Workshop JČF 2022

Saturday, 11 June 2022 - Saturday, 18 June 2022

Bílý Potok (u Frýdlantu)

Book of Abstracts

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Theory and phenomenology / 1

Jet energy loss in relativistic heavy-ion collisions with realistic medium modeling

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Jets are narrow collimated showers of hadrons that originate from hard QCD processes at the beginning of high energy collision. In case of ion-ion collision, the QCD medium called quark-gluon plasma (QGP) is created and the shower is quenched by QCD energy loss in the medium. The medium can be realistically simulated by relativistic viscous hydrodynamics. At the same time, the parton shower undergoes its evolution in the medium.

STAR / 2

A talk about jets which everyone will understand

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I have noticed that talks about jet physics and jet analyses are far too often too technical for younger students or non-experts to understand. This makes it harder to fully appreciate the power and beauty of the measurements and the physics. In this student-oriented talk, I will try to explain in detail the very basics of jet physics and jet analyses, especially focusing on jet analysis in high-energy heavy-ion collisions. We will start with a definition of a jet, continue with a brief course through the history of jet measurements and work our way towards modern analysis techniques and results.

Theory and phenomenology / 3

Predictions for future electron-hadron colliders using the Balitsky-Kovchegov equation

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This talk presents the overview of the latest predictions from our group for several QCD processes at low-x in the color dipole picture which are of interest for current hadron-hadron and future electron-hadron colliders. The predictions are derived using the solution to the Balitsky-Kovchegov equation for proton and nuclear targets with the collinearly improved kernel and including the impact-parameter dependence. We study the influence from the different versions of the model for the energy evolution in the following processes: inclusive and diffractive DIS, production of vector mesons in ep collisions, coherent production of a J/psi meson in ultra-peripheral collisions at the LHC, and the deeply virtual Compton scattering. By comparison to the available data and to other CGC-inspired models, we demonstrate that the future measurements will be useful to discriminate among different approaches to saturation physics. The talk will also introduce the possible inclusion of NLO contribution to the BK calculation and its implications.

STAR / **4**

Measurements of open-heavy flavor hadrons at RHIC and the LHC

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One of main physics goals of heavy-ion physics program at RHIC and the LHC is to study properties of hot and dense state of matter called the Quark Gluon Plasma (QGP). An excellent probe of the QGP are charm and bottom quarks, which are produced at a very early stage of the heavy-ion collisions and thus experience the whole evolution of the medium. One possible way to access information about heavy quark production is by measurement of open-heavy flavor hadrons. The information about energy loss of the heavy quarks in the QGP can be then accessed by comparing the invariant yields of open-heavy flavor hadrons in heavy-ion collisions to those measured in p+p collisions via nuclear modification factor, or by measurement of harmonic flow of the open-heavy flavor hadrons. This talk provides a summary of recent open-heavy flavor hadron measurements by experiments at RHIC and the LHC.

Astroparticle physics / **5**

Moon shadow (not) seen by the experiment KASCADE

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The Moon blocks trajectories of cosmic rays, while the geomagnetic field of Earth deflects it, shifting it with the respect to the true Moon position. This offset can be wrongly interpreted as a systematic offset of event reconstruction, making the study of the Moon shadow crucial for correct event reconstruction. We investigate whether the Moon shadow is visible on the data recorded by the experiment KASCADE between the dates 8.5.1998 - 20.12.2003.

Third year students / **6**

ALICE upgrade and latest data

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In 2019 the period of a Long Shutdown 2 of the LHC has begun. During the past three years, the ALICE detector has been significantly upgraded, including the creation of a new online-offline analysis software. In September 2021, the first test run has been done, which provided us with the first set of data of the Run3, used for calibration of the upgraded detectors and software. The test run has been done for both polarities of the L3 magnet and Monte Carlo simulations have been also created. These data allow us to study possible missalignments of the new detectors based on their comparison. Once the test data are fully analysed and all the encountered discrepancies are dealt with, the ALICE detector will be ready for the real data collection of Run3.

STAR / **7**

Physics with Forward Protons at RHIC

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At the Relativistic Heavy Ion Collider (RHIC), the diffractively scattered protons are moving intact inside the RHIC beam pipe after the collision and are measured in the Roman Pots system allowing physics programs with tagged forward protons such as: elastic scattering, central (exclusive) production, and single diffraction dissociation. In this talk, the history of forward physic program at RHIC and its up-to-date status with obtained results shall be presented. The focus shall be on the measurement of the central exclusive production with the STAR detector, where a double Pomeron exchange mechanism is expected to be dominant.

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Performance studies for the upcoming mCBM experiment campaigns

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With mCBM@SIS18 (short "mCBM") a CBM precursor and demonstrator experiment has been constructed 2017/18 at the SIS18 facility of GSI/FAIR, taking data within the FAIR phase-0 program since 2019. The primary aim of mCBM is to commission and optimise the CBM triggerless-streaming data acquisition system including data transport to a high performance computer farm, the online track and event reconstruction and event selection algorithms and the online data analysis as well as the controls software packages. mCBM comprises of prototypes and pre-series components of all CBM detector subsystems and their read-out systems. The reconstruction of Lambda hyperons will be used as a benchmark observable probing the performance of the CBM hard- and software. Using simulations, various detector configurations have been tested identifying the most suitable geometry for reconstruction of Lambda hyperons with the mCBM setup in real data.

ATLAS / 9

Inclusive dijet studies in the ATLAS experiment

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Inclusive dijet studies have been performing using proton-proton collisions at a centre-of-mass $\sqrt{s} = 13$ TeV recorded in LHC phase Run 2, which were placed between 2015 and 2018, with total integrated luminosity 139 fb^{-1} at the ATLAS experiment using calibrated anti-k_{T} topological jets with radius $R = 0.4$. The inclusive dijet is understood as a vector sum of four-momenta of the two jet-leading jets with the highest transverse momentum p_T. The dijets are measured double and triple differentially. The two-dimensional measurements are proposed in two versions: for dijet mass m_{jj} and half absolute rapidity separation $y^{\star}$ between the leading and sub-leading jets; and for dijet mass m_{jj} and absolute average rapidity y_{boost} of the two leading jets within $|y| < 3.0$, $p_{\mathrm{T}} > 75$ GeV and $y^{\star} < 3.0$. The three-dimensional measurement is designed for m_{jj}, $y^{\star}$, y_{boost}. The measured cross-section is compared to LO MC Pythia8.

Astroparticle physics / **10**

Application of the deep machine learning for the studies of the muon air-shower component using the Pierre Auger Surface Detector data

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The number of muons in air showers is one of the most important parameters linked to the mass of a primary particle. The knowledge of the mass composition is the key input required for verifying the astrophysical models describing the acceleration and propagation of cosmic rays. This talk will be devoted to the application of machine learning for the extraction of the muon component of the signal recorded by the water Cherenkov detectors of the Pierre Auger Observatory.

Computing / **11**

Cluster sunrise

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Základní informace jak používat výpočetní prostředky katedry fyziky.

Basic information how to use the computing resources available at the department.

Theory and phenomenology / **12**

INVESTIGATION OF THE DP → DP AND DP → PPN REACTIONS AT INTERMEDIATE ENERGIES

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The polarization observables of the dp-elastic scattering and cross section of the breakup channel of $d + p$ reaction are sensitive to the two-nucleon (2NF) and three-nucleon forces (3NF) of the nuclei. Their investigations is worth to carry out in different kinematic regions and for different reactions.

The aim of the deuteron short range spin structure (DSS) experiment is to obtain polarization observables in dp elastic scattering at large CMS angles ($> 60°$) and in $dp \to ppn$ breakup with the detection of the two protons in the final state. Of great importance is the study of spin and relativistic effects in these reactions because the experimental data are scarce.

ALICE / **13**

Incoherent photoproduction of J/psi with ALICE

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The measurement of the cross section of incoherent J/psi photoproduction in ultra-peripheral Pb-Pb collisions can help us to examine event-by-event fluctuations of the transverse structure of nucleons at low Bjorken-*x*. In this talk, the analysis of the $|t|$-dependence of the incoherent J/psi photonuclear cross section with ALICE will be presented.

Astroparticle physics / 14

Longitudinal profiles of the highest energy cosmic-ray air showers measured at the Pierre Auger Observatory

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Alternative reconstruction methods of the Pierre Auger Observatory data measured by its fluorescence telescopes have the potential to extend the number of detected cosmic-ray showers. This extension is of great importance especially for ultra-high-energy showers burdened by very low statistic due to the steeply decreasing flux of particles with their increasing energy. The increase of the data set used for the analysis of cosmic-ray properties could lead to a better understanding of the physics behind this phenomenon. This work focuses on a comparison of two alternative reconstruction methods with one standard method and shows that the combination of all three methods does not bring unwanted biases into the data analysis.

STAR / 15

Purity measurements of non-photonic electrons from open heavy-flavor hadron decays in heavy-ion collisions at STAR

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In this analysis, we report on the steps towards the measurement of the production yield of heavy-flavour electrons (HFE) in Au+Au collisions (0 - 60\% centrality) at $\sqrt{s_{NN}} = 54$ GeV at the STAR Experiment at RHIC. HFEs are mainly produced due to the semileptonic decays of heavy quarks (charm or beauty), which are created during hard processes very early in the collisions. Given this characteristic, they constitute important probes of the Quark-Gluon Plasma properties.

The current primary purpose of this study consists of including recently available information from the Barrel Electromagnetic Calorimeter (BEMC) subdetector to improve the electron identification in the referred dataset. According to the parameters obtained from the purity studies and the analysis of hot BEMC towers, the results can be applied in further studies of the STAR Collaboration. Another priority of this study is estimating the purity of the inclusive electron sample, used to calculate the yield of non-photonic electrons.

Future goals of this analysis include the attainment of the non-photonic electron yield, with a possible distinction of HFE from within this sample. Non-photonic electrons are identified within the inclusive electrons using statistical methods. The obtained result comprises HFE and electrons from hadron decays (heavy quarkonia, vector mesons and Drell-Yan processes), the first representing the most significant contribution.

After obtaining the heavy-flavour electron yield, the analysis of the energy loss of heavy-flavour electrons in the medium via the calculation of the nuclear modification factors R_{AA} and R_{CP} becomes possible.

Third year students / **16**

Charm production at CBM experiment

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Charm production is considered to be an important signal of the onset of the deconfinement of nuclear matter created in collisions of heavy ions. At high collisions energies the heavy quarks are used to probe the properties of the hot deconfined phase and its interaction (energy loss mechanism) with the traversing partons. At low collisions energies it can be used to study properties of the very high net baryon density matter close to the transition. In this regime important questions such as what is the microscopic mechanism of the charm production and how is it affected by the deconfinement can be answered. Several experiments such as NA61/SHINE, J-PARC, or CBM, which is being built in Darmstadt, aim to collect data about charm production close to the charm production threshold. In this talk I will discuss the topic of the charm production in heavy ion collisions and perspective of the measurements that can be done at CBM experiment at FAIR.

Detectors / **17**

Development of Barrel Hadronic Calorimeter for proposed ATHENA experiment

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ATHENA and ECCE are few of the proposed experiments at the upcoming Electron-Ion Collider project. These experiments focus on the studies of structure of nucleons in the nuclei and their spin. Each one features a large acceptance and low-mass, high precision trackers with a set of dedicated calorimeters and particle identification detectors.

This presentation, as an introduction, will discuss the Electron-Ion Collider project as well as status of ATHENA and ECCE detectors. Next, the technical aspects of development of Barrel Hadronic Calorimeter for ATHENA will be discussed. The geometry of this detector is implemented with the use of Detector Description Toolkit for High Energy Physics (dd4hep). A short description of dd4hep will be also given in this presentation.

Third year students / **18**

Linearita nové řídící elektroniky na Observatoři Pierra Augera

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Každý moment na Zemi dopadá vysoké množství částic vesmírného původu. Na Observatoři Pierra Augera se tyto částice pozorují s cílem určit jejich přesný původ a způsob urychlení. Jednou součástí vylepšení AugerPrime, které v posledních letech na observatoři probíhá, je i nahrazení starých základních desek, které zpracovávají signály z povrchových detektorů, novými, vylepšenými verzemi. Vlastnosti jednotlivých desek jako například linearita však musí být řádně otestovány, než mohou být poslané do Argentiny a namontované.

Third year students / **19**

Centrální inkluzivní produkce K0S na experimentu STAR

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Centrální produkce se řadí mezi difrakční jevy ze třídy měkkých hadronových procesů. Pro popis difrakčních procesů je používána Reggeova teorie, která je popisuje pomocí výměny tzv. reggeonů. V difrakčních procesech asymptoticky dominuje reggeon Pomeron, jehož konkrétní vlastnosti nejsou zatím známy a v pQCD je reprezentován dvojicí gluonů. Prezentováno bude zkoumání centrální inkluzivní produkce ve srážkách příčně polarizovaných protonů, které bylo fyzikální motivací pro analýzu dat v rámci mé bakalářské práce. Cílem bylo zrekonstruovat mezon K^0_S za využití jeho hlavního rozpadového kanálu na dva piony. Představen bude způsob analýzy, detektory experimentu STAR relevantní pro tuto práci a výsledky v podobě distribuce invariantní hmotnosti pionových párů vznikajících rozpadem K^0_S a výpočtu výtěžku K^0_S.

ALICE / **20**

Studies of strangeness production vs. charged particle multiplicity with PYTHIA8 and particle source using two-pion femtoscopic correlations

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The fundamental constituents of matter, Quarks and Gluons under normal conditions appear only to be confined to hadrons. Lattice QCD calculations have predicted that at temperatures above 160 MeV quarks and gluons would no longer be bound but instead form a phase of free quarks and gluons, the Quark-Gluon Plasma (QGP). The aim of relativistic heavy-ion collisions is to produce such a QGP in order to learn more about the strong nuclear force.

Strangeness production in relativistic heavy-ion collisions is a signature and a diagnostic tool of QGP formation and properties. The enhanced production of strange hadrons in proton-proton collisions at 7 TeV center-of-mass energy as measured by the ALICE experiment at CERN is investigated in this presentation using the PYTHIA8 event generator. The combined effect of color reconnection

and the formation of ropes due to overlapping of QCD strings in a high multiplicity environment (Rope Hadronization) was able to describe the observed trend. The influence of this Rope Hadronization model on the event-shape (transverse spherocity) of proton-proton collisions at LHC energies was investigated. The transverse momentum distribution of those strange hadrons measured in the collisions was analyzed using q-Weibull formalism. The q parameter which is related to the degree of deviation from conditions of thermal equilibrium was almost a constant with respect to centrality.

This presentation also includes some aspects of two-particle femtoscopy, where the objective is to extract the space-time structure of a particle emitting source from momentum spectra. The effects of Coulomb interaction in identical two-pion correlations and how short-lived resonances influence the HBT radius parameters of a particle source are presented here. Within the framework of a Core-Halo model of pion emission implemented in CorAL (Correlation Algorithm Library), a collision fireball's HBT radius parameters were studied. CorAL is an in-progress code-base to analyze two-particle correlations at small relative momentum. The source imaging routine incorporated in CorAL was used to analyze a particle's source function from two-pion correlations. At small relative momentum, long-range Coulomb repulsion effects caused a suppression in the $\pi^+ - \pi^+$ correlation function.

Third year students / **21**

Návrh a optimalizace femtosekundového elektrostatického děla

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Využití femtosekundových laserových impulsů k vyražení elektronů a jejich následné urychlení statickým elektrickým polem nabízí efektivní způsob generování krátkých monoenergetických elektronových svazků urychlených v závislosti na využitém poli na stovky keV. Tyto elektronů lze dále využít pro injekci do plazmových urychlovačů nebo přímo jako zdroj rentgenového záření. Další využití se nabízí například jako zdroj elektronů pro elektronové mikroskopy. Pro fokusaci svazku se využívá elektrostatická čočka einzellens. Předmětem práce je simulace vývoje svazku a jeho fokusace za účelem optimalizaci využité čočky.

STAR / **22**

Upsilon meson production in p+p collisions measured at STAR

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The study of quarkonium yield dependence on charged particle multiplicity serves to help our understanding of quarkonium production mechanism, improve the production models and to investigate a link between hard and soft processes involved. This presentation introduces an analysis of Υ meson production in 510 GeV centre-of-mass energy proton-proton collisions recorded by the STAR experiment during Run 17. No Υ signal was observed when reconstructed with only the available TPC information, but the algorithm was successfully used to reconstruct a J/ψ signal.

STAR / **23**

Charm meson production in proton-nucleus collisions in the STAR experiment

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Just a moment after the Big Bang a state of matter called the Quark-Gluon Plasma was present in the Universe. We are able to reproduce this state of matter for a fraction of second in heavy-ion collisions on large particle colliders such as LHC or RHIC. Multiple different tools can be used to study QGP. To correctly describe behavior in heavy-ion collisions, effects caused by a simple presence of a nucleus have to be understood. These effects are called cold nuclear matter effects and can be studied in proton+nucleus collisions. Heavy quarks originating from the early stages of collisions are a good probe for the measurements. Analysis of experimental data from STAR experiment searching for D^0 signal in p+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV will be presented.

Third year students / **24**

Štúdium zloženia a hadronických interakcií kozmického žiarenia ultra-vysokých energií pomocou dát Observatória Pierra Augera

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Kozmické žiarenie sú energetické častice prilietavajúce do zemskej atmosféry. Ich pôvod môže byť rôzny, často je však neznámy a to najmä u častíc s ultra-vysokými energiami. Jeden z experimentov slúžiacich na detekciu a skúmanie kozmického žiarenia s energiou vyššou ako 10^17 eV je Observatórium Pierra Augera, ktoré je za pomoci kombinácie flourescenčných teleskopov a Čerenkovovych detektorov schopné získať informácie o primárnej častici.

Astroparticle physics / **25**

Features of Ultra-High Energy Cosmic Ray sources

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The investigation of the mass composition relations to the large-scale anisotropies found in the arrival directions of ultra-high energy cosmic rays (UHECR).
Open framework simulator for simulated data generated by CRPropa3, which is a publicly available code to simulate the propagation of UHECR in the universe, for four primary particles, on which test for a directional anisotropy when UHECR protons are deflected in the Galactic magnetic field is conducted. This comes from the fact that heavier particles of the same energy get trapped in the region of the Galactic plane where the magnetic field is the strongest. However, due to Liouville' s theorem, an isotropic cosmic-ray flux entering the Galaxy remains isotropic for any observer inside the Galaxy. What is further tested is the hypothesis of an anisotropy laying along the galactic plane which depends on the mass of primary cosmic-rays, according to recent measurements. The sensitivity to the cosmic-ray mass is provided by the depth of shower maximum Xmax. The more in-depth analyse sis is done with a specific mixing, namely, pure proton, pure iron and 50/50 mix of proton/iron, but also for a more general approach where all possible combinations.

The next step is to then repeat such analysis but for FD detectors which had to be a analytically obtained through real monte Carlo simulations. These data are then further analyse due to specifics effect that are appearing. Such effect are the result of multi telescope composition which comes from each different telescope at Aguer-observastory.
These data were found correct and can be used as a "mask"for the CRPROPA data.

Theory and phenomenology / 26

Transverse expansion in nuclear collisions at RHIC BES

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During heavy-ion collisions a very hot and dense strongly interacting matter is created. Such matter can pass into the state of quark-gluon plasma, if sufficient energy density is reached. At the beginning of the collision, the energy is distributed unevenly and since the created matter behaves collectively, it leads to its anisotropic evolution. It is possible to study the strongly interacting matter by computer simulations and comparing the results to the experimental data. One of the approaches for simulation of the quark-gluon plasma evolution is by means of hydrodynamic models, where the plasma is described as a viscous fluid. However, the solutions of hydrodynamic models are strongly dependent on the initial state. One of the experiments, the aim of which is to probe the phase diagram of the strongly interacting matter is RHIC BES program, during which Au+Au collisions at the energies $\sqrt{s_{NN}} = 7.7 - 62.4$ GeV were taken. There were presented results of the elliptic flow and particle spectra in transverse momentum by STAR collaboration. The aim is to create a new Glauber model, which would allow initial transverse momentum deposition that would lead to an initial transverse expansion in hydrodynamic code vHLLE. Altogether with vHLLE code, the SMASH transport model is used for final state simulations. Results from the simulations with the new model are compared to the results presented by STAR collaboration and also with results from the simulations with Glissando initial state generator for collision energy $\sqrt{s_{NN}} = 27$ GeV and for the centralities 10-20%, 20-30% a 30-40%.

Theory and phenomenology / 27

Imaginary magnetic field in relativistic quantum mechanics

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The magnetic field is an interesting concept in quantum mechanics and leads to physical effects that have no classical analogy. A surprise of recent years is the relevance of magnetic fields with a non-zero imaginary component in the mathematical description of quantum mechanics.
The magnetic field occurs also in the relativistic description of the stability of rotating black holes. An analogy between the characterisation of black hole apparent horizons as stable marginally outer trapped surfaces (MOTS) and the quantum description of a non-relativistic charged particle is pointed out.
An important equation in relativistic quantum mechanics is Dirac's equation, which replaces the Schrödinger equation which is not Lorentz invariant. The non-selfadjoint Dirac operator D_a on circle with a complex magnetic field is investigated. We will find out under which conditions this operator will be normal and under which conditions it will be quasi-self-adjoint. Its spectrum and eigenvectors will be found.

Third year students / 28

Plazmové vlnovody pro stolní synchrotrony

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Urychlování částic plazmovou vlnou generovanou intenzivním femtosekundovým laserem představuje alternativu ke konvenčním urychlovačům založených na radiofrekvenční technologii. Ty mají z důvodu nebezpečí průrazu urychlovací dutiny omezení na maximální intenzitu elektrického pole kolem 100 MV/m. V iontové brázdě vytvořené za laserovým impulsem lze dosáhnout až 100 GV/m, přičemž jediným rizikem je kolaps plazmové vlny, nikoliv poškození zařízení. Tím je možné urychlovač významně zmenšit a snížit tak náklady na konstrukci. Ukazuje se, že vhodnou přípravou plazmového kanálu je možné vést laserový impuls, a tím i urychlované částice, po zakřivené dráze, čímž je možné docílit konstrukce prstencového urychlovače a vícefázového urychlování. Cílem práce je návrh a optimalizace zakřiveného plazmového vlnovodu vhodného pro urychlování částic.

Computing / **29**

Design patterns in data science

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A light hearted look at patterns and anti-patterns in software design. While there are many excellent resources that discuss this topic, the majority of them are focused on application development, which has different challenges to scientific programming. This will focus on patterns relevant to data analysis in physics. It's quite possible that even if you don't know the names of these design patterns, you have seen them and used them in your own research. Equipped with names for these patterns, we can discuss the advantages and potential pitfalls of different choices. Such analysis will hopefully enable us to treat ourselves to an easy (or easier) to maintain code base.

STAR / **30**

Multi-dimensional measurements of parton shower in pp collisions at RHIC

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Jets are collimated sprays of hadrons and serve as an experimental tool for studying the dynamics of quarks and gluons. In particular, differential measurements of jet substructure enable a systematic exploration of the parton shower evolution. The SoftDrop grooming technique utilizes the angular ordered Cambridge/Aachen reclustering tree and provides a correspondence between the experimental observables, such as the shared momentum fraction (z_{g}), groomed jet radius or split opening angle (R_{g}), and the QCD splitting functions in vacuum. We present fully corrected correlations between z_{g} and R_{g} at the first split for jets of varying momenta and radii in pp collisions at $\sqrt{s} = 200$ GeV. As these novel measurements are presented in three dimensions, we outline the correction procedure so that it can be used as a template for future multi-differential measurements across all experiments.

Astroparticle physics / **31**

Southern Wide-field Gamma-ray Observatory (SWGO)

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SWGO is a planned observatory of high energy gamma rays. It is going to be the first wide-field observatory in the Southern hemisphere and it will complement measurements from observatories in the Northern hemisphere like HAWC or LHAASO. The scientific potential of the experiment is extensive as it will provide access to transient and variable multi-wavelength and multi-messenger phenomena near the Galactic center and in the Galactic plane, regions that are not visible by any other current observatory. In this talk, I will provide an overview of the current status of this project and introduce scientific topics SWGO plans to cover.

Theory and phenomenology / **32**

Study of non-linear evolution of the hadron structure within quantum chromodynamics

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As the upgrades of experimental facilities such as CERN or BNL promise to reach higher and higher collision energies, probing the hadron structure becomes more precise and the conundrum of its evolution is thus extremely tantalizing.
One of the ways to approach the problematics is using the so-called colour dipole model which describes the deep inelastic electron-proton scattering. Within this framework, evolution equations can be obtained such that the previously unobserved yet crucial phenomenon of parton saturation is implemented.
The centrepiece of the presented talk is the Balitsky-Kovchegov evolution equation which contains such a mechanism and its results are shown to provide potentially interesting predictions of the newly obtained experimental data. This ultimately brings us a bit closer to understanding what happens inside of hadrons - the smallest composite pieces of matter.

ATLAS / **33**

B physics at ATLAS

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ATLAS explores a range of physics topics, with the primary focus of improving our understanding of the fundamental constituents of matter. Specific branch of the studies carried out at ATLAS is the Beauty physics that deals with B mesons, a combination of $q\bar{q}$ with nonzero beauty quantum number. Due to the large cross-section of b-quark production at LHC, this channel is expected to be sensitive to hints of Beyond Standard Model physics.
The ATLAS B-Physics program includes SM measurements and new physics searches, such as measurement of the CPviolating phase ϕ_s of the B_s^0 system, searching for anomalous rates of the rare

B-decay channel: $B_s^0 \to \mu^+\mu^-$, as well as precise tests of QCD by studying the production mechanisms of $q\bar{q}$ pairs, beauty baryon polarization, and lifetime measurement.

After-dinner talks / **35**

Quiz time

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After-dinner talks / **36**

Kosmologie v éře Webbova teleskopu

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Official start of JCF workshop

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Astroparticle physics / **38**

Evolution of galaxies in clusters

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The hot and dense environment of galaxy clusters represents a site of dramatic changes in member galaxies' morphology as they shift from blue gas-rich to red gas-poor objects due to multiple processes.
One of the essential external processes is the ram pressure stripping that galaxies experience while moving with high velocities through the hot intra-cluster medium (ICM), whose temperatures reach $\sim 10^7$ K. During this process, the gas reservoir of galaxies is gradually depleted from outside in as suggested by multiple observations of partially or fully gas-stripped galaxies. Without any gas in the disk left, the star formation of the galaxy is quenched. However, a very different story evolves in the tail behind the parent galaxy. After leaving the disk, the displaced gas presumably mixes with the ICM forming a multi-phase environment whose temperature and density depends locally on domination of heating and cooling processes respectively. Yet, details of the evolution of the tail gas remain unknown and are subject of the intense research.

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Official end of JCF workshop

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ALICE / **40**

Understanding non-flow effects on multiparticle cumulants in small collision systems using Pythia model

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Anisotropic flow in high-multiplicity collisions of small systems has been studied extensively by several high-energy experiments to address the possible existence of a strongly-interacting medium similar to that created in heavy-ion collisions. One of the most suitable measurement techniques are multiparticle cumulants with subevent method to suppress non-flow contamination. The amount of non-flow suppression may depend on the detector acceptance and the chosen subevent configuration, which impedes direct comparison between results reported by different experiments. In this contribution, I will present my studies of such effects on anisotropic flow and their correlations using multiparticle cumulants with subevent method as a function of particle multiplicity in pp collisions at $\sqrt{s}$ = 13 TeV generated with the PYTHIA model. My findings will help in interpretation of experimental results from different experiments and in their mutual comparison, which is crucial in the current debate about the origins of collectivity in small collision systems.

After-dinner talks / **41**

Discussion: present and future of JCF

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After-dinner talks / **42**

TBA

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After-dinner talks / **43**

EPS Young Minds

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