Jet Modification and Hard-Soft Correlations (SoftJet 2024)

Report of Contributions

https://indico.cern.ch/e/1403965

Contribution ID: **4** Type: **not specified**

Jet-flow coupling in heavy-ion collisions

Saturday 28 September 2024 16:00 (20 minutes)

Particles associated with the jet will be deflected from their initial direction due to the scatterings with the thermal partons flowing in the QGP fluid. Such deflections depend on the energy of the jet, the local energy gradient, and the local flow velocity. In general, the soft particles will drift towards the direction of the flowing medium, away from the center of the jet cone where the hard particles are located, leading to an intra-jet asymmetry coupled with flow, which can be used to extract the properties of the QGP medium. In this work, we first calculate the intra-jet asymmetry distribution in both transverse and longitudinal directions and investigate their dependence on path length, viscosity, and jet multiplicity. Such asymmetry is also observed in the jet chemical structure. We then extract the average radial flow velocity distribution via the intra-jet asymmetry distribution and compared it with the hydrodynamic simulation results. Our approach can be further used to localize the initial production position of the jet without specified requirements of the jet direction. As we apply jet localization to gamma-jet and dijet events, we find an improvement in the localization accuracy of dijet events due to the interplay between QGP flow and the diffusion wake induced by the backside jet.

Category

Theory

Collaboration

Primary author: LUO, Tan (Hunan university)

Presenter: LUO, Tan (Hunan university)

Session Classification: Session 4

Contribution ID: **5** Type: **not specified**

How the Structure of Hard Jets Shapes their Soft Wakes

Saturday 28 September 2024 14:30 (20 minutes)

We begin by using Hybrid Model calculations to reproduce experimental results published by ATLAS in 2023 on R_{AA} for $R = 1$ jets in Pb+Pb collisions. These jets are identified via first reconstructing anti-k_t $R = 0.2$ subjets and then reclustering them. Following ATLAS, we investigate how R_{AA} for these large-radius jets depends on the angle between the two subjets involved in the final clustering step of the $R = 1$ jet. We also study the dependence of R_{AA} for these jets on the resolution length of QGP, which suggests that measurements like those pioneered by ATLAS can constrain this property of QGP.

We also use this setup to analyze the response of the medium to the passage of large-radius $R = 2$ jets containing two $R = 0.2$ subjets, produced in gamma-jet events, and identified as above. We introduce novel jet-shape observables that allow us to visualize the angular shape of the soft hadrons originating from wakes that wide jets with two skinny subjets excite in the droplet of QGP, as a function of the angular separation between the subjets. We find that even when two hard subjets are 0.8 to 1.0 radians apart, a single broad wake is produced. When the two subjets are even farther apart, the presence of two sub-wakes is revealed. We show that the way in which the structure of hard jets shapes their soft wakes can be visualized with similar clarity in experiments by measuring the observables we have introduced using only soft hadrons with low transverse momenta.

Category

Theory

Collaboration

Primary authors: KUDINOOR, Arjun Srinivasan (University of Cambridge); Dr PABLOS, Daniel (INFN Torino); RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

Presenter: KUDINOOR, Arjun Srinivasan (University of Cambridge)

Session Classification: Session 3

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

Jet quenching in evolving matter

Saturday 28 September 2024 17:30 (20 minutes)

Over the last decades, the theoretical picture of how hadronic jets interact with nuclear matter has been extended to account for the medium's finite longitudinal length and expansion. However, only recently a first-principle approach has been developed that allows to couple the jet evolution to the medium flow and anisotropic structure. In this talk, I will review these developments, and discuss the features of jet quenching in evolving matter. I will consider the modifications of the single particle momentum broadening distribution and single-gluon production rate, and discuss the potential phenomenological implications.

Category

Theory

Collaboration

Primary authors: LOURENCO HENRIQUES BARATA, Joao; MAYO LÓPEZ, Xoán (Universidade de Santiago de Compostela - IGFAE); Dr SADOFYEV, Andrey (LIP, Lisbon); SALGADO LOPEZ, Carlos Albert (Universidade de Santiago de Compostela (ES))

Presenter: Dr SADOFYEV, Andrey (LIP, Lisbon)

Session Classification: Session 5

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

Identical particle correlation from jet-induce medium response

Saturday 28 September 2024 16:40 (20 minutes)

The jet-induced medium response of a quark-gluon plasma (QGP) is an intriguing phenomenon as it reveals dynamics of QGP at various wavelengths. However, it has not been unambiguously identified in experiments. This is mainly because of the complicated background of current observables. Furthermore, current observables only focus on consequences of the medium response in the momentum space. In this talk, we propose to use the Bose-Einstein correlation of identical particles (the HBT correlation) in events triggered on jets to search for signals of medium response. There can be two advantages: 1) the HBT correlation is sensitive to the spatial inhomogeneity of the perturbed medium, encoding information of the medium response in the coordinate space; 2) computation of the HBT correlation uses soft particles and does not require the distinction of background from jet-modified contributions in simulations. Finally, using the CoLBT model, we estimate the size of the medium-response effect on HBT correlations in both Pb-Pb and O-O collisions at the LHC.

Category

Theory

Collaboration

Primary authors: Dr KE, Weiyao (Central China Normal University); Dr WANG, Xin-Nian (Lawrence Berkeley National Lab. (US)); YANG, Zhong (CCNU)

Presenter: Dr KE, Weiyao (Central China Normal University)

Session Classification: Session 4

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

Study of medium induced modification of jet-like azimuthal correlations of heavy-flavour trigger particles

Saturday 28 September 2024 18:10 (20 minutes)

In hadronic collisions, heavy quarks are produced in hard scattering processes with large momentum transfer, which then generate a parton shower that develops into a jet. In heavy-ion collisions, where quark-gluon plasma (QGP) is produced, heavy quarks interact with the QGP constituents, losing energy which leads to quenching of the produced jets. In this process, the parton shower can be affected, leading to a modification of the fragmentation function. The injection of energy and momentum by the jet into the plasma can modify the medium itself. Theoretical models of partonic interactions with the medium constituents predict that energy loss depends on the quark mass and the color charge of the parton. Heavy quarks are expected to lose less energy than light quarks.

The two-particle angular correlation technique with a heavy-flavor particle trigger allows the study of heavy-flavor jets and their properties. In this contribution, we will present ALICE measurements of heavy-flavor triggered angular correlations with charged particles in pp collisions at $\sqrt{s} = 5.02, 13$ and 13.6 TeV, and in p–Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV to study any cold nuclear effects affecting the correlation distribution. Measurements of correlation distribution and per-trigger nuclear modification factor in Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV, used to study jet quenching and other jet-medium interactions, will also be presented.

Category

Experiment

Collaboration

ALICE

Primary author: Dr THOMAS, Deepa (University of Texas at Austin (US))

Presenter: Dr THOMAS, Deepa (University of Texas at Austin (US))

Session Classification: Session 5

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

Exploring QGP Properties through Unified High-pt and Low-pt approach with Bayesian Inference

Sunday 29 September 2024 12:00 (30 minutes)

High-pt theory and data traditionally study the interactions of high-pt partons with the Quark-Gluon Plasma (QGP), while bulk QGP properties are inferred from low-pt data. Our approach unifies these domains using the DREENA framework, enabling a comprehensive assessment of QGP properties. We will overview the ebe-DREENA framework, a state-of-the-art dynamical energy loss model optimized to incorporate various medium-averaged and event-by-event evolutions, and applicable to both large and small collision systems. The framework provides a unique tomography tool for mapping QGP properties, which we will demonstrate by constraining the temperature dependence of the shear viscosity to entropy density ratio. This example will suggest the intriguing hypothesis that the quasiparticle picture remains valid across the entire temperature range in QGP.

As our most recent advancement, we will present our Bayesian inference results with low-pt and high-pt data. We demonstrate that using both low-pt and high-pt data results in parameter distributions that are consistent with those inferred solely from low-pt data yet are much more constrained. This highlights the necessity of high-pt data for precise QGP parameter determination. Thus, integrating DREENA within a formal statistical framework (Bayes-DREENA) enables more accurate inferences of QGP properties and may provide optimal usage of a wide range of available and upcoming experimental data from RHIC and LHC.

Category

Theory

Collaboration

Primary authors: DJORDJEVIC, Magdalena; Prof. DJORDJEVIC, Marko (University of Belgrade); Dr KARMAKAR, Bithika (Institute of Physics Belgrade); ZIGIC, Dusan (Institute of Physics Belgrade); Dr SALOM, Igor (Institute of Physics Belgrade); HUOVINEN, Pasi (University of Wroclaw); AUVINEN, Jussi (U)

Presenter: DJORDJEVIC, Magdalena

Session Classification: Session 7

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

Backreaction of QGP fluids from recoil partons

Saturday 28 September 2024 17:00 (20 minutes)

Modification of jets is a powerful tool to diagnose a quark gluon plasma (QGP) in high-energy heavy-ion collisions. During propagation of partons in a jet through the QGP medium, constituents of the medium acquire high energy and momentum from them and are kicked out to be non-equilibrated partons. These partons are called the recoil partons. Together with how the jet partons radiate energy and momentum during traversing the medium, the recoil process is also crucial in description of jet modification and in understanding of properties of the QGP in high-energy heavy-ion collisions.

Due to the energy-momentum conservation, the backreaction of the QGP would occur when the partons are kicked out from the QGP medium. To develop a general-purpose event generator which respects the energy-momentum conservation, the recoil process should be implemented as "deposition of negative energy and momentum"into the fluids.

In this study, we introduce the negative source terms in hydrodynamic equations to consider the dynamical evolution of backreaction of the QGP medium in recoil processes. Using this framework, we analyze effects of the backreaction on the jet structure function toward comprehensive understanding of jet propagation in medium.

Category

Theory

Collaboration

Primary author: SAKUMA, Shoto (Sophia University)

Co-author: HIRANO, Tetsufumi

Presenter: SAKUMA, Shoto (Sophia University)

Session Classification: Session 4

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

Jet modification in the QGP and the hadronic phases with SUBA-Jet framework

Sunday 29 September 2024 14:30 (20 minutes)

We study jet production and modification in lead-lead collisions at the LHC energies within a recently introduced SUBA-Jet framework [1]. The core of the framework is a time-like parton shower that starts with a seed parton with high Q^2, as well as realistic fluid dynamic evolution of the medium, simulated using the vHLLE code. The initial seed partons are produced by PYTHIA, whereas the initial state for the medium is modeled with TrENTo model. At particlization, the medium decouples into hadrons. The jet partons lose energy in the medium and hadronize. Jet and medium hadrons rescatterings are simulated using the SMASH hadronic transport. The ingredients above allow to simulate a complete event containing both soft and hard hadrons.

We benchmark the jet energy loss in lead-lead collisions at 5.02 TeV LHC energy in this framework, and, in particular, we examine the influence of hadronic phase on the jet properties. Traditionally, jet modification is assumed to happen solely in the QGP phase, based on arguments of formation time of jet hadrons and low jet transport coefficient in hadronic phase. We argue that the validity of those arguments depends on hadron p_{T}, and as a result the complete jet object can have a visible modification in the hadronic phase, as quantified by different observables.

[1] Iu. Karpenko, A. Lind, M. Rohrmoser, J. Aichelin, P.-B. Gossiaux, arXiv: 2404.14579 [hep-ph]

Category

Theory

Collaboration

Primary authors: Dr KARPENKO, Iurii (FNSPE CTU in Prague); BOBEK, Josef (CTU FNSPE)

Presenter: BOBEK, Josef (CTU FNSPE)

Session Classification: Session 8

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

Insight into the electrical conductivity of quark gluon plasma through photon production

Saturday 28 September 2024 15:10 (20 minutes)

Heavy-ion collisions have been used to study quark-gluon plasma (QGP) and can be used to study strong electromagnetic (EM) fields. Because the EM fields penetrate the QGP medium, their evolutions are coupled together. In turn, both contribute to the production of photons [1, 2]. Usually, the EM field modifications are considered separately from the evolution of the QGP. Instead, we model the dynamic evolution of the QGP and EM fields together using relativistic resistive magneto-hydrodynamics (RRMHD) [2]. Our RRMHD model is unique for heavy-ion collisions because it includes a finite scalar electrical conductivity. That conductivity acts as a dissipative correction in the distribution function of QGP, similar to viscosity. This alters the yield and flow of photons, and results in energy loss for jets. We will give a detailed discussion on how our RRMHD model is connected to the EM dissipative corrections of QGP. Also, we will introduce some possible methods to study the electrical conductivity of QGP.
[1] Sun and Yan, Phys. Rev.C 109, 034917 (2024)
[2] K. Tuchin, Advances in High Energy Physics 2013, 1 (2013)
[3] Nakamura, Miyoshi, Nonaka, and Takahashi, Phys.Rev.C 107, 014901 (2023)
Nakamura, Miyoshi, Nonaka, and Takahashi, Eur.Phys. J.C 83, 229 (2023)
Nakamura, Miyoshi, Nonaka, and Takahashi, Phys.Rev.C 107, 034912 (2023)

Category

Theory

Collaboration

Primary author: BENOIT, Nicholas (Hiroshima University)

Co-authors: SAKAI, Azumi; NONAKA, Chiho; TAKAHASHI, Hiroyuki (Komazawa University); MIYOSHI, Takahiro (Hiroshima University (JP))

Presenter: BENOIT, Nicholas (Hiroshima University)

Session Classification: Session 3

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

Heavy quark transport: from heavy flavor hadrons to heavy flavor jets

Sunday 29 September 2024 17:30 (20 minutes)

We develop a linear Boltzmann transport model to describe the evolution of heavy and light flavor partons inside the QGP. By taking into account both elastic and inelastic scattering processes and both Yukawa (perturbative) and string (non-perturbative) interactions, we provide a good description of open heavy flavor hadron phenomenology from low to high transverse momenta. This model is then implemented to investigate the nuclear modification of B_c mesons, where we find sensitivities of their dissociation and regeneration processes to the interaction dynamics between heavy quarks and the QGP. In the end, we extend our study from heavy flavor hadrons to heavy flavor jets, and explore the effects of parton energy loss, medium-induced gluon emission, and jet-induced medium excitation on the energy-energy correlations (EECs) inside jets. By comparing the EECs between light flavor jets, D-tagged jets and B-tagged jets in proton-proton and nucleus-nucleus collisions, we find a clear flavor hierarchy of EECs at small angles between jet constituents, signifying the dead cone effect on both vacuum and medium-modified parton showers. Medium-induced gluon emission and jet-induced medium excitation are shown to play essential roles in enhancing the EECs at large angles.

Category

Theory

Collaboration

Primary author: CAO, Shanshan (Shandong University)

Co-authors: Ms XING, Wen-Jing (CCNU); Ms ZHANG, Lejing (Shandong University); QIN, Guang-You (Central China Normal University)

Presenter: CAO, Shanshan (Shandong University)

Session Classification: Session 10

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

Beyond isolating perturbative QCD splittings in heavy-ion collisions

Sunday 29 September 2024 16:00 (20 minutes)

We propose a novel approach to investigate the evolution of jets in heavy-ion collisions by employing a combination of jet substructure measurements. Our method focuses on isolating the perturbative regime of jet evolution. As a proof of concept, we analyze the distribution of the hardest splitting above a transverse momentum scale, $k_{t,\mathrm{cut}}$, in high-p_T jets. For a $k_{t,\mathrm{cut}}$ that is significantly greater than any medium scale, the observable is determined by vacuum-like emissions. Therefore, it serves as a unique baseline independent of the medium modeling. Furthermore, a moderate enhances the sensitivity to energy loss, specifically highlighting the presence of a critical resolution angle. Finally, our main focus in this talk is at low $k_{t,\mathrm{cut}}$, where the observable becomes sensitive to induced emissions and medium response. We validate the generality of our findings using various heavy-ion event generators, including Hybrid, JetMed, Jewel, and Matter+LBT/MARTINI models. Consequently, these substructure measurements can serve as a valuable guideline for future model developments, effectively disentangling different medium contributions. Our study paves the way for the definition of jet observables that can be calculated from first principles, dominated by perturbative QCD, and within the experimental reach of Run3 at the LHC.

[1] L. Cunqueiro, D. Pablos, A. Soto-Ontoso, M. Spousta, A. Takacs, M. Verweij, arXiv:2311.07643

Category

Theory

Collaboration

Primary authors: TAKACS, Adam (Heidelberg University); SOTO ONTOSO, Alba (CERN); Dr PABLOS, Daniel (INFN Torino); CUNQUEIRO MENDEZ, Leticia (Roma Sapienza University); VERWEIJ, Marta (Utrecht University (NL)); SPOUSTA, Martin (Charles University (CZ))

Presenter: TAKACS, Adam (Heidelberg University)

Session Classification: Session 9

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

Minijet quenching in non-equilibrium quark-gluon plasma

Sunday 29 September 2024 11:30 (30 minutes)

We study the energy deposition and thermalisation of high-momentum on-shell partons (minijets) travelling through a non-equilibrium Quark-Gluon Plasma using QCD kinetic theory. For thermal backgrounds, we show that the parton energy first flows to the soft sector by collinear cascade and then isotropises via elastic scatterings. In contrast, the momentum deposition from a minijet reaches the equilibrium distribution directly. For expanding non-equilibrium QGP, we study the time for a minijet perturbation to lose memory of its initial conditions, namely, the hydrodynamisation time. We show that the minijet evolution scales well with the characteristic relaxation time.

Category

Theory

Collaboration

Primary authors: Dr MAZELIAUSKAS, Aleksas (Heidelberg University (DE)); BREWER, Jasmine Therese (University of Oxford (GB)); ZHOU, Luyao Fabian (ITP Heidelberg)

Presenter: ZHOU, Luyao Fabian (ITP Heidelberg)

Session Classification: Session 7

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

No-quenching baseline for energy-loss signals in oxygen-oxygen collisions

Sunday 29 September 2024 15:10 (20 minutes)

In this work, we perform computations of inclusive jet and semi-inclusive jet-hadron cross sections for minimum-bias oxygen-oxygen collisions at RHIC and LHC collision energies. We compute the no-quenching baseline for the jet nuclear modification factor R_{AA} and jet-, and hadron-triggered semi-inclusive nuclear modification factors I_{AA}. We do this with state-of-the-art nuclear parton distribution functions, NLO matrix elements and parton shower. We show significant deviations from unity due to cold-nuclear matter effects even in the absence of quenching. We demonstrate that the nPDF uncertainties constitute a major limitation in detecting potentially small energy loss effects in small collision systems. Hadron-triggered observables are in particular sensitive to uncertainties due to the non-trivial correlation of the trigger hadron and analyzed particles. For jet-triggered I_{AA}, there exist kinematic regions in which errors cancel down to 2\%, overcoming the main limitation of small-system energy loss measurements.

Category

Theory

Collaboration

Primary authors: TAKACS, Adam (Heidelberg University); Dr MAZELIAUSKAS, Aleksas (Heidelberg University (DE)); GEBHARD, Jannis (Heidelberg University)

Presenter: Dr MAZELIAUSKAS, Aleksas (Heidelberg University (DE))

Session Classification: Session 8

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

Momentum broadening in strongly coupled N=4 Yang-Mills theory revisited

Saturday 28 September 2024 14:50 (20 minutes)

Due to the strongly coupled nature of quark-gluon plasma (QGP) formed in heavy-ion collisions, and the notorious difficulties in carrying out QCD calculations at realistic values of the coupling, supersymmetric N=4 Yang-Mills theory at large N_c has served as a highly helpful reference point to gain intuition on aspects of the strongly coupled physics of QGP.

In this work, we revisit the setup of the independent calculations by [1], and by [2] of the momentum broadening (MB) coefficient of a heavy quark propagating through a strongly coupled N=4 plasma, and the calculation by [3] of the MB coefficient of a highly energetic, light like particle through the same plasma. At the time, both MB coefficients were regarded as unconnected due to the different kinematic regimes in which each calculation was set up.
We show that these coefficients are, in fact, two different features of a common distribution: the probability distribution for a hard particle to change its momentum by given amounts. We calculate this distribution and show that the results of [1, 2] correspond to the MB of a particle that has lost a certain amount of energy and that the result of [3] corresponds to the transverse MB of a particle that does not lose any energy.

Our calculation allows us to obtain, for the first time, nontrivial correlations between MB and energy loss of a hard particle propagating through strongly coupled plasma.

[1] hep-th/0612143
[2] hep-th/0701123
[3] hep-ph/0605178

Category

Theory

Collaboration

Primary authors: SCHEIHING HITSCHFELD, Bruno Sebastian (Massachusetts Institute of Technology); RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US)); WIEDEMANN, Urs (CERN)

Presenter: SCHEIHING HITSCHFELD, Bruno Sebastian (Massachusetts Institute of Technology)

Session Classification: Session 3

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

Soft-hard correlations in small systems

Sunday 29 September 2024 14:50 (20 minutes)

Collisions of small systems like pp and p+A remain one of the least understood scenarios of the heavy ion interactions. Limited ability to control the collisional geometry requires new observables, novel experimental approaches, and more sensitive analysis techniques. Such are available, in particular, by measuring heavy quarkonia states that offer an alternative classification scheme of interactions in small systems and allow us to compare them. A wealth of new measurements of soft-hard correlations in interactions with the heavy quarkonia final states have emerged from the LHC experiments. The results produced by all four LHC detectors show that the quarkonia production rates are modified due to the interaction with soft particles coming from the underlying event.

The talk will review recent experimental results, provide possible theoretical explanations, attempt to assess what other observables can be involved, and trigger the discussion about new experimental approaches to tackle the small system problem.

Category

Experiment

Collaboration

Primary author: MILOV, Alexander (Weizmann Institute of Science (IL))

Presenter: MILOV, Alexander (Weizmann Institute of Science (IL))

Session Classification: Session 8

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

Flavor dependence of jet quenching in heavy-ion collisions from a Bayesian analysis

Sunday 29 September 2024 17:10 (20 minutes)

We investigate the flavor dependence of jet quenching, by performing a systematic analysis of medium modifications on the inclusive jet, γ+jet, and b-jet in Pb+Pb collisions at the LHC. Our results from MadGraph+PYTHIA exhibit excellent agreement with experimental measurements of the inclusive jet, γ+jet and b-jet simultaneously in p+p collisions. We then utilize a Bayesian data-driven method to extract systematically the flavor-dependent jet energy loss distributions from experimental data, where the gluon, light quark and b-quark initiated energy loss distributions are well constrained and satisfy the predicted flavor hierarchy of jet quenching, i.e. $\langle \Delta E_g \rangle > \langle \Delta E_q \rangle > \langle \Delta E_b \rangle$. It is shown that the quark-initiated jet energy loss distribution shows weaker centrality and $p_{\rm T}$ dependence than the gluon-initiated one. We demonstrate the impacts of the slope of initial spectra, color-charge as well as parton mass dependent jet energy attenuation on the γ/b-jet suppression observed in heavy-ion collisions.

Category

Theory

Collaboration

Primary author: Dr ZHANG, Shan-Liang (Hubei University)

Co-authors: Prof. WANG, Enke (South China Normal University); XING, Hongxi (South China Normal University); ZHANG, Ben-Wei (Central China Normal University)

Presenter: Dr ZHANG, Shan-Liang (Hubei University)

Session Classification: Session 10

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

Temperature weighted path lengths in PbPb and isobar collisions

In this talk we will give an overview of temperature-velocity-weighted path lengths in the Trajectum code as traversed by hard probes in PbPb collisions or Ru/Zr and Ne/O isobar collisions. For the latter the number of binary collisions has a strong sensitivity to the neutron skin, which is an interesting observable. For PbPb collisions we elaborate on the difference between in- and out-of-plane hard probes, dijets, and events selected according to their v2 (event shape engineering).

Category

Theory

Collaboration

Primary authors: NIJS, Govert Hugo (CERN); Dr VAN DER SCHEE, Wilke (CERN)

Presenter: Dr VAN DER SCHEE, Wilke (CERN)

Session Classification: Session 9

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

Jet Drift in Heavy Ion Collisions

Saturday 28 September 2024 17:50 (20 minutes)

We introduce a sub-eikonal anisotropic contribution to jet-broadening, "jet drift", that couples to the flow of the nuclear medium, showing that this effect results in a deflection of hard partons, and thus jets, in the direction of the medium flow. Next, we study this effect in both toy models and a full-fledged hybrid transport simulation of $\sqrt{s}$ = 5.02 TeV PbPb collisions at the LHC, tracking trajectories of hard partons with perturbative energy loss and drift. We show that sub-eikonal anisotropic effects, including flow-mediated jet drift, are sensitive to properties of the medium that traditional eikonal isotropic effects are insensitive to, demonstrating that inclusion of these effects leads to modifications to jet and hard particle observables that survive averaging over events. We show that jet drift leads to an enhancement of the elliptic flow (v2) and acoplanarity of hard particles and discuss the implications for jet substructure and medium response effects. Our simulation package (APE) is also capable of studying different collisional energies and systems: critical for understanding dynamical jet-QGP interactions.

Category

Theory

Collaboration

Primary authors: Mr RAHMAN, Hasan (New Mexico State University); Dr VITEV, Ivan (Los Alamos National Lab); Mr BAHDER, Joseph (New Mexico State University); SIEVERT, Matthew (New Mexico State University); Mr BALDONADO, Nicholas (New Mexico State University)

Presenter: Mr RAHMAN, Hasan (New Mexico State University)

Session Classification: Session 5

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

Probing medium response via hadron chemistry around quenched jets

Saturday 28 September 2024 16:20 (20 minutes)

Jet-medium interaction not only leads to the energy loss of jet partons, but also induces medium excitations, such as the Mach cone generated by supersonic partons passing through the QGP. It is currently a hot topic to search for the decisive signal of jet-induced medium excitation in high-energy nuclear collisions. Here we present our recent work on searching for the signature of medium response via hadron chemistry around quenched jets. More specifically, we find that the baryon-to-meson ratio and strangness productin around the triggered jets in heavy-ion collisions are enhanced comapred to proton-proton collisions. Since the deposited energy by the quenched jets can flow to large angles in the medium, such enhancement is stronger for larger values of the relative distance with respect to the jet axis.

Category

Theory

Collaboration

Primary authors: QIN, Guang-You (Central China Normal University); LUO, Ao; Prof. WANG, Enke (South China Normal University); ZHANG, Hanzhong (IOPP, CCNU); CAO, Shanshan (Shandong University); MAO, Yaxian (Central China Normal University CCNU (CN))

Presenter: QIN, Guang-You (Central China Normal University)

Session Classification: Session 4

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

Why and how to measure n-point EECs in heavy ion collisions

Sunday 29 September 2024 16:20 (20 minutes)

Energy-Energy Correlators are a class of jet structure observables that has gained notoriety in recent years. These observables are designed and built from foundational concepts in field theory such as energy fluxes at varying resolution scales and are therefore a direct test of theoretical concepts with experimental measurements. With results from pretty much every experimental collaborations, past and present, in a variety of systems from small to large, we are now able to focus on what we are learning from this data especially with the two-point correlators. In this talk, we focus on heavy ion collisions and highlight the importance of higher point correlators and at the same time discuss how one can go about measuring them, possibly negating the impact of the fluctuating background. We also present a novel application of a machine learning model that is able to quantify the degree of quenching in a jet and use it categorize the varying observations from the n-point energy correlators.

Category

Theory

Collaboration

Primary author: KUNNAWALKAM ELAYAVALLI, Raghav (Vanderbilt University)

Co-authors: Mr SHENG, Junxing (Vanderbilt University); Ms KOH, Rachel (Vanderbilt University); WU, Yilun (Vanderbilt University)

Presenter: KUNNAWALKAM ELAYAVALLI, Raghav (Vanderbilt University)

Session Classification: Session 9

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

What do we learn from the first EEC measurements in PbPb collisions by the CMS collaboration?

Sunday 29 September 2024 09:00 (30 minutes)

The physics of different angular scales can be separated using energy-energy correlators in pp collisions. The first energy-energy correlator measurement in PbPb collisions by the CMS experiment has recently observed this also in the heavy ion environment. Significant modifications in the shape of the correlator are observed in the large angle region, which corresponds to the free quark/gluon phase of the parton shower. This part of the showers happens within quark-gluon plasma in heavy ion collisions, and the modifications cannot be explained by a simple parton energy loss. In this talk, we will explore what physics do we learn from the modifications of the large angle structures in energy-energy correlators.

Category

Experiment

Collaboration

Primary author: VIINIKAINEN, Jussi (Vanderbilt University (US))

Presenter: VIINIKAINEN, Jussi (Vanderbilt University (US))

Session Classification: Session 6

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

Energy correlators in heavy-ion inclusive jets

Sunday 29 September 2024 16:40 (20 minutes)

Energy correlators have been measured in heavy-ion collisions for the first time this year. We present a theoretical description and interpretation of the two-point energy correlator in the collinear limit of inclusive heavy-ion jet samples. Specifically, we focus on describing the effects of selection bias due to energy loss, which manifests as a shift in the transition region of the correlator spectra. Additionally, we propose a new energy correlator observable for inclusive jets that is not sensitive to selection bias. Our results are crucial for understanding these and forthcoming heavy-ion experimental measurements.

Category

Theory

Collaboration

Primary author: ANDRES, Carlota (LIP, Lisbon)

Presenter: ANDRES, Carlota (LIP, Lisbon)

Session Classification: Session 9

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

Search for the diffusion wake via measurements of jet-track correlations

Saturday 28 September 2024 11:00 (30 minutes)

The medium modification induced by jets in heavy ion collisions often manifests as an increase in medium particles in the direction of the parton (the so-called "wake") and a decrease in the opposite direction (the so-called "diffusion wake"). In this talk, we will discuss jet-track correlations measured in photon-jet events from Pb+Pb collisions at 5.02 TeV with the ATLAS detector, in an effort to disentangle the medium modification from other physical effects, such as parton shower modification, and to detect diffusion wake signals. The results do not reveal a significant diffusion wake signal within the current uncertainties. We provide upper limits on the probability, and the CoLBT theory predictions are found to be consistent with the observed data within a 68% confidence interval. Future possible observables will also be discussed.

Category

Experiment

Collaboration

ATLAS

Primary author: GO, Yeonju (Brookhaven National Laboratory (US))

Presenter: GO, Yeonju (Brookhaven National Laboratory (US))

Session Classification: Session 2

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

Overview of experimental medium response signal and insights from theoretical models

Saturday 28 September 2024 09:00 (30 minutes)

Collaboration

Category

Primary author: LEE, Yen-Jie (Massachusetts Inst. of Technology (US))

Presenter: LEE, Yen-Jie (Massachusetts Inst. of Technology (US))

Session Classification: Session 1

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

Thermalization of jets in QCD plasma

Sunday 29 September 2024 11:00 (30 minutes)

Collaboration

Category

Primary author: Dr SOUDI, ismail (University of Jyvaskyla)

Presenter: Dr SOUDI, ismail (University of Jyvaskyla)

Session Classification: Session 7

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

SUBA-Jet framework for jet and medium production in heavy-ion collisions at high energies

Sunday 29 September 2024 14:00 (30 minutes)

Collaboration

Category

Primary author: Dr KARPENKO, Iurii (FNSPE CTU in Prague)

Presenter: Dr KARPENKO, Iurii (FNSPE CTU in Prague)

Session Classification: Session 8

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

Study of jet-induced medium response in high-energy heavy-ion collisions within the CoLBT-hydro model

Saturday 28 September 2024 12:00 (30 minutes)

Collaboration

Category

Primary author: YANG, Zhong (CCNU)

Presenter: YANG, Zhong (CCNU)

Session Classification: Session 2

Contribution ID: **36** Type: **not specified**

Jet substructure in small systems with JEWEL

Sunday 29 September 2024 09:30 (30 minutes)

Collaboration

Category

Primary author: KOLBE, Isobel (University of the Witwatersrand (ZA))

Presenter: KOLBE, Isobel (University of the Witwatersrand (ZA))

Session Classification: Session 6

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

Using the Hybrid Model to Learn How to Visualize, or See Through, Jet Wakes

Saturday 28 September 2024 14:00 (30 minutes)

Collaboration

Category

Primary author: RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

Presenter: RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

Session Classification: Session 3

Contribution ID: **38** Type: **not specified**

Uncovering the wake

Saturday 28 September 2024 11:30 (30 minutes)

Probing jet energy redistribution and broadening with hadron+jet correlations at ALICE and The search for jet scattering and medium response are merged to this talk

Collaboration

Category

Primary authors: NORMAN, Jaime (University of Liverpool (GB)); JACOBS, Peter Martin (Lawrence Berkeley National Lab. (US))

Presenter: JACOBS, Peter Martin (Lawrence Berkeley National Lab. (US))

Session Classification: Session 2

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

Recent progress in inclusive jet measurements with ALICE

Saturday 28 September 2024 09:30 (30 minutes)

Collaboration

Category

Primary author: GRUENWALD, Nadine Alice (Heidelberg University (DE))

Presenter: GRUENWALD, Nadine Alice (Heidelberg University (DE))

Session Classification: Session 1

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

Studies of photon-tagged jets in PbPb and pp collisions with CMS

Sunday 29 September 2024 10:00 (30 minutes)

Collaboration

Category

Primary author: PARK, Molly (Massachusetts Inst. of Technology (US))

Presenter: PARK, Molly (Massachusetts Inst. of Technology (US))

Session Classification: Session 6

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

Study of medium response and electroweak probes with the CMS collaboration

Saturday 28 September 2024 10:00 (30 minutes)

Collaboration

Category

Presenter: Ms CHEN, Yi (Vanderbilt University (US))

Session Classification: Session 1

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

The search for jet scattering and medium response

Collaboration

Category

Primary author: JACOBS, Peter Martin (Lawrence Berkeley National Lab. (US))

Presenter: JACOBS, Peter Martin (Lawrence Berkeley National Lab. (US))

Session Classification: Session 3