter. Track pointing resolution of better than 10 micron for $p_T > 200$ MeV/c can be achieved by placing the vertex detector on a retractable structure inside the beam pipe. ALICE 3 will, on the one hand, enable novel studies of the quark-gluon plasma and, on the other hand, open up important physics opportunities in other areas of QCD and beyond. The main new studies in the QGP sector focus on low-p_T heavy-flavour production, including beauty hadrons, multi-charm baryons and charm-charm correlations, as as well as on precise multi-differential measurements of dielectron emission to probe the mechanism of chiral-symmetry restoration and the time-evolution of the QGP temperature. Besides QGP studies, ALICE 3 can uniquely contribute to hadronic physics, with femtoscopic studies of the interaction potentials between charm mesons and searches for nuclei with charm, and to fundamental physics, with tests of the Low theorem for ultra-soft photon emission. The presentation will cover the detector concept, the physics performance, and the status of novel sensor R&D.

Primary author: DAINESE, Andrea (Istituto Nazionale di Fisica Nucleare)

Presenter: DAINESE, Andrea (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **6** Type: **not specified**

Review on strangeness hadron physics

In this talk I will review the recent developments on strangeness hadron physics, covering aspects of the elementary interactions of kaons and hyperons with nucleons and nuclei. I will also discuss the impact of strange particles in astrophysical contexts, analyzing their role in the properties of neutron stars and in the characteristics of gravitational waves produced during binary neutron star mergers.

Primary author: Prof. RAMOS, Angels (University of Barcelona)

Presenter: Prof. RAMOS, Angels (University of Barcelona)

Contribution ID: **7** Type: **not specified**

Astrophysical simulations of compact stellar objects probing the QCD phase transition in dense matter

Motivated from the observations of poorly understood explosive stellar phenomena associated with massive supergiant stars of zero-age main sequence (ZAMS) masses around 30–60 solar masses, new light has been shed on an old idea [1], namely, that the appearance of QCD degrees of freedom may account for such cosmic explosions [2]. Obeying nuclear physics constraints and taking yet another important observation of the very existence of massive pulsars of more than 2 solar masses seriously into account, puts sever constraints on the behaviour of the equation of state at supersaturation density. In particular, sufficient stiffness with increasing density is required, which puts the frequently employed class of bag models into jeopardy. During the supernova evolution of very massive progenitor stars, with ZAMS masses of about 30–75 solar masses, high core temperatures and densities are reached, where the appearance of the hadron-quark phase transition can potentially trigger not only the supernova explosion but also release a millisecond neutrino burst, which is absent in canonical neutrino-driven supernova explosions. This observable signature provides unique evidence for the presence of a first–order phase transition at supersaturation density. The future observation of such a feature, from the next galactic event, will allow us to either confirm such scenario or, if not observed, rule out a (strong) first-order phase transition at high densities encountered at the interior of (proto)neutron stars. In my talk I will revisit this scenario with special emphasis on observables, which concerns neutrinos [3] and gravitational waves [4], and their potential link to the yet incompletely understood high-density equation of state.

References

1. Sagert, I.; Fischer, T.; Hempel, M.; Pagliara, G.; Schaffner-Bielich, J.; Mezzacappa, A.; Thielemann, F.-K.; Liebendoerfer, M.; "Signals of the QCD phase transition in core-collapse supernovae". Phys. Rev. Lett., 102, 081101 (2009).
2. Fischer, T.; Bastian, N.-U. F.; Wu, M.-R.; Typel, S.; Klähn, T.; Blaschke, D. B.; "Quark deconfinement as a supernova explosion engine for massive blue supergiant stars". Nature Astronomy, 2, 980 (2019).
3. Khosravi Largani, N.; Fischer, T., Bastian, N.-U. F.; "Constraining the Onset Density for the QCD Phase Transition with the Neutrino Signal from Core-collapse Supernovae". Atrophys. J., 964, 143 (2024).
4. Kuroda, T.; Fischer, T.; Takiwaki, T.; Kotake, K.; "Core-collapse supernova simulations and the formation of neutron stars, hybrid stars and black holes". Astrophys. J., 924, 38 (2021).

Primary authors: FISCHER, Tobias; KHOSRAVI LARGANI, Noshad (University of Wroclaw)

Presenter: FISCHER, Tobias

Contribution ID: **9** Type: **not specified**

PRESTO - A PROtotype STOrage ring for the precision frontier

Two of the major scientific drivers of particle physics and cosmology are the faith of antimatter after the Big Bang and the origin of Dark Matter. The answers to these questions can be addressed by investigating permanent and oscillating Electric Dipole Moments (EDM) of fundamental particles. The experiments can be performed with polarized beams in a dedicated storage ring.
Important milestones have been achieved by the JEDI Collaboration, using the magnetic storage ring COSY at Forschungszentrum Juelich (Germany). The next measure is to design a Prototype Storage Ring, comprising two steps: (i) an all-electric version and (ii) a hybrid ring, complementing the electric fields with magnetic ones. The layout of the ring with a beam energy of about 30-45 MeV and a circumference of around 100 m will serve as enabler for the final EDM facility facility operated at a magic energy of 233 MeV, with a circumference of about 500 m.
Once built, the first phase will demonstrate the remaining ambiguities and technologies, and in the second stage provide a first direct measurement of the EDM of the proton with a sensitivity comparable to EDM measurements of neutrons.

Primary author: LENISA, Paolo (Istituto Nazionale di Fisica Nucleare)

Presenter: LENISA, Paolo (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **10** Type: **not specified**

LNF Frascati

Tuesday, 18 June 2024 09:00 (30 minutes)

Presenter: SCORDO, Alessandro (Istituto Nazionale di Fisica Nucleare)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **11** Type: **not specified**

CERN

Tuesday, 18 June 2024 09:40 (30 minutes)

Presenter: GROSSE-OETRINGHAUS, Jan Fiete (CERN)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **12** Type: **not specified**

GSI/FAIR

Tuesday, 18 June 2024 10:20 (30 minutes)

Presenter: GALATYUK, Tetyana (TU Darmstadt / GSI)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **13** Type: **not specified**

MAMI/MESA

Tuesday, 18 June 2024 11:30 (30 minutes)

Presenter: VANDERHAEGHEN, Marc (University Mainz)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **14** Type: **not specified**

ELSA

Tuesday, 18 June 2024 12:10 (30 minutes)

Presenter: SCHMIEDEN, Hartmut (Universität Bonn, Physikalisches Institut)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **15** Type: **not specified**

JPARC

Tuesday, 18 June 2024 12:50 (30 minutes)

Presenter: SAKUMA, Fuminori

Session Classification: Infrastructures Present and Future programme

Contribution ID: **16** Type: **not specified**

EIC

Tuesday, 18 June 2024 15:00 (30 minutes)

Presenter: DESHPANDE, Abhay

Session Classification: Infrastructures Present and Future programme

Contribution ID: **17** Type: **not specified**

ECT*

Tuesday, 18 June 2024 15:40 (30 minutes)

Presenter: AARTS, Gert (Swansea University)

Session Classification: Infrastructures Present and Future programme

Contribution ID: **18** Type: **not specified**

Recent advances in instrumentation R&D and their impact on future projects

Tuesday, 18 June 2024 17:20 (30 minutes)

Presenter: CONTARDO, Didier

Session Classification: Invited talks

Contribution ID: **19** Type: **not specified**

Strangeness measurements in hadronic collisions at LHC with links to expectations at EIC and future programs

Tuesday, 18 June 2024 18:00 (20 minutes)

Presenter: DOBRIGKEIT CHINELLATO, David (Universidade Estadual de Campinas (UNICAMP))

Session Classification: Invited talks

Contribution ID: **20** Type: **not specified**

Review on strangeness hadron physics

Wednesday, 19 June 2024 09:00 (20 minutes)

Presenter: RAMOS, Angels (University of Barcelona)

Session Classification: Invited talks

Contribution ID: **21** Type: **not specified**

Jet quenching in heavy ion collisions

Wednesday, 19 June 2024 10:00 (20 minutes)

Presenter: ANDRES, Carlota

Session Classification: Invited talks

Contribution ID: **22** Type: **not specified**

Thermalization in small and large systems in heavy ion collisions

Wednesday, 19 June 2024 09:30 (20 minutes)

Presenter: MAZELIAUSKAS, Aleksas (CERN Theoretical Physics Department)

Session Classification: Invited talks

Contribution ID: **23** Type: **not specified**

High-precision measurements of the strong interaction

Wednesday, 19 June 2024 13:00 (20 minutes)

Presenter: VAZQUEZ DOCE, Oton (Istituto Nazionale di Fisica Nucleare)

Session Classification: Invited talks

Contribution ID: **24** Type: **not specified**

Overview on GPDs and TMDs

Wednesday, 19 June 2024 11:30 (20 minutes)

Presenter: PASQUINI, Barbara (Istituto Nazionale di Fisica Nucleare)

Session Classification: Invited talks

Contribution ID: **25** Type: **not specified**

Overview on Parton distributions from Lattice QCD

Wednesday, 19 June 2024 12:00 (20 minutes)

Presenter: ZAFEIROPOULOS, Savvas (CNRS and Aix Marseille University)

Session Classification: Invited talks

Contribution ID: **26** Type: **not specified**

Application of Machine Learning for the extraction of parton distribution functions

Wednesday, 19 June 2024 12:30 (20 minutes)

Presenter: FORTE, Stefano (Istituto Nazionale di Fisica Nucleare)

Session Classification: Invited talks

Contribution ID: **27** Type: **not specified**

Precision Hadron Spectroscopy - Light and Heavy Quarks

Wednesday, 19 June 2024 10:30 (20 minutes)

Presenter: KÜSSNER, Meike (Ruhr-Universität Bochum)

Session Classification: Invited talks

Contribution ID: **28** Type: **not specified**

Muon g-2 - Theory versus Experiment

Wednesday, 19 June 2024 15:00 (20 minutes)

Presenter: VENANZONI, Graziano (Istituto Nazionale di Fisica Nucleare)

Session Classification: Invited talks

Contribution ID: **29** Type: **not specified**

Optimising hadrontherapy: challenges and prospects

Wednesday, 19 June 2024 15:30 (20 minutes)

Presenter: CERELLO, Piergiorgio (Istituto Nazionale di Fisica Nucleare)

Session Classification: Invited talks

Contribution ID: **30** Type: **not specified**

What can we learn from Gravitational Wave Signals concerning the nuclear equation of state

Tuesday, 18 June 2024 16:50 (20 minutes)

Presenter: REZZOLLA, Luciano (Albert Einstein Institute)

Session Classification: Invited talks

Contribution ID: **31** Type: **not specified**

Hadrons under extreeme conditions

As the temperature increases, hadrons are expected to be affected and eventually dissolve or melt into deconfined quarks and gluons. I'll review some of the work done using lattice QCD on the behaviour of hadrons under increasing temperature, focussing on activities of the FASTSUM collaboration.

Primary author: AARTS, Gert (Swansea University)

Presenter: AARTS, Gert (Swansea University)

Contribution ID: **32** Type: **not specified**

Present and future perspectives for Hadron Physics at LNF's infrastructures

The INFN Laboratories of Frascati (LNF) are a very sparkling laboratory.
Thanks to already existing and planned high-quality infrastructures, they
represent an ideal environment to perform Hadron Physics experiments.
The main infrastructure is the DAFNE e+e- collider, where several crucial
activities and experiments have been already performed in the strangeness
sector. In particular, the SIDDHARTA and the SIDDHARTA-2 experiments provided and will provide extremely important results to the hadron physics community, among which the first measurements of the strong-interaction induced shifts and widths of kaonic hydrogen and deuterium fundamental level.
A second important beamline is the Beam Test Facility (BTF) of LNF, where
bunched beams of electrons and positrons with tunable energy (up to 510
MeV/c2) and multiplicity are extracted from the LINAC with a frequency of
25-50 kHz. This facility can be used either for physics experiments or for
detectors' tests and every year hosts several external groups selected among a list of applicants.
A similar extracted beam is presently hosting the PADME experiments,
dedicated to the search of dark photons.
Finally, a key role in the future of the LNF will be placed by the Eupraxia project, the first European project that develops a dedicated particle accelerator research infrastructure based on novel plasma acceleration concepts and laser technology. This beamline could be also used, in future, for nuclear physics experiments.
In this contribution, all these facilities will be presented, as well as the most important results that have been already obtained and those that are foreseen in the future.

Primary author: SCORDO, Alessandro (Istituto Nazionale di Fisica Nucleare)

Presenter: SCORDO, Alessandro (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **33** Type: **not specified**

Kaonic atoms measurements with SIDDHARTA-2 at the DAFNE collider

The low-energy QCD, the theory within the Standard Model describing the strong interaction, is still missing fundamental experimental results to achieve a breakthrough in its understanding. Among these experimental results, kaonic atoms X-ray spectroscopy represents a unique laboratory for the study of the antikaon-nucleon/nuclei interaction at threshold energy, with important consequences going from particle and nuclear physics to astrophysics (neutron stars and their equation of state).
Combining the excellent quality of the low-energy kaon beam delivered by the DAΦNE collider in Frascati (Italy) with new experimental techniques, as fast and very precise X-ray detectors, like the Silicon Drift Detectors, the SIDDHARTA collaboration performed unprecedented measurements in the low-energy strangeness sector and is presently running the SIDDHARTA-2 experiment for the challenging kaonic atoms measurements, such as kaonic deuterium first measurement.
I will introduce the scientific case, the experiment and the results concerning various measurements of kaonic atoms, such as helium-4 and neon. Finally, I will outline the prospects for the ongoing kaonic deuterium measurement and our future plans.
The experiments at the DAΦNE collider represents a unique opportunity in the world to, finally, unlock the secrets of the QCD in the strangeness sector and contribute to better understand the role of strangeness in the Universe, from nuclei to the stars.

Primary author: SGARAMELLA, Francesco (INFN-LNF)

Presenter: SGARAMELLA, Francesco (INFN-LNF)

Contribution ID: **34** Type: **not specified**

Supporting $^3P_0$ Quark-Pair Creation using Landau Gauge Green's Functions

Phenomenological evidence suggests that strong decays of low-excitation hadrons often involve the creation of a light quark-antiquark pair with zero angular momentum, known as the $^3P_0$ mechanism, derived from a scalar bilinear. Despite Quantum Chromodynamics being mediated perturbatively by spin-one gluons and exhibiting chiral symmetry in its Lagrangian, a scalar decay term appears spontaneously upon chiral symmetry breaking. We explore this by employing the quark-gluon vertex in the Landau gauge and the nonperturbative effects recently clarified, alongside a constant chromoelectric field similar to the Schwinger pair production in Quantum Electrodynamics. We compare this to a two-field insertion diagram in QED and argue that the relevant quantum numbers for discussing production are $^3\Sigma_0$, $^3\Sigma_1$, and $^3\Pi_0$, analogous to those in diatomic molecules. Our results indicate significant contributions from the third decay mechanism, supporting the $^3P_0$ phenomenology at momenta at or below the fermion mass scale. However, ultrarelativistic fermions predominantly exhibit $^3\Sigma_1$ quantum numbers. In QED, $^3\Sigma_0$ is dominant, whereas in QCD, $^3\Pi_0$ prevails at sub-GeV momenta due to the requirement to form a color singlet.

Primary authors: SALAS-BERNÁRDEZ, Alexandre (Universidad Complutense de Madrid); LLANES-ESTRADA, Felipe J. (Universidad Complutense de Madrid); Prof. ALKOFER, Reinhard (Graz University)

Presenter: SALAS-BERNÁRDEZ, Alexandre (Universidad Complutense de Madrid)

Contribution ID: **35** Type: **not specified**

Exploring TMDs with kaon and pion SIDIS with CLAS12

A multidimensional study of the structure function ratio $F_{LU}^{\sin(\phi)}/F_{UU}$ has been performed for pion and charged kaon semi-inclusive deeply inelastic scattering (SIDIS), based on the measurement of beam-spin asymmetries. It uses the high statistics data recorded with the CLAS12 spectrometer at Jefferson Laboratory. The 10.6 GeV longitudinally polarized electron beam interacted with an unpolarised liquid hydrogen target during the experiment. $F_{LU}^{\sin(\phi)}$ is a twist-3 quantity that provides information about the quark-gluon-correlations in the proton.

The talk will present a study of the three pion flavours and a simultaneous analysis of two kaon channels (K^+ and K^-) using machine learning improved particle identification, over a large kinematic range with virtualities Q^2 ranging from 1 GeV^2 to 8 GeV^2. The precise multidimensional measurement was performed in a large range of z, x_B, p_T and Q^2 for the first time in the valence quark region. Based on the precise multidimensional data, a comparison with different TMD based reaction models will be presented for the different kinematic regions. As an outlook the extraction of SIDIS cross-sections as well as $\cos\phi$ and $\cos 2\phi$ moments will be presented.

This work is supported by HFHF and funded by DFG (Project No: 508107918) and this project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093.

Primary authors: KRIPKO, Aron (JLU Gießen); Dr DIEHL, Stefan (JLU Gießen and UConn)

Presenter: KRIPKO, Aron (JLU Gießen)

Contribution ID: **37** Type: **not specified**

Expanding nuclear and hadron physics horizons with the Gamma Factory

A relativistic beam of partially-stripped ions can be irradiated with a laser whose frequency is tuned to a resonant atomic transition which will subsequently de-excite. This mechanism allows one to obtain a γ-source of an unprecedented brilliance and intensity. The Gamma Factory proposed at the LHC is able to produce up to 10^{18} photons per second (7 orders of magnitude beyond the existing sources) with the energy up to 400 MeV, not accessible for FEL sources. A tunable, 100% polarized γ-source of such intensity will furnish us with a versatile tool to significantly improve our understanding of known phenomena, and to study tiny effects that until now have been prohibitively small. The proof of principle experiment at the SPS@CERN will produce 10^{15} γ/s with the energy of up to 44 keV for a variety of exciting applications in atomic and nuclear physics, and is in preparation. The same principle can be applied at other facilities, such as future EIC or FAIR. I give an overview of the reach of the Gamma Factory in hadron and nuclear physics.

Primary authors: Prof. BUDKER, Dmitry (JGU Mainz); Dr KRASNY, Mieczyslaw Witold (Sorbonne U. & CERN); GORSHTEYN, Mikhail (Mainz University)

Presenter: GORSHTEYN, Mikhail (Mainz University)

Contribution ID: **39** Type: **not specified**

Charge-conjugation asymmetry and molecular content: the Tcc(3875) and Ds(2317) in nuclear matter

We analyze the modifications that a dense nuclear medium induces in the Ds(2317)± and Tcc(3875)±. In the vacuum, we consider them as isoscalar DK (Dbar Kbar) and DD (Dbar Dbar) S-wave bound states, which are dynamically generated from effective interactions that lead to different Weinberg compositeness scenarios. Matter effects are incorporated through the two-meson loop functions, taking into account the self energies that the D, D, Dbar, Dbar, K and Kbar develop when embedded in a nuclear medium. Although Ds(2317) and Tcc(3875) particle-antiparticle lineshapes are the same in vacuum, we find extremely different density patterns in matter. This charge-conjugation asymmetry for the Ds(2317) [Tcc[3875]) mainly stems from the very different kaon [Dbar and Dbar] and antikaon [D and D] interaction with the nucleons of the dense medium. We show that the in-medium lineshapes found for these resonances strongly depend on their DK and DD molecular contents, respectively, and discuss how this novel feature can be used to better determine/constrain the inner structure of these exotic states.

Primary author: NIEVES, Juan (IFIC (CSIC-UV))

Presenter: NIEVES, Juan (IFIC (CSIC-UV))

Contribution ID: **40** Type: **not specified**

CdZnTe-based radiation detectors, a breakthrough for hadron physics experiments

In this work, we will present the potentialities of new quasi-hemispherical CdZnTe (CZT) detectors, recently developed at IMEM- CNR Parma (Italy), for high-resolution X-ray spectroscopy of intermediate mass kaonic atoms. Among the possible single-polarity electrode configurations, such as coplanar, pixelated, or virtual Frisch-grid geometries, quasi-hemispherical detectors are the most cost-effective alternative with comparable raw energy resolution in the high and low energy range. Furthermore, this latter contacts geometry allows the reading from a large volume of CZT (0.5 cm^3) with a single readout channel, facilitating coverage of relatively large detection areas with minimal readout channels. A fine optimization of the quasi-hemispherical CZT detectors was performed exploiting the first principle simulator developed by IMEM-CNR. The optimal configuration of the sensor in terms of dimension of the crystals and electrode specifications has been first determined by simulations, and successively validated with experimental measures. Spectra from different sources have been acquired to evaluate the detectors performances.
The readout electronics, engineered by the University of Palermo, entails an initial analog preamplification stage, followed promptly by signal digitalization. This setup enables the integration of sophisticated algorithms for extrapolating signal features and, combined with developed detectors, it yields high time and energy resolution. Results of the experiment performed at the DAΦNE collider in Frascati (Italy) will be presented highlighting the potentialities of CZT in X-ray spectroscopy of heavy kaonic atoms.
CZT's role in hadron physics holds exceptionally promising future prospects. The ultra-high energy resolution (FWHM of approximately 600 eV at 59.5 keV) and rapid signal shaping (approximately 30 ns) achieved in the last year with CZT detectors at room temperature, position this material as one of the most compelling candidate for investigating high-energy radiation relevant to the physics of kaonic atoms.

Primary authors: BETTELLI, Manuele (IMEM-CNR); Dr CALESTANI, Davide (IMEM-CNR); SCORDO, Alessandro (Istituto Nazionale di Fisica Nucleare); CURCEANU, Catalina Oana (Istituto Nazionale di Fisica Nucleare); BUTTACAVOLI, Antonino (University of Palermo Department of Physics and Chemistry "E. Segrè"); Dr PRINCIPATO, Fabio (UNIPA); ABBENE, Leonardo (Istituto Nazionale di Fisica Nucleare); ZMESKAL, Johann (Istituto Nazionale di Fisica Nucleare); ZAPPETTINI, Andrea

Presenter: ZAPPETTINI, Andrea

Contribution ID: **41** Type: **not specified**

Spin-transfer to Lambda hyperons in DIS

The HERMES experiment has collected a wealth of data using the 27.6 GeV longitudinally polarized HERA lepton beam and various polarized and unpolarized gaseous targets. This allows for a series of unique measurements of observables sensitive to the multidimensional (spin) structure of the nucleon, in particular semi-inclusive deep-inelastic scattering (SIDIS) measurements, for which the HERMES dual-radiator ring-imaging Cherenkov counter provided final-hadron identification between 2 GeV to 15 GeV for pions, kaons, and (anti)protons.
Lambda hyperons in the final state give us the unique opportunity to study spin dependent effects through its polarization measurements using its weak decay channel. In this contribution, the longitudinal and transverse component of the spin transfer coefficient from the longitudinally polarized electron/positron beam to the lambda or antilambda hyperon alongside with kinematical dependences on Feyman- and Bjorken-x as well as the hyperon's transverse momentum will be presented. These spin-transfer coefficients provide access to several spin-dependent fragmentation functions, which have been related to the inner structure of lambda hyperons. The results are also compared to similar measurements at the COMPASS and NOMAD experiments.

Primary author: VERETENNIKOV, Denis (University of the Basque Country UPV/EHU)

Co-author: HERMES COLLABORATION

Presenter: VERETENNIKOV, Denis (University of the Basque Country UPV/EHU)

Contribution ID: **42** Type: **not specified**

Extensions of MadGraph5_aMC@NLO for QCD studies

In this talk, I will present our extensions of MadGraph5_aMC@NLO for two asymmetric systems, photoproduction and proton-nucleus collisions, as well as progress towards automation of computations for inclusive-quarkonium production, currently being worked out at leading order.
Indeed, to consolidate the figures of merit of a variety of measurements at the Electron-Ion Collider and systematise data-theory comparisons at the LHC, it is essential to include radiative corrections in simulations of electron-proton,electron-nucleus and proton-nucleus collisions. Such an automation is currently achieved at NLO in the fixed-order mode within MadGraph5_aMC@NLO.
Extensive validations for hard reactions, like charm, beauty, Drell-Yan-pair,Z and W boson production, will be shown as well as predictions for future measurements.

Primary author: MANNA, Laboni (Warsaw University of Technology)

Co-authors: Ms COLPANI SERRI, Alice (Warsaw University of Technology); Mr SAFRONOV, Anton (Warsaw University of Technology); Dr FLORE, Carlo (Università di Torino and INFN); Dr KIKOLA, Daniel (Warsaw University of Technology); LANSBERG, Jean-Philippe (IJCLab- Paris-Saclay U. - CNRS); Dr MATTELAER, Olivier (UCLouvain); Dr FLETT, christopher (Université Paris-Saclay, CNRS-IJCLab)

Presenter: MANNA, Laboni (Warsaw University of Technology)

Contribution ID: **43** Type: **not specified**

LaVA : Lattice Virtual Academy for advanced e-learning

LaVA is established within the STRONG-2020 project, with the support of FBK/ECT* and INFN, with the aim of providing an advanced and inclusive tool for training in Lattice Field Theory. The scientific management is done by the LatticeHadrons Network of Strong-2020 , with the support of an invited Advisory Board comprising leading scientists in the field.
A Beta version of the site is available at https://sites.google.com/view/lattice-virtual-academy
If successful, this format may be replicated for ther disciplines, within and beyond hadron physics

Primary author: LOMBARDO, Maria Paola (Istituto Nazionale di Fisica Nucleare)

Presenter: LOMBARDO, Maria Paola (Istituto Nazionale di Fisica Nucleare)

Contribution ID: **44** Type: **not specified**

The BGOOD experiment at ELSA and multi-quark structures in the uds-sector *

The discovery of the X, Y, Z states in the (hidden) charm meson sector first by Belle, and the P_C baryon states by LHCb revealed the existence of multi-quark objects beyond the simple quark-antiquark or 3-quark valence configurations. If the emergence of such multi-quark structures was a general feature of QCD, then related structures should exhibit in the uds-sector as well. The BGOOD experiment at the ELSA electron accelerator of Bonn University is exactly devoted to investigate such possible baryonic structures in meson photoproduction. Particular attention is paid to threshold effects. I will discuss recent results which include the archetypal meson-baryon 5-quark hyperon Λ(1405), the hypothesised N*(2030/2080) as the strange-sector partners of the charm-sector P_C*(4380/4450) pentaquarks, and possible "hexaquark"di-baryon configurations.

- This project received funding from the DFG (Project no 50165297 and 405882627), from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093, and from the Land NRW.

Primary author: SCHMIEDEN, Hartmut (Universität Bonn, Physikalisches Institut)

Presenter: SCHMIEDEN, Hartmut (Universität Bonn, Physikalisches Institut)

Contribution ID: **45** Type: **not specified**

3DPartons: recent achievements and prospects

The need for efficient and accurate numerical codes to study the 3D structure of hadrons is today more than ever an essential requirement. In this respect the virtual-access (VA) packages of STRONG2020 have played a leading role. In this contribution, we will present the latest achievements of the 3DPartons VA package of STRONG2020. On top of the code developments accomplished over the past years, we will highlight some of the most relevant physics results obtained within 3DPartons, including theoretical and numerical advances that have contributed to enrich the code infrastructure developed by this work package.
We will also consider future perspectives of 3DPartons. In particular, we will discuss how this work package can evolve by undertaking new avenues aimed at supporting and exploiting the activities of current and future facilities. Indeed, the present physics programmes of CERN, Jefferson Laboratory, and Brookhaven National Laboratory offer many opportunities in the short and medium term to the study of the hadronic structure. Moreover, the advent of the Electron-Ion Collider broadens even further the range of possibilities, allowing 3DPartons to potentially encompass a wider range of subjects.

Primary authors: MOUTARDE, Hervé (Irfu, CEA-Saclay); Dr BERTONE, Valerio (CEA Paris-Sclay)

Presenter: Dr BERTONE, Valerio (CEA Paris-Sclay)

Contribution ID: **46** Type: **not specified**

Homage to Carlo Guaraldo

Monday, 17 June 2024 09:30 (20 minutes)

Presenter: CURCEANU, Catalina Oana (Istituto Nazionale di Fisica Nucleare)

Session Classification: Opening

Contribution ID: **47** Type: **not specified**

Kaonic atoms measurements with SIDDHARTA-2 at the DAFNE collider

Monday, 17 June 2024 10:50 (15 minutes)

Presenter: SGARAMELLA, Francesco (INFN-LNF)

Session Classification: Contributed talks

Contribution ID: **48** Type: **not specified**

Hadrons under extreme conditions

Monday, 17 June 2024 11:10 (15 minutes)

Presenter: AARTS, Gert (Swansea University)

Session Classification: Contributed talks

Contribution ID: **49** Type: **not specified**

Thermal hadron yields from a coupled-channel analysis

Monday, 17 June 2024 11:30 (15 minutes)

Presenter: MAN LO, Pok

Session Classification: Contributed talks

Contribution ID: **50** Type: **not specified**

Charge-conjugation asymmetry and molecular content: the Tcc(3875) and Ds(2317) in nuclear matter

Monday, 17 June 2024 12:10 (15 minutes)

Presenter: NIEVES, Juan (IFIC (CSIC-UV))

Session Classification: Contributed talks

Contribution ID: **51** Type: **not specified**

Supporting $^3P_0$ Quark-Pair Creation using Landau Gauge Green's Functions

Monday, 17 June 2024 12:30 (15 minutes)

Presenter: SALAS-BERNÁRDEZ, Alexandre (Universidad Complutense de Madrid)

Session Classification: Contributed talks

Contribution ID: **52** Type: **not specified**

Spin-transfer to Lambda hyperons in DIS

Monday, 17 June 2024 12:50 (15 minutes)

Presenter: VERETENNIKOV, Denis (University of the Basque Country UPV/EHU)

Session Classification: Contributed talks

Contribution ID: **53** Type: **not specified**

Cabibbo Angle Anomaly: Status and Outlook

Monday, 17 June 2024 13:10 (15 minutes)

Presenter: GORSHTEYN, Mikhail (Mainz University)

Session Classification: Contributed talks

Contribution ID: **54** Type: **not specified**

Astrophysical simulations of compact stellar objects probing the QCD phase transition in dense matter

Monday, 17 June 2024 15:00 (15 minutes)

Presenter: FISCHER, Tobias

Session Classification: Contributed talks

Contribution ID: **55** Type: **not specified**

Exploring TMDs with kaon and pion SIDIS with CLAS12

Monday, 17 June 2024 15:20 (15 minutes)

Presenter: KRIPKO, Aron (JLU Gießen)

Session Classification: Contributed talks

Contribution ID: **56** Type: **not specified**

3DPartons: recent achievements and prospects

Monday, 17 June 2024 15:40 (15 minutes)

Presenter: Dr BERTONE, Valerio (CEA Paris-Sclay)

Session Classification: Contributed talks

Contribution ID: **57** Type: **not specified**

Extensions of MadGraph5_aMC@NLO for QCD

Monday, 17 June 2024 16:00 (15 minutes)

Presenter: MANNA, Laboni (Warsaw University of Technology)

Session Classification: Contributed talks

Contribution ID: **58** Type: **not specified**

LaVA : Lattice Virtual Academy for advanced e-learning

Monday, 17 June 2024 16:20 (15 minutes)

Presenter: LOMBARDO, Maria Paola (Istituto Nazionale di Fisica Nucleare)

Session Classification: Contributed talks

Contribution ID: **59** Type: **not specified**

CdZnTe-based radiation detectors, a breakthrough for hadron physics

Monday, 17 June 2024 17:10 (15 minutes)

Presenter: ZAPPETTINI, Andrea

Session Classification: Contributed talks

Contribution ID: **60** Type: **not specified**

The BGOOD experiment at ELSA and multi-quark structures in the uds-sector

Monday, 17 June 2024 17:30 (15 minutes)

Presenter: SCHMIEDEN, Hartmut (Universität Bonn, Physikalisches Institut)

Session Classification: Contributed talks

Contribution ID: **61** Type: **not specified**

Search for Electric Dipole Moments and Axions/ALPs of charged particles using storage rings

Monday, 17 June 2024 17:50 (15 minutes)

Presenter: LENISA, Paolo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Contributed talks

Contribution ID: **62** Type: **not specified**

Expanding nuclear and hadron physics horizons with the Gamma Factory

Monday, 17 June 2024 18:10 (15 minutes)

Presenter: GORSHTEYN, Mikhail (Mainz University)

Session Classification: Contributed talks

Contribution ID: **63** Type: **not specified**

ALICE 3: a next-generation heavy-ion detector for LHC Run 5 and beyond

Monday, 17 June 2024 18:30 (25 minutes)

Presenter: TRILOKI, Triloki (INFN Bari Italy)

Session Classification: Contributed talks

Contribution ID: **64** Type: **not specified**

NuPECC and Long Range Plan 2024 for European nuclear physics

Monday, 17 June 2024 10:20 (30 minutes)

Presenter: LEWITOWICZ, Marek (GANIL)

Session Classification: Opening

Contribution ID: **65** Type: **not specified**

Presentation of LNF Frascati

Monday, 17 June 2024 09:50 (30 minutes)

Presenter: BOSSI, Fabio (Istituto Nazionale di Fisica Nucleare)

Session Classification: Opening

Contribution ID: **66** Type: **not specified**

Thermal hadron yields from a coupled-channel analysis

I shall present an analysis of the thermal composition of the S=-1 strange baryons using an S-matrix formulation of statistical mechanics. The thermal abundances are computed based on the density of states extracted from a coupled-channel model. The approach entails a consistent treatment of resonances and naturally incorporates nonresonant interactions and the contribution from some additional states beyond the listing of the PDG. Influences from beyond the elastic scatterings of elementary hadrons, i.e. quasi-two-body states and unitarity backgrounds will be examined. Lastly, constraints from thermal model analysis of the LHC hadron yields and the LQCD results on baryon strangeness correlations will be discussed.

Primary author: MAN LO, Pok

Presenter: MAN LO, Pok

Contribution ID: **67** Type: **not specified**

Photo competition award

Wednesday, 19 June 2024 16:30 (15 minutes)

Session Classification: Prizes award

Contribution ID: **68** Type: **not specified**

Best contributed talk award

Wednesday, 19 June 2024 16:45 (15 minutes)

Session Classification: Prizes award