

# Abstracta

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## Artigos publicados

[P231-2023] “A 50 l Cygno prototype overground characterization

Amaro, F.D.; Antonietti, R.; Baracchini, E.; Kemp, E.\*; et al.

The nature of dark matter is still unknown and an experimental program to look for dark matter particles in our Galaxy should extend its sensitivity to light particles in the GeV mass range and exploit the directional information of the DM particle motion (Vahsen et al. in CYGNUS: feasibility of a nuclear recoil observatory with directional sensitivity to dark matter and neutrinos, arXiv:2008.12587, 2020). The Cygno project is studying a gaseous time projection chamber operated at atmospheric pressure with a Gas Electron Multiplier (Sauli in Nucl Instrum Meth A 386:531, [https://doi.org/10.1016/S0168-9002\(96\)01172-2](https://doi.org/10.1016/S0168-9002(96)01172-2), 1997) amplification and with an optical readout as a promising technology for light dark matter and directional searches. In this paper we describe the operation of a 50 l prototype named LIME (Long Imaging ModulE) in an overground location at Laboratori Nazionali di Frascati (LNF) of INFN. This prototype employs the technology under study for the 1 cubic meter Cygno demonstrator to be installed at the Laboratori Nazionali del Gran Sasso (LNGS) (Amaro et al. in Instruments 2022, 6(1), <https://www.mdpi.com/2410-390X/6/1/6>, 2022). We report the characterization of LIME with photon sources in the energy range from few keV to several tens of keV to understand the performance of the energy reconstruction of the emitted electron. We achieved a low energy threshold of few keV and an energy resolution over the whole energy range of 10-20%, while operating the detector for several weeks continuously with very high operational efficiency. The energy spectrum of the reconstructed electrons is then reported and will be the basis to identify radio-contaminants of the LIME materials to be removed for future Cygno detectors.

EUROPEAN PHYSICAL JOURNAL C 83[10], 946, 2023. DOI: 10.1140/epjc/s10052-023-11988-9

[P232-2023] “A novel comparison between the annealing kinetics of induced and spontaneous fission tracks in zircon”

Sales, A.S.W.; Dias, A.N.C.; Guedes, S.\*; Tagami, T.; Delgado-Silva, A.D.; Cantao, R.F.; Pereira, V. de Q.

The annealing kinetics of fission tracks in zircon is dependent on the quantity of alpha recoil damage accumulated. This effect must be better understood to improve zircon fission track age interpretation and to enable the safe inference of thermal histories. We conducted annealing experiments on zircon from Pocos de Caldas (ZPC, Brazil) to compare the annealing kinetics of freshly induced fission tracks in pre-heated zircon with the annealing kinetics of spontaneous fission tracks. For reference, we also conducted annealing experiments on spontaneous fission tracks of the Nisatai Dacite (NST) zircon, for which annealing data are available in the literature. ZPC has an age of 81.4 Ma (FT) while NST is younger (21 Ma), but has a higher uranium content, leading to a similar magnitude of alpha recoil damage. Our results indicate that the freshly induced fission tracks in previously annealed zircons are more resistant to annealing than the spontaneous fission tracks in the ZPC sample during initial stages of annealing. However, under advanced annealing conditions, the annealing kinetics of both types of fission tracks appear to converge. It is yet unclear whether this is due to differences in track formation in a damaged structure, by the alpha recoil impacting already formed tracks or by a combination of both. The annealing datasets were used to fit annealing models, whose geological extrapolations yield higher annealing temperatures for the induced than for the spontaneous fission tracks. When a 1 Ma geological natural annealing dataset is included in the fitting, the predicted annealing temperatures fit better to geological constraints, at least in part, mitigating the alpha recoil damage effects.

CHEMICAL GEOLOGY 641, 121763, 2023. DOI: 10.1016/j.chemgeo.2023.121763

[P233-2023] “Accessing the strong interaction between  $\Lambda$  baryons and charged kaons with the femtoscopy technique at the LHC”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guaridiano, G. G.\*; Jahnke, C.\*; Liveraro, G. S. S.\*; Takahashi, J.\*; et al.

ALICE Collaboration

The interaction between  $\Lambda$  baryons and kaons/antikaons is a crucial ingredient for the strangeness  $S=0$  and  $S=-2$  sector of the meson-baryon interaction at low energies. In particular, the  $\Lambda(K)$  over bar might help in understanding the origin of states such as the  $\Xi(1620)$ , whose nature and properties are still under debate. Experimental data on  $\Lambda$ -K and  $\Lambda$ -(K) over bar systems are scarce, leading to large uncertainties and tension between the available theoretical predictions constrained by such data. In this Letter we present the measurements of  $\Lambda$ -K<sup>+</sup> circle plus ( $\Lambda$ ) over bar -K<sup>-</sup> and  $\Lambda$ -K<sup>-</sup> circle plus ( $\Lambda$ ) over bar -K<sup>+</sup> correlations obtained in the high-multiplicity triggered data sample in pp collisions at root s = 13TeV recorded by ALICE at the LHC. The correlation function for both pairs is modeled using the Lednicky-Lyuboshits analytical formula and the corresponding scattering parameters are extracted. The  $\Lambda$ -(K) circle plus ( $\Lambda$ ) over bar -K<sup>+</sup> correlations show the presence of several structures at relative momenta  $k^*$  above 200 MeV/c, compatible with the Omega baryon, the  $\Xi(1690)$ , and  $\Xi(1820)$  resonances decaying into  $\Lambda$ -K pairs. The low  $k^*$  region in the  $\Lambda$ -K<sup>-</sup> circle plus ( $\Lambda$ ) over bar -K<sup>+</sup> also exhibits the presence of the  $\Xi(1620)$  state, expected to strongly couple to the measured pair. The presented data allow to access the  $\Lambda$ -K<sup>+</sup> and  $\Lambda$ -K<sup>-</sup> strong interaction with an unprecedented precision and deliver the first experimental observation of the  $\Xi(1620)$  decaying into  $\Lambda$ -K.

PHYSICS LETTERS B 845, 138145, 2023. DOI: 10.1016/j.physletb.2023.138145

[P234-2023] “Azimuthal anisotropy of dijet events in PbPb collisions at  $\sqrt{s_{NN}}=5.02$  TeV”

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.

CMS Collaboration

The path-length dependent parton energy loss within the dense partonic medium created in lead-lead collisions at a nucleon-nucleon center-of-mass energy of root s(NN) = 5.02TeV is studied by determining the azimuthal anisotropies for dijets with high transverse momentum. The data were collected by the CMS experiment in 2018 and correspond to an integrated luminosity of 1.69 nb<sup>-1</sup>. For events containing back-to-back jets, correlations in relative azimuthal angle and pseudorapidity ( $\eta$ ) between jets and hadrons, and between two hadrons, are constructed. The anisotropies are expressed as the Fourier expansion coefficients  $v(n)$ ,  $n = 2-4$  of these azimuthal distributions. The dijet  $v(n)$  values are extracted from long-range ( $1.5 < \Delta\eta < 2.5$ ) components of these correlations, which suppresses the background contributions from jet fragmentation processes. Positive dijet  $v(2)$  values are observed which increase from central to more peripheral events, while the  $v(3)$  and  $v(4)$  values are consistent with zero within experimental uncertainties.

JOURNAL OF HIGH ENERGY PHYSICS [7], 139, 2023. DOI: 10.1007/JHEP07(2023)139

**[P235-2023] “Azimuthal correlations in Z plus jets events in proton-proton collisions at  $\sqrt{s}=13\text{TeV}$ ”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

The production of Z bosons associated with jets is measured in pp collisions at  $\sqrt{s} = 13$  TeV with data recorded with the CMS experiment at the LHC corresponding to an integrated luminosity of 36.3 fb<sup>-1</sup>. The multiplicity of jets with transverse momentum  $p_T > 30$  GeV is measured for different regions of the Z boson's  $p_T(Z)$ , from lower than 10 GeV to higher than 100 GeV. The azimuthal correlation  $\Delta\phi$  between the Z boson and the leading jet, as well as the correlations between the two leading jets are measured in three regions of  $p_T(Z)$ . The measurements are compared with several predictions at leading and next-to-leading orders, interfaced with parton showers. Predictions based on transverse-momentum dependent parton distributions and corresponding parton showers give a good description of the measurement in the regions where multiple parton interactions and higher jet multiplicities are not important. The effects of multiple parton interactions are shown to be important to correctly describe the measured spectra in the low  $p_T(Z)$  regions.

EUROPEAN PHYSICAL JOURNAL C 83[8], 722, 2023. DOI: 10.1140/epjc/s10052-023-11833-z

**[P236-2023] “Azimuthal correlations of heavy-flavor hadron decay electrons with charged particles in pp and p-Pb collisions at  $\sqrt{s_{NN}}=5.02$  TeV”**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guaridiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The azimuthal ( $\Delta\phi$ ) correlation distributions between heavy-flavor decay electrons and associated charged particles are measured in pp and p-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV. Results are reported for electrons with transverse momentum  $4 < p_T < 16$  GeV/c and pseudorapidity  $|\eta| < 0.6$ . The associated charged particles are selected with transverse momentum  $1 < p_T < 7$  GeV/c, and relative pseudorapidity separation with the leading electron  $|\Delta\eta| < 1$ . The correlation measurements are performed to study and characterize the fragmentation and hadronization of heavy quarks. The correlation structures are fitted with a constant and two von Mises functions to obtain the baseline and the near- and away-side peaks, respectively. The results from p-Pb collisions are compared with those from pp collisions to study the effects of cold nuclear matter. In the measured trigger electron and associated particle kinematic regions, the two collision systems give consistent results. The  $\Delta\phi$  distribution and the peak observables in pp and p-Pb collisions are compared with calculations from various Monte Carlo event generators.

EUROPEAN PHYSICAL JOURNAL C 83[8], 741, 2023. DOI: 10.1140/epjc/s10052-023-11835-x

**[P237-2023] “Beyond the 3rd moment: a practical study of using lensing convergence CDFs for cosmology with DES Y3”**

Anbajagane, D.; Chang, C.; Banerjee, A.; Navarro-Alsina, A.\*; et al.  
Des Collaboration

Widefield surveys probe clustered scalar fields - such as galaxy counts, lensing potential, etc. - which are sensitive to different cosmological and astrophysical processes. Constraining such processes depends on the statistics that summarize the field.

We explore the cumulative distribution function (CDF) as a summary of the galaxy lensing convergence field. Using a suite of N-body light-cone simulations, we show the CDFs' constraining power is modestly better than the second and third moments, as CDFs approximately capture information from all moments. We study the practical aspects of applying CDFs to data, using the Dark Energy Survey (DES Y3) data as an example, and compute the impact of different systematics on the CDFs. The contributions from the point spread function and reduced shear approximation are less than or similar to of the total signal. Source clustering effects and baryon imprints contribute 1-10 per cent. Enforcing scale cuts to limit systematics-driven biases in parameter constraints degrade these constraints a noticeable amount, and this degradation is similar for the CDFs and the moments. We detect correlations between the observed convergence field and the shape noise field at 13 sigma. The non-Gaussian correlations in the noise field must be modelled accurately to use the CDFs, or other statistics sensitive to all moments, as a rigorous cosmology tool.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 526[4], 5530-5554, 2023. DOI: 10.1093/mnras/stad3118

**[P238-2023] “Can tactile reactivity in preterm born infants be explained by an immature cortical response to tactile stimulation in the first year? A pilot study”**

Machado, A.C.C.D.; Magalhaes, L.D.C.; Oliveira, S.R. de; Novi, S.L.\*; Mesquita, R.C.\*; Miranda, D.M. de; Bouzada, M.C.F.

This study aimed to compare preterm (PT) and full-term (FT) infants' adaptive behavior and functional cortical response to tactile stimulus, as measured by Test of Sensory Functions in Infants and functional Near-Infrared Spectroscopy (fNIRS). Outcome measures were taken at 6 (PT = 26/FT = 21 infants) and 12 months (PT = 15/FT = 14 infants). At 6 months, poorer tactile reactivity was observed in PT, but not confirmed at 12 months. At 6 months, cortical response to tactile stimulus was found in the primary sensorimotor cortex and differences between groups did not reach significance. At 12 months, cortical response was found in the primary sensorimotor cortex and premotor area and in the somatosensory associative area, with significant less frequent response in premotor area in PT. The findings reinforce fNIRS as a tool to complement the knowledge of tactile adaptive behaviors in PT in early life.

JOURNAL OF PERINATOLOGY 43[6], 728-734, 2023. DOI: 10.1038/s41372-022-01536-w

**[P239-2023] “CMS PYTHIA 8 colour reconnection tunes based on underlying-event data”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

New sets of parameter tunes for two of the colour reconnection models, quantum chromodynamics-inspired and gluon-move, implemented in the PYTHIA 8 event generator, are obtained based on the default CMS PYTHIA 8 underlying-event tune, CP5. Measurements sensitive to the underlying event performed by the CMS experiment at centre-of-mass energies  $\sqrt{s} = 7$  and 13 TeV, and by the CDF experiment at 1.96 TeV are used to constrain the parameters of colour reconnection models and multiple-parton interactions simultaneously. The new colour reconnection tunes are compared with various measurements at 1.96, 7, 8, and 13 TeV including measurements of the underlying-event, strange-particle multiplicities, jet substructure observables, jet shapes, and colour flow in top quark pair ( $t\bar{t}$ ) events.

The new tunes are also used to estimate the uncertainty related to colour reconnection modelling in the top quark mass measurement using the decay products of  $t$  ( $t$ ) over bar events in the semileptonic channel at 13 TeV.

EUROPEAN PHYSICAL JOURNAL C 83[7], 587, 2023. DOI: 10.1140/epjc/s10052-023-11630-8

[P240-2023] "Combination of inclusive top-quark pair production cross-section measurements using ATLAS and CMS data at  $\sqrt{s}=7$  and 8 TeV"

Aad, G.; Abbott, B.; Abbott, D. C.; Chinellato, J.A.\*; et al. ATLAS Collaboration; ATLAS Collaboration; CMS Collaboration

A combination of measurements of the inclusive top-quark pair production cross-section performed by ATLAS and CMS in proton-proton collisions at centre-of-mass energies of 7 and 8 TeV at the LHC is presented. The cross-sections are obtained using top-quark pair decays with an opposite-charge electron-muon pair in the final state and with data corresponding to an integrated luminosity of about 5 fb<sup>-1</sup> at root s = 7 TeV and about 20 fb<sup>-1</sup> at root s = 8 TeV for each experiment. The combined cross-sections are determined to be 178.5 +/- 4.7 pb at root s = 7 TeV and 243.3(-5.9)(+6.0) pb at root s = 8 TeV with a correlation of 0.41, using a reference top-quark mass value of 172.5 GeV. The ratio of the combined crosssections is determined to be  $R=8/7 = 1.363 \pm 0.032$ . The combined measured cross-sections and their ratio agree well with theory calculations using several parton distribution function (PDF) sets. The values of the top-quark pole mass (with the strong coupling fixed at 0.118) and the strong coupling (with the top-quark pole mass fixed at 172.5 GeV) are extracted from the combined results by fitting a next-to-next-to-leading-order plus next-to-next-to-leading-log QCD prediction to the measurements. Using a version of the NNPDF3.1 PDF set containing no top-quark measurements, the results obtained are  $m(t)(\text{pole}) = 173.4(-2.0)(+1.8)$  GeV and  $\alpha_s(m(Z)) = 0.1170(-0.0018)(+0.0021)$ .

JOURNAL OF HIGH ENERGY PHYSICS [7], 213, 2023. DOI: 10.1007/JHEP07(2023)213

[P241-2023] "Connecting  $(g-2)\mu$  to neutrino mass in the extended neutrinophilic 2HDM"

Cherchiglia, A. L.\*; De Conto, G.; Nishi, C. C.

One simple way to lower the scale of the seesaw mechanism that generates neutrino masses is to attribute part of their smallness to a suppressed vacuum expectation value of a second Higgs doublet as in the neutrinophilic 2HDM or in the type IB seesaw model. On that structure we add one charged singlet scalar to induce a chirally enhanced contribution to  $(g-2)(\mu)$  with the same righthanded neutrinos of the seesaw. We discuss the interplay of generating the necessary contribution to the latter with lepton flavor violation which is also necessarily brought to low scale. We show that it is possible to explain  $(g-2)(\mu)$  even for heavy neutrino masses of order of a few TeV.

JOURNAL OF HIGH ENERGY PHYSICS [8], 170, 2023. DOI: 10.1007/JHEP08(2023)170

[P242-2023] "Constraints on anomalous Higgs boson couplings to vector bosons and fermions from the production of Higgs bosons using the  $t\bar{t}$  final state"

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al. CMS Collaboration

A study of anomalous couplings of the Higgs boson to vector bosons and fermions is presented. The data were recorded by the CMS experiment at a center-of-mass energy of pp collisions at the LHC of 13 TeV and correspond to an integrated luminosity of 138 fb<sup>-1</sup>. The study uses Higgs boson candidates produced mainly in gluon fusion or electroweak vector boson fusion at the LHC that subsequently decay to a pair of  $z$  leptons. Matrix-element and machine-learning techniques were employed in a search for anomalous interactions. The results are combined with those from the four-lepton and two-photon decay channels to yield the most stringent constraints on anomalous Higgs boson couplings to date. The pure CP-odd scenario of the Higgs boson coupling to gluons is excluded at 2.4 standard deviations. The results are consistent with the standard model predictions.

PHYSICAL REVIEW D 108[3], 032013, 2023. DOI: 10.1103/PhysRevD.108.032013

[P243-2023] "Contraction Velocity of the Elbow Flexors Assessed by Tensiomyography: A Comparison Between Formulas"

Mesquita, R. N. O.; Latella, C.; Ruas, C.V.\*; Nosaka, K.; Taylor, J.L.

Contraction velocity of the elbow flexors assessed by tensiomyography: A comparison between formulas. J Strength Cond Res 37(10): 1969-1977, 2023-Muscle contraction velocity (Vc) assessed by tensiomyography is a promising measure for athlete profiling. Multiple formulas are used to estimate Vc, but the most suitable method is yet to be established. Fifteen adults (2 female subjects) underwent tensiomyography assessment of biceps brachii muscle at 10, 45 and 90 & DEG; of elbow flexion on 2 separate days. Vc was calculated using 6 formulas. Formulas 1 and 2 are measures of the early phase of the twitch; Formulas 3-5 are measures over a wider time-window, with Formula 5 normalizing Vc to maximal displacement (Dm); and we proposed Formula 6 as a measure of peak Vc. Test-retest reliability, the required minimum number of trials, proportional bias, and effects of joint angle were investigated. Higher reliability (coefficient of variation: 2.8-6.9%) was found for Formula 1 (0-2 mm of displacement) and Formula 5 (normalized 10-90% of Dm). Overall, a minimum of 6-7 trials was required to obtain reliable estimates. For 10 & DEG; only, significant positive proportional bias ( $r = 0.563-0.670$ ) was found for all formulas except Formula 5. Vc was faster ( $p < 0.001$ ) at shorter muscle lengths for all formulas except Formula 5 ( $p = 0.06$ ). Vc in the early phase of the twitch was more reliable when calculated using absolute displacement (Formula 1) than a relative threshold (Formula 2). Over a larger time-window, Formulas 3 and 4 were similarly reliable. Because they are derived from different components of the twitch and different parameters, the different formulas should not be used interchangeably. Additionally, more precise nomenclature is required to describe the information obtained from each formula.

JOURNAL OF STRENGTH AND CONDITIONING RESEARCH 37[10], 1969-1977, 2023. DOI: 10.1519/JSC.0000000000004495

[P244-2023] "Deciphering Interactions between Potential Inhibitors and the Plasmodium falciparum DHODH Enzyme: a computational perspective"

Costa, A.H.L.; Bezerra, K.S.\*; Lima Neto, J.X. de; Oliveira, J.I.N.; Galvao, D.S.\*; Fulco, U.L.

Malaria is a parasitic disease that, in its most severe form, can even lead to death. Insect-resistant vectors, insufficiently effective vaccines, and drugs that cannot stop parasitic infestations are making the fight against the disease increasingly difficult. It is known that the enzyme dihydroorotate dehydrogenase (DHODH) is of paramount importance for the synthesis of pyrimidine from the Plasmodium precursor, that is,

for its growth and reproduction. Therefore, its blockade can lead to disruption of the parasite's life cycle in the vertebrate host. In this scenario, PfDHODH inhibitors have been considered candidates for a new therapy to stop the parasitic energy source. Given what is known, in this work, we applied molecular fractionation with conjugated caps (MFCC) in the framework of the quantum formalism of density functional theory (DFT) to evaluate the energies of the interactions between the enzyme and the different triazolopyrimidines (DSM483, DMS557, and DSM1), including a complex carrying the mutation C276F. From these results, it was possible to identify the main features of each system, focusing on the wild-type and mutant PfDHODH and examining the major amino acid residues that are part of the four complexes. Our analysis provides new information that can be used to develop new drugs that could prove to be more effective alternatives to present antimalarial drugs.

**JOURNAL OF PHYSICAL CHEMISTRY B 127[44], 9461-9475, 2023. DOI: 10.1021/acs.jpccb.3c05738**

**[P245-2023] "Electron ionization induced fragmentation pathways of trichloroanisole"**

Mendes, M.; Bou-Debes, D.; Eden, S.; Bundaleski, N.; Teodoro, O.M.N.D.; Cornetta, L.M.\*; Silva, F.F. da

Trichloroanisole (TCA) is one of the most significant contaminants in cork stoppers. The presence of TCA leads to an unpleasant odor known as "cork taint", resulting in high economic losses for the cork and wine industries. Hence, the detection, quantification, and characterization of TCA are essential to address this concern. The present study investigates the electron-driven fragmentation pathways of TCA through electron ionization mass spectrometry as a function of electron energy (0-100 eV), and the results are supported by theoretical characterization of ionization potentials, dissociation thresholds, and electron ionization cross sections. The appearance energies of ten cations were measured, including the first experimental evaluation of the molecule's ionization energy at 8.8 & PLUSMN; 0.3 eV, in excellent agreement with the calculations (8.83 eV). For lower energies, around 20 eV, the parent cation accounted for more than 60% of the total ion signal, followed by its demethylated fragment. Taken together, these ion signals could be used as fingerprints of TCA in industrial quality control by low-energy electron ionization mass spectrometry. Fifty other fragments have been identified at higher electron energies, revealing the very rich fragmentation pattern of TCA. This work probes electron-driven ionization of TCA. New fragment ions are identified by mass spectrometry and experimental appearance energies show excellent agreement with calculated threshold energies for the most significant pathways.

**PHYSICAL CHEMISTRY CHEMICAL PHYSICS 25[37], 25361-25367, 2023. DOI: 10.1039/d3cp02019c**

**[P246-2023] "Elliptic flow of charged particles at midrapidity relative to the spectator plane in Pb-Pb and Xe-Xe collisions"**

Acharya, S.; Adamova, D.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Measurements of the elliptic flow coefficient relative to the collision plane defined by the spectator neutrons  $v(2)\{\Psi(SP)\}$  in collisions of Pb ions at center-of-mass energy per nucleon-nucleon pair  $\sqrt{s(NN)} = 2.76$  TeV and Xe ions at  $\sqrt{s(NN)} = 5.44$  TeV are reported. The results are presented for charged particles produced at midrapidity as a function of centrality and transverse momentum for the 5-70% and 0.2-6 GeV/c ranges, respectively.

The ratio between  $v(2)\{\Psi(SP)\}$  and the elliptic flow coefficient relative to the participant plane  $v(2)\{4\}$ , estimated using four-particle correlations, deviates by up to 20% from unity depending on centrality. This observation differs strongly from the magnitude of the corresponding eccentricity ratios predicted by the T(R)ENTo and the elliptic power models of initial state fluctuations that are tuned to describe the participant plane anisotropies. The differences can be interpreted as a decorrelation of the neutron spectator plane and the reaction plane because of fragmentation of the remnants from the colliding nuclei, which points to an incompleteness of current models describing the initial state fluctuations. A significant transverse momentum dependence of the ratio  $v(2)\{\Psi(SP)\}/v(2)\{4\}$  is observed in all but the most central collisions, which may help to understand whether momentum anisotropies at low and intermediate transverse momentum have a common origin in initial state fluctuations. The ratios of  $v(2)\{\Psi(SP)\}$  and  $v(2)\{4\}$  to the corresponding initial state eccentricities for Xe-Xe and Pb-Pb collisions at similar initial entropy density show a difference of (7.0 +/- 0.9)% with an additional variation of +1.8% when including RHIC data in the T(R)ENTo parameter extraction. These observations provide new experimental constraints for viscous effects in the hydrodynamic modeling of the expanding quark-gluon plasma produced in heavy-ion collisions at the LHC.

**PHYSICS LETTERS B 846, 137453, 2023. DOI: 10.1016/j.physletb.2022.137453**

**[P247-2023] "Enhanced Deuteron Coalescence Probability in Jets"**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The transverse-momentum (pT) spectra and coalescence parameters B-2 of (anti)deuterons are measured for p-p collisions at  $\sqrt{s} = 13$  TeV for the first time in and out of jets. In this measurement, the direction of the leading particle with the highest pT in the event ( $p(T)(lead) > 5$  GeV/c) is used as an approximation for the jet axis. The event is consequently divided into three azimuthal regions, and the jet signal is obtained as the difference between the toward region, that contains jet fragmentation products in addition to the underlying event (UE), and the transverse region, which is dominated by the UE. The coalescence parameter in the jet is found to be approximately a factor of 10 larger than that in the underlying event. This experimental observation is consistent with the coalescence picture and can be attributed to the smaller average phase-space distance between nucleons in the jet cone as compared with the underlying event. The results presented in this Letter are compared to predictions from a simple nucleon coalescence model, where the phase-space distributions of nucleons are generated using PYTHIA8 with the Monash 2013 tuning, and to predictions from a deuteron production model based on ordinary nuclear reactions with parametrized energy-dependent cross sections tuned on data. The latter model is implemented in PYTHIA8.3. Both models reproduce the observed large difference between in-jet and out-of-jet coalescence parameters, although the almost flat trend of the B-Jet (2) is not reproduced by the models, which instead give a decreasing trend.

**PHYSICAL REVIEW LETTERS 131[4], 042301, 2023. DOI: 10.1103/PhysRevLett.131.042301**

**[P248-2023] "First Measurement of Antideuteron Number Fluctuations at Energies Available at the Large Hadron Collider"**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The first measurement of event-by-event antideuteron number fluctuations in high energy heavy-ion collisions is presented. The measurements are carried out at midrapidity ( $1 < 0.8$ ) as a function of collision centrality in Pb-Pb collisions at  $\sqrt{s} = 5.02$  TeV using the ALICE detector. A significant negative correlation between the produced antiprotons and antideuterons is observed in all collision centralities. The results are compared with a state-of-the-art coalescence calculation. While it describes the ratio of higher order cumulants of the antideuteron multiplicity distribution, it fails to describe quantitatively the magnitude of the correlation between antiproton and antideuteron production. On the other hand, thermal-statistical model calculations describe all the measured observables within uncertainties only for correlation volumes that are different with respect to those describing proton yields and a similar measurement of net-proton number fluctuations.

**PHYSICAL REVIEW LETTERS 131[4], 041901, 2023. DOI: 10.1103/PhysRevLett.131.041901**

**[P2492023] “First measurement of the A-E interaction in proton-proton collisions at the LHC”**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiani, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The first experimental information on the strong interaction between A and E-strange baryons is presented in this Letter. The correlation function of A-E and A-E+ pairs produced in high-multiplicity proton-proton (pp) collisions at  $\sqrt{s} = 13$  TeV at the LHC is measured as a function of the relative momentum of the pair. The femtoscopy method is used to calculate the correlation function, which is then compared with theoretical expectations obtained using a meson exchange model, chiral effective field theory, and Lattice QCD calculations close to the physical point. Data support predictions of small scattering parameters while discarding versions with large ones, thus suggesting a weak A-E interaction. The limited statistical significance of the data does not yet allow one to constrain the effects of coupled channels like E-E and N-S2. & COPY; 2022 European Organization for Nuclear Research, ALICE.

**PHYSICS LETTERS B 844, 137223, 2023. DOI: 10.1016/j.physletb.2022.137223**

**[P250-2023] “First measurement of the top quark pair production cross section in proton-proton collisions at  $\sqrt{s}=13.6$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

The first measurement of the top quark pair ( $t\bar{t}$ ) over bar production cross section in proton-proton collisions at  $\sqrt{s} = 13.6$  TeV is presented. Data recorded with the CMS detector at the CERN LHC in Summer 2022, corresponding to an integrated luminosity of  $1.21 \text{ fb}^{-1}$ , are analyzed. Events are selected with one or two charged leptons (electrons or muons) and additional jets. A maximum likelihood fit is performed in event categories defined by the number and flavors of the leptons, the number of jets, and the number of jets identified as originating from b quarks. An inclusive  $t\bar{t}$  over bar production cross section of  $881 \pm 23$  (stat + syst)  $\pm 20$  (lumi) pb is measured, in agreement with the standard model prediction of  $924(-40)(+32)$  pb.

**JOURNAL OF HIGH ENERGY PHYSICS [8], 204, 2023. DOI: 10.1007/JHEP08(2023)204**

**[P251-2023] “Functionalization of breast implants by cyclodextrin in-situ polymerization: a local drug delivery system for augmentation mammoplasty”**

Escobar, K.; Carrera, I.; Naveas, N.; Pulido, R.; Manso, M.; Guarnieri, J.P. de O.; Lancellotti, M.; Cotta, M.A.\*; Corrales-Ureña, Y.R.; Rischka, K.; Hernandez-Montelongo, J.

Mammoplasty is a widely performed surgical procedure worldwide, utilized for breast reconstruction, in the context of breast cancer treatment, and aesthetic purposes. To enhance post-operative outcomes and reduce risks (hematoma with required evacuation, capsular contracture, implant-associated infection and others), the controlled release of medicaments can be achieved using drug delivery systems based on cyclodextrins (CDs). In this study, our objective was to functionalize commercially available silicone breast implants with smooth and textured surfaces through in-situ polymerization of two CDs: beta-CD/citric acid and 2-hydroxypropyl-beta-CD/citric acid. This functionalization serves as a local drug delivery system for the controlled release of therapeutic molecules that potentially can be a preventive treatment for post-operative complications in mammoplasty interventions. Initially, we evaluated the pre-treatment of sample surfaces with  $O_2$  plasma, followed by chitosan grafting. Subsequently, in-situ polymerization using both types of CDs was performed on implants. The results demonstrated that the proposed pre-treatment significantly increased the polymerization yield. The functionalized samples were characterized using microscopic and physicochemical techniques. To evaluate the efficacy of the proposed system for controlled drug delivery in augmentation mammoplasty, three different molecules were utilized: pirfenidone (PFD) for capsular contracture prevention, Rose Bengal (RB) as anticancer agent, and KR-12 peptide (KR-12) to prevent bacterial infection. The release kinetics of PFD, RB, and KR-12 were analyzed using the Korsmeyer-Peppas and monolithic solution mathematical models to identify the respective delivery mechanisms. The antibacterial effect of KR-12 was assessed against *Staphylococcus epidermidis* and *Pseudomonas aeruginosa*, revealing that the antibacterial rate of functionalized samples loaded with KR-12 was dependent on the diffusion coefficients. Finally, due to the immunomodulatory properties of KR-12 peptide on epithelial cells, this type of cells was employed to investigate the cytotoxicity of the functionalized samples. These assays confirmed the superior properties of functionalized samples compared to unprotected implants.

**FRONTIERS IN BIOENGINEERING AND BIOTECHNOLOGY 11, 1254299, 2023. DOI: 10.3389/fbioe.2023.1254299**

**[P252-2023] “Graph analysis of cortical reorganization after virtual reality-based rehabilitation following stroke: a pilot randomized study”**

Feitosa, J.A.\*; Casseb, R.F.; Camargo, A.; Brandao, A.F.\*; Li, L.M.; Castellano, G.\*

Introduction: Stroke is the leading cause of functional disability worldwide. With the increase of the global population, motor rehabilitation of stroke survivors is of ever-increasing importance. In the last decade, virtual reality (VR) technologies for rehabilitation have been extensively studied, to be used instead of or together with conventional treatments such as physiotherapy or occupational therapy. The aim of this work was to evaluate the GestureCollection VR-based rehabilitation tool in terms of the brain changes and clinical outcomes of the patients. Methods: Two groups of chronic patients underwent a rehabilitation treatment with (experimental) or without (control) complementation with GestureCollection. Functional magnetic resonance imaging exams and clinical assessments were performed before and after the treatment. A functional connectivity graph-based analysis was used to assess differences between the connections and in the network parameters strength and clustering coefficient.

Results: Patients in both groups showed improvement in clinical scales, but there were more increases in functional connectivity in the experimental group than in the control group. Discussion: The experimental group presented changes in the connections between the frontoparietal and the somatomotor networks, associative cerebellum and basal ganglia, which are regions associated with reward-based motor learning. On the other hand, the control group also had results in the somatomotor network, in its ipsilateral connections with the thalamus and with the motor cerebellum, which are regions more related to a purely mechanical activity. Thus, the use of the GestureCollection system was successfully shown to promote neuroplasticity in several motor-related areas.

FRONTIERS IN NEUROLOGY 14, 1241639, 2023. DOI: 10.3389/fneur.2023.1241639

[P253-2023] “Inclusive and multiplicity dependent production of electrons from heavy-flavour hadron decays in pp and p-Pb collisions”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Measurements of the production of electrons from heavy-flavour hadron decays in pp collisions at  $\sqrt{s} = 13$  TeV at midrapidity with the ALICE detector are presented down to a transverse momentum ( $p(T)$ ) of 0.2 GeV/c and up to  $p(T) = 35$  GeV/c, which is the largest momentum range probed for inclusive electron measurements in ALICE. In p-Pb collisions, the production cross section and the nuclear modification factor of electrons from heavy-flavour hadron decays are measured in the  $p(T)$  range  $0.5 < p(T) < 26$  GeV/c at  $\sqrt{s(NN)} = 8.16$  TeV. The nuclear modification factor is found to be consistent with unity within the statistical and systematic uncertainties. In both collision systems, first measurements of the yields of electrons from heavy-flavour hadron decays in different multiplicity intervals normalised to the multiplicity-integrated yield (self-normalised yield) at midrapidity are reported as a function of the self-normalised charged-particle multiplicity estimated at midrapidity. The self-normalised yields in pp and p-Pb collisions grow faster than linear with the self-normalised multiplicity. A strong  $p(T)$  dependence is observed in pp collisions, where the yield of high- $p(T)$  electrons increases faster as a function of multiplicity than the one of low- $p(T)$  electrons. The measurement in p-Pb collisions shows no  $p(T)$  dependence within uncertainties. The self-normalised yields in pp and p-Pb collisions are compared with measurements of other heavy-flavour, light-flavour, and strange particles, and with Monte Carlo simulations.

JOURNAL OF HIGH ENERGY PHYSICS 8, 006, 2023. DOI: 10.1007/JHEP08(2023)006

[P254-2023] “Inclusive photon production at forward rapidities in pp and p-Pb collisions at  $\sqrt{sNN}=5.02$  TeV”

Acharya, S.; Adamová, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

A study of multiplicity and pseudorapidity distributions of inclusive photons measured in pp and p-Pb collisions at a center-of-mass energy per nucleon-nucleon collision of  $\sqrt{s(NN)} = 5.02$  TeV using the ALICE detector in the forward pseudorapidity region  $2.3 < \eta(\text{lab}) < 3.9$  is presented. Measurements in p-Pb collisions are reported for two beam configurations in which the directions of the proton and lead ion beam were reversed. The pseudorapidity distributions in p-Pb collisions are obtained for seven centrality classes which are defined based on different event activity estimators, i.e.,

the charged-particle multiplicity measured at midrapidity as well as the energy deposited in a calorimeter at beam rapidity. The inclusive photon multiplicity distributions for both pp and p-Pb collisions are described by double negative binomial distributions. The pseudorapidity distributions of inclusive photons are compared to those of charged particles at midrapidity in pp collisions and for different centrality classes in p-Pb collisions. The results are compared to predictions from various Monte Carlo event generators. None of the generators considered in this paper reproduces the inclusive photon multiplicity distributions in the reported multiplicity range. The pseudorapidity distributions are, however, better described by the same generators.

EUROPEAN PHYSICAL JOURNAL C 83[7], 661, 2023. DOI: 10.1140/epjc/s10052-023-11729-y

[P255-2023] “Infrared subtleties and chiral vertices at NLO: an implicit regularization analysis”

Rosado, R.J.C.; Cherchiglia, A.\*; Sampaio, M.; Hiller, B.

We employ implicit regularization (IReg) in quark-antiquark decays of the Z, or of a scalar (CP-even or odd) boson at NLO, and compare with dimensional schemes to reveal subtleties involving infrared divergence cancellation and  $\gamma(5)$ -matrix issues. Besides the absence of evanescent fields in IReg, such as epsilon-scalars required in certain schemes that operate partially in the physical dimension, we verify that our procedure preserves gauge invariance in the presence of the  $\gamma(5)$  matrix without requiring symmetry preserving counterterms while the amplitude is infrared finite as stated by the KLN theorem.

EUROPEAN PHYSICAL JOURNAL C 83[9], 879, 2023. DOI: 10.1140/epjc/s10052-023-12052-2

[P256-2023] “Interplays between classical and quantum entanglement-assisted communication scenarios”

Vieira, C.; Gois, C. de; Pollyceno, L.\*; Rabelo, R.\*

Prepare-and-measure scenarios (pm), in their many forms, can be seen as the basic building blocks of communication tasks. As such, they can be used to analyze a diversity of classical and quantum protocols-of which dense coding and random access codes are key examples-in a unified manner. In particular, the use of entanglement as a resource in pm scenarios have only recently started to be systematically investigated, and many crucial questions remain open. In this work, we explore such scenarios and provide answers to some seminal questions. More specifically, we show that, in scenarios where entanglement is a free resource, quantum messages are equivalent to classical ones with twice the capacity. We also prove that, in such scenarios, it is always advantageous for the parties to share entangled states of dimension greater than the transmitted message. Finally, we show that unsteerable states cannot provide advantages in classical communication tasks, thus proving that not all entangled states are useful resources in these scenarios.

NEW JOURNAL OF PHYSICS 25[11], 113004, 2023. DOI: 10.1088/1367-2630/ad0526

[P257-2023] “Iron Oxide Nanoparticles in a Dynamic Flux: Magnetic Hyperthermia Effect on Flowing Heavy Crude Oil”

Brollo, M.E.F.\*; Pinheiro, I.F.; Bassani, G.S.; Varet, G.; Merino-Garcia, D.; Guersoni, V.C.B.; Knobel, M.\*; Bannwart, A.C.; van der Geest, C.; Muraca, D.\*

An essential part for crude oil extraction is flow assurance, being critical to maintain a financially sustainable flow while getting the petroleum to the surface. When not well managed, it can develop into a significant issue for the O & G industry. By heating the fluids, problems with flow assurance, including paraffin deposition, asphaltene, and methane hydrate, can be reduced. Also, as the temperature rises, a liquid's viscosity decreases. Research focusing on the application of magnetic nanoparticles (NPs) in the oil industry is very recent. When magnetic nanofluids are exposed to an alternating magnetic field, the viscosity decreases by several orders of magnitude as a result of the fluid's temperature rising due to a phenomenon known as magnetic hyperthermia. This work focuses on the use of magnetic NPs (9 nm) in heavy crude oil (API 19.0). The frequency and strength of the magnetic field, as well as the characteristics of the fluid and the NPs intrinsic properties all affect the heating efficiency. For all of the experimental settings in this work, the flowloop's temperature increased, reaching a maximum of  $\Delta T = 16.3$  degrees C, using 1% wt NPs at the maximum available frequency of the equipment (533 kHz) and the highest field intensity for this frequency (14 kA/m), with a flow rate of 1.2 g/s. This increase in temperature causes a decrease of nearly 45% on the heavy crude oil viscosity, and if properly implemented, could substantially increase oil flow in the field during production.

ACS OMEGA 8[36], 32520-32525, 2023. DOI: 10.1021/acsomega.3c02832

[P258-2023] "Jet-like correlations with respect to  $K_S(0)$  and  $\Lambda(\Lambda)$  over-bar in pp and central Pb-Pb collisions at  $\sqrt{s_{NN}}=5.02$  TeV"

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al. ALICE Collaboration

Two-particle correlations with  $K_S(0)$ ,  $\Lambda(\Lambda)$  over bar, and charged hadrons as trigger particles in the transverse momentum range  $8 < p(T), \text{trig} < 16$  GeV/c, and associated charged particles within  $1 < p(T), \text{assoc} < 8$  GeV/c, are studied at midrapidity in pp and central Pb-Pb collisions at a centre-of-mass energy per nucleon-nucleon collision  $\sqrt{s_{NN}} = 5.02$  TeV with the ALICE detector at the LHC. After subtracting the contributions of the flow background, the per-trigger yields are extracted on both the near and away sides, and the ratio in Pb-Pb collisions with respect to pp collisions (I-AA) is computed. The per-trigger yield in Pb-Pb collisions on the away side is strongly suppressed to the level of I-AA approximate to 0.6 for  $p(T, \text{assoc}) > 3$  GeV/c as expected from strong in-medium energy loss, while an enhancement develops at low  $p(T)$ , assoc on both the near and away sides, reaching I-AA approximate to 1.8 and 2.7 respectively. These findings are in good agreement with previous ALICE measurements from two-particle correlations triggered by neutral pions ( $\pi(0)$ -h) and charged hadrons (h-h) in Pb-Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV. Moreover, the correlations with  $K_S(0)$  mesons and  $\Lambda(\Lambda)$  over bar baryons as trigger particles are compared to those of inclusive charged hadrons. The results are compared with the predictions of Monte Carlo models.

EUROPEAN PHYSICAL JOURNAL C 83[6], 497, 2023. DOI: 10.1140/epjc/s10052-023-11614-8

[P259-2023] "Lattice thermal conductivity of 2D nanomaterials: a simple semi-empirical approach"

Tromer, R. M.\*; Felix, I. M.; Pereira, L. F. C.; Luz, M.G.E. da; Ribeiro Junior, L.A.; Galvao, D. S.\*

Extracting reliable information on certain physical properties of materials, such as thermal transport, can be computationally very demanding.

Aiming to overcome such difficulties in the particular case of lattice thermal conductivity (LTC) of 2D nanomaterials, we propose a simple, fast, and accurate semi-empirical approach for LTC calculation. The approach is based on parameterized thermochemical equations and Arrhenius-like fitting procedures, thus avoiding molecular dynamics or ab initio protocols, which frequently require computationally expensive simulations. As a proof of concept, we obtain the LTC of some prototypical physical systems, such as graphene (and other 2D carbon allotropes), hexagonal boron nitride (hBN), silicene, germanene, binary, and ternary BNC lattices and two examples of the fullerene network family. Our obtained values are in good agreement with other theoretical and experimental estimations, nonetheless, being derived in a rather straightforward way, at a fraction of the usual computational cost.

PHYSICAL CHEMISTRY CHEMICAL PHYSICS 25[42], 28703-28715, 2023. DOI: 10.1039/d3cp02896h

[P260-2023] "Magnetic properties of an oxo-bridged dinuclear iron(III) complex resulting from the oxidation of mononuclear iron metallacycles with a flexible ethylenediphenylenebis(oxamate) ligand"

Silveira, C. O. C. da; Santos, S. H. M.; Cunha, T. T. da; Almeida, A. A. de\*; Knobel, M.\*; et al.

Transition metal ions such as copper(II), nickel(II), cobalt(II), and manganese(II) are widely used in the formation of mono- or oligonuclear metallacyclic complexes with the flexible N,N'-2,2 & PRIME;-ethylenediphenylenebis(oxamate) ligand (H4edpba); however similar supramolecular complexes with iron(II) and iron(III) are rarely obtained. In this work, we synthesized for the first time a new air-stable oxo-bridged diiron(III) complex of formula  $\{[\text{Fe}(\text{H}_2\text{edpba})(\text{dmsO})]_2(\mu_2\text{-O})\} \cdot \text{BULL}; \text{dmsO} \cdot \text{BULL}; \text{H}_2\text{O}$  (2) from dioxygen oxidation of the putative mononuclear iron(II) complex precursor of formula  $[\text{Fe}(\text{H}_2\text{edpba})(\text{H}_2\text{O})_2]\text{Cl}$  (1) in dimethylsulfoxide (dmsO). Compound 2 crystallizes in the monoclinic system and contains one oxo group bridging two cationic mononuclear metallacyclic moieties,  $[\text{Fe}(\text{H}_2\text{edpba})(\text{dmsO})]^{+}$ . The iron(III) ions are also coordinated to four oxygen atoms from the dianionic H2edpba<sup>2-</sup>-ligands in a tetradentate fashion, while an oxygen atom from the coordinated dmsO molecules. Mössbauer spectroscopy confirms the presence of high-spin (HS) Fe<sup>3+</sup> ions (2). The magnetic properties of 2 reveal a strong antiferromagnetic interaction between the two HS Fe<sup>3+</sup> ions ( $J = -226.46$  cm<sup>-1</sup>), in agreement with the DFT calculations ( $J = -207.99$  cm<sup>-1</sup>).

JOURNAL OF MOLECULAR STRUCTURE 1294, 136472, 2023. DOI: 10.1016/j.molstruc.2023.136472

[P261-2023] "Measurement of electrons from beauty-hadron decays in pp and Pb-Pb collisions at  $\sqrt{s_{NN}}=5.02$  TeV"

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al. ALICE Collaboration

The production of electrons from beauty-hadron decays was measured at midrapidity in proton-proton (pp) and central Pb-Pb collisions at center-of-mass energy per nucleon-nucleon pair  $\sqrt{s_{NN}} = 5.02$  TeV, using the ALICE detector at the LHC. The cross section measured in pp collisions in the transverse momentum interval  $2 < p_T < 8$  GeV/c was compared with models based on perturbative quantum chromodynamics calculations. The yield in the 10% most central Pb-Pb collisions, measured in the interval  $2 < p_T < 26$  GeV/c, was used to compute the nuclear modification factor R-AA, extrapolating the pp reference cross section to  $p_T$  larger than 8 GeV/c.

The measured RAA shows significant suppression of the yield of electrons from beauty-hadron decays at high  $p_T$  and does not show a significant dependence above 8 GeV/c within uncertainties. The results are described by several theoretical models based on different implementations of the interaction of heavy quarks with a quark-gluon plasma, which predict a smaller energy loss for beauty quarks compared to light and charm quarks.

**PHYSICAL REVIEW C 108[3], 034906, 2023. DOI: 10.1103/PhysRevC.108.034906**

**[P262-2023] “Measurement of the differential  $t(\bar{t})$  over-bar production cross section as a function of the jet mass and extraction of the top quark mass in hadronic decays of boosted top quarks”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A measurement of the jet mass distribution in hadronic decays of Lorentz-boosted top quarks is presented. The measurement is performed in the lepton + jets channel of top quark pair production ( $t(\bar{t})$  over bar) events, where the lepton is an electron or muon. The products of the hadronic top quark decay are reconstructed using a single large-radius jet with transverse momentum greater than 400 GeV. The data were collected with the CMS detector at the LHC in proton-proton collisions and correspond to an integrated luminosity of 138 fb<sup>-1</sup>. The differential  $t(\bar{t})$  over bar production cross section as a function of the jet mass is unfolded to the particle level and is used to extract the top quark mass. The jet mass scale is calibrated using the hadronic W boson decay within the large-radius jet. The uncertainties in the modelling of the final state radiation are reduced by studying angular correlations in the jet substructure. These developments lead to a significant increase in precision, and a top quark mass of 173.06 ± 0.84 GeV.

**EUROPEAN PHYSICAL JOURNAL C 83[7], 560, 2023. DOI: 10.1140/epjc/s10052-023-11587-8**

**[P263-2023] “Measurement of the Higgs boson inclusive and differential fiducial production cross sections in the diphoton decay channel with pp collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

The measurements of the inclusive and differential fiducial cross sections of the Higgs boson decaying to a pair of photons are presented. The analysis is performed using proton-proton collisions data recorded with the CMS detector at the LHC at a centre-of-mass energy of 13 TeV and corresponding to an integrated luminosity of 137 fb<sup>-1</sup>. The inclusive fiducial cross section is measured to be  $\sigma(\text{fid}) = 73.4(-5.3)(+5.4)(\text{stat})(+2.4)(-2.2)(\text{syst})$  fb, in agreement with the standard model expectation of 75.4 ± 4.1 fb. The measurements are also performed in fiducial regions targeting different production modes and as function of several observables describing the diphoton system, the number of additional jets present in the event, and other kinematic observables. Two double differential measurements are performed. No significant deviations from the standard model expectations are observed.

**JOURNAL OF HIGH ENERGY PHYSICS [7], 091, 2023. DOI: 10.1007/JHEP07(2023)091**

**[P264-2023] “Measurement of the  $J/\psi$  Polarization with Respect to the Event Plane in Pb-Pb Collisions at the LHC”**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

We study the polarization of inclusive  $J/\psi$  produced in Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV at the LHC in the dimuon channel, via the measurement of the angular distribution of its decay products. We perform the study in the rapidity region  $2.5 < y < 4$ , for three transverse momentum intervals ( $2 < p_T < 4$ ,  $4 < p_T < 6$ ,  $6 < p_T < 10$  GeV=c) and as a function of the centrality of the collision for  $2 < p_T < 6$  GeV=c. For the first time, the polarization is measured with respect to the event plane of the collision, by considering the angle between the positive-charge decay muon in the  $J/\psi$  rest frame and the axis perpendicular to the event-plane vector in the laboratory system. A small transverse polarization is measured, with a significance reaching 3.9 $\sigma$  at low  $p_T$  and for intermediate centrality values. The polarization could be connected with the behavior of the quark-gluon plasma, formed in Pb-Pb collisions, as a rotating fluid with large vorticity, as well as with the existence of a strong magnetic field in the early stage of its formation.

**PHYSICAL REVIEW LETTERS 131[4], 042303, 2023. DOI: 10.1103/PhysRevLett.131.042303**

**[P265-2023] “Measurement of the Lifetime and  $\Lambda$  Separation Energy of  $3\Lambda\text{H}$ ”**

Acharya, S.; Adamová, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The most precise measurements to date of the  $3\Lambda\text{H}$  lifetime  $\tau$  and  $\Lambda$  separation energy  $B_\Lambda$  are obtained using the data sample of Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV collected by ALICE at the LHC. The  $3\text{sNN}\Lambda\text{H}$  is reconstructed via its charged two-body mesonic decay channel ( $3\Lambda\text{H} \rightarrow 3\text{He} + \pi^\pm$  and the charge-conjugate process). The measured values  $\tau = [253 \pm 11(\text{stat}) \pm 16(\text{syst})]$  ps and  $B_\Lambda = [102 \pm 63(\text{stat}) \pm 167(\text{syst})]$  keV are compatible with predictions from effective field theories and confirm that the  $3\Lambda\text{H}$  structure is consistent with a weakly bound system.

**PHYSICAL REVIEW LETTERS 131[10], 102302, 2023. DOI: 10.1103/PhysRevLett.131.102302**

**[P266-2023] “Measurement of the production of (anti)nuclei in p-Pb collisions at  $\sqrt{s_{NN}}=8.16$  TeV”**

Acharya, S.; Adamova, D.; Chinellato, D. D.\*; Guardiano, G. G.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Measurements of (anti)proton, (anti)deuteron, and (anti) $3\text{He}$  production in the rapidity range  $-1 < y < 0$  as a function of the transverse momentum and event multiplicity in p-Pb collisions at a center-of-mass energy per nucleon-nucleon pair  $\sqrt{s_{NN}} = 8.16$  TeV are presented. The coalescence parameters  $B_2$  and  $B_3$ , measured as a function of the transverse momentum per nucleon and of the mean charged-particle multiplicity density, confirm a smooth evolution from low to high multiplicity across different collision systems and energies. The ratios between (anti)deuteron and (anti) $3\text{He}$  yields and those of (anti)protons are also reported as a function of the mean charged-particle multiplicity density. A comparison with the predictions of the statistical hadronization and coalescence models for different collision systems and center-of-mass energies favors the coalescence description for the deuteron-to-proton yield ratio with respect to the canonical statistical model. (c) 2023 European Organization for Nuclear Research. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>). Funded by SCOAP<sup>3</sup>.

**[P267-2023] “Measurement of the top quark pole mass using  $t(\bar{t})$ -jet events in the dilepton final state in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A measurement of the top quark pole mass  $m(t)$ (pole) in events where a top quark-antiquark pair ( $t(\bar{t})$ ) is produced in association with at least one additional jet ( $t(\bar{t})$ -jet) is presented. This analysis is performed using proton-proton collision data at  $\sqrt{s}=13$  TeV collected by the CMS experiment at the CERN LHC, corresponding to a total integrated luminosity of 36.3 fb<sup>-1</sup>. Events with two opposite-sign leptons in the final state ( $e^+e^-$ ,  $\mu^+\mu^-$ ,  $e^+\mu^-$ ,  $e^-\mu^+$ ) are analyzed. The reconstruction of the main observable and the event classification are optimized using multivariate analysis techniques based on machine learning. The production cross section is measured as a function of the inverse of the invariant mass of the  $t(\bar{t})$ -jet system at the parton level using a maximum likelihood unfolding. Given a reference parton distribution function (PDF), the top quark pole mass is extracted using the theoretical predictions at next-to-leading order. For the ABMP-16NLO PDF, this results in  $m(t)$ (pole) = 172.93  $\pm$  1.36 GeV.

JOURNAL OF HIGH ENERGY PHYSICS [7], 077, 2023. DOI: 10.1007/JHEP07(2023)077

**[P268-2023] “Measurements of Higgs boson production in the decay channel with a pair of  $\tau$  leptons in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

Measurements of Higgs boson production, where the Higgs boson decays into a pair of tau leptons, are presented, using a sample of proton-proton collisions collected with the CMS experiment at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. Three analyses are presented. Two are targeting Higgs boson production via gluon fusion and vector boson fusion: a neural network based analysis and an analysis based on an event categorization optimized on the ratio of signal over background events. These are complemented by an analysis targeting vector boson associated Higgs boson production. Results are presented in the form of signal strengths relative to the standard model predictions and products of cross sections and branching fraction to tau leptons, in up to 16 different kinematic regions. For the simultaneous measurements of the neural network based analysis and the analysis targeting vector boson associated Higgs boson production signal strengths are found to be 0.82  $\pm$  0.11 for inclusive Higgs boson production, 0.67  $\pm$  0.19 (0.81  $\pm$  0.17) for the production mainly via gluon fusion (vector boson fusion), and 1.79  $\pm$  0.45 for vector boson associated Higgs boson production.

EUROPEAN PHYSICAL JOURNAL C 83[7], 562, 2023. DOI: 10.1140/epjc/s10052-023-11452-8

**[P269-2023] “Measurements of inclusive and differential cross sections for the Higgs boson production and decay to four-leptons in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Hayrapetyan, A.; Tumasyan, A.; Adam, W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

Measurements of the inclusive and differential fiducial cross sections for the Higgs boson production in the  $H \rightarrow ZZ \rightarrow 4l$  ( $l = e, \mu$ ) decay channel are presented. The results are obtained from the analysis of proton-proton collision data recorded by the CMS experiment at the CERN LHC at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. The measured inclusive fiducial cross section is 2.73  $\pm$  0.26 fb, in agreement with the standard model expectation of 2.86  $\pm$  0.1 fb. Differential cross sections are measured as a function of several kinematic observables sensitive to the Higgs boson production and decay to four leptons. A set of double-differential measurements is also performed, yielding a comprehensive characterization of the four leptons final state. Constraints on the Higgs boson trilinear coupling and on the bottom and charm quark coupling modifiers are derived from its transverse momentum distribution. All results are consistent with theoretical predictions from the standard model.

JOURNAL OF HIGH ENERGY PHYSICS [8], 40, 2023. DOI: 10.1007/JHEP08(2023)040

**[P270-2023] “Measurements of jet multiplicity and jet transverse momentum in multijet events in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Multijet events at large transverse momentum ( $p_T$ ) are measured at  $\sqrt{s}=13$  TeV using data recorded with the CMS detector at the LHC, corresponding to an integrated luminosity of 36.3 fb<sup>-1</sup>. The multiplicity of jets with  $p_T > 50$  GeV that are produced in association with a high- $p_T$  dijet system is measured in various ranges of the  $p_T$  of the jet with the highest transverse momentum and as a function of the azimuthal angle difference  $\Delta\phi(1,2)$  between the two highest  $p_T$  jets in the dijet system. The differential production cross sections are measured as a function of the transverse momenta of the four highest  $p_T$  jets. The measurements are compared with leading and next-to-leading order matrix element calculations supplemented with simulations of parton shower, hadronization, and multiparton interactions. In addition, the measurements are compared with next-to-leading order matrix element calculations combined with transverse-momentum dependent parton densities and transverse-momentum dependent parton shower.

EUROPEAN PHYSICAL JOURNAL C 83[8], 742, 2023. DOI: 10.1140/epjc/s10052-023-11753-y

**[P271-2023] “Measurements of the Higgs boson production cross section and couplings in the  $W$  boson pair decay channel in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

Production cross sections of the standard model Higgs boson decaying to a pair of  $W$  bosons are measured in proton-proton collisions at a center-of-mass energy of 13 TeV. The analysis targets Higgs bosons produced via gluon fusion, vector boson fusion, and in association with a  $W$  or  $Z$  boson. Candidate events are required to have at least two charged leptons and moderate missing transverse momentum, targeting events with at least one leptonically decaying  $W$  boson originating from the Higgs boson. Results are presented in the form of inclusive and differential cross sections in the simplified template cross section framework, as well as couplings of the Higgs boson to vector bosons and fermions.

The data set collected by the CMS detector during 2016-2018 is used, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. The signal strength modifier  $\mu$ , defined as the ratio of the observed production rate in a given decay channel to the standard model expectation, is measured to be  $\mu = 0.95(-0.09)(+0.10)$ . All results are found to be compatible with the standard model within the uncertainties.

EUROPEAN PHYSICAL JOURNAL C 83[7], 667, 2023. DOI: 10.1140/epjc/s10052-023-11632-6

[P272-2023] “Mechanical energy absorption of architecturally interlocked petal-schwarzites”

Bastos, L.V.; Ambekar, R.S.; Tiwary, C.S.; Galvao, D.S.\*; Woellner, C.F.

We carried out fully atomistic reactive molecular dynamics simulations to study the mechanical behavior of six newly proposed hybrid schwarzite-based structures (interlocked petal-schwarzites). Schwarzites are carbon crystalline nanostructures with negative Gaussian curvature created by mapping a TPMS (Triply Periodic Minimal Surface) with carbon rings containing six to eight atoms. Our simulations have shown that petal-schwarzite structures can withstand uni-axial compressive stress up to the order of GPa and can be compressed past 50 percent strain without structural collapse. Our most resistant hierarchical structure has a calculated compressive strength of 260 GPa and specific energy absorption (SEA) of 45.95 MJ/kg, while possessing a mass density of only 685 kg/m<sup>3</sup>. These results show that these structures could be excellent lightweight materials for applications that require mechanical energy absorption.

CARBON TRENDS 13, 100299, 2023. DOI: 10.1016/j.car-tre.2023.100299

[P273-2023] “Multiplicity dependence of charged-particle production in pp, p-Pb, Xe-Xe and Pb-Pb collisions at the LHC”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Multiplicity ( $N_{ch}$ ) distributions and transverse momentum ( $p_T$ ) spectra of inclusive primary charged particles in the kinematic range of  $|\eta| < 0.8$  and  $0.15 \text{ GeV}/c < p_T < 10 \text{ GeV}/c$  are reported for pp, p-Pb, Xe-Xe and Pb-Pb collisions at centre-of-mass energies per nucleon pair ranging from  $\sqrt{s_{NN}} = 2.76 \text{ TeV}$  up to 13 TeV. A sequential two-dimensional unfolding procedure is used to extract the correlation between the transverse momentum of primary charged particles and the charged-particle multiplicity of the corresponding collision. This correlation sharply characterises important features of the final state of a collision and, therefore, can be used as a stringent test of theoretical models. The multiplicity distributions as well as the mean and standard deviation derived from the  $p_T$  spectra are compared to state-of-the-art model predictions. Providing these fundamental observables of bulk particle production consistently across a wide range of collision energies and system sizes can serve as an important input for tuning Monte Carlo event generators.

PHYSICS LETTERS B 845, 138110, 2023. DOI: 10.1016/j.physletb.2023.138110

[P274-2023] “Novel relaxation time approximation: a consistent calculation of transport coefficients with QCD-inspired relaxation times”

Rocha, G.S.; Denicol, G.S.; Ferreira, M.N.\*; Noronha, J.

We use a novel formulation of the relaxation time approximation to consistently calculate the bulk and shear viscosity coefficients using QCD-inspired energy-dependent relaxation times and phenomenological thermal masses obtained from fits to lattice QCD thermodynamics. The matching conditions are conveniently chosen to simplify the computations.

ACTA PHYSICA POLONICA B PROCEEDINGS SUPPLEMENT 16[1], 1-A29, 2023. DOI: 10.5506/APhysPolBSupp.16.1-A29

[P275-2023] “Observation of flow angle and flow magnitude fluctuations in Pb-Pb collisions at  $\sqrt{s_{NN}}=5.02 \text{ TeV}$  at the CERN Large Hadron Collider”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

This Letter reports on the first measurements of transverse momentum dependent flow angle  $\psi(n)$  and flow magnitude  $\epsilon(n)$  fluctuations determined using new four-particle correlators. The measurements are performed for various centralities in Pb-Pb collisions at a center-of-mass energy per nucleon pair of  $\sqrt{s_{NN}} = 5.02 \text{ TeV}$  with ALICE at the CERN Large Hadron Collider. Both flow angle and flow magnitude fluctuations are observed in the presented centrality ranges and are strongest in the most central collisions and for a transverse momentum  $p(T) > 2 \text{ GeV}/c$ . Comparison with theoretical models, including iEBE-VISHNU, MUSIC, and AMPT, show that the measurements exhibit unique sensitivities to the initial state of heavy-ion collisions.

PHYSICAL REVIEW C 107[5], L051901, 2023. DOI: 10.1103/PhysRevC.107.L051901

[P276-2023] “Performance of the ALICE Electromagnetic Calorimeter”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

The performance of the electromagnetic calorimeter of the ALICE experiment during operation in 2010-2018 at the Large Hadron Collider is presented. After a short introduction into the design, readout, and trigger capabilities of the detector, the procedures for data taking, reconstruction, and validation are explained. The methods used for the calibration and various derived corrections are presented in detail. Subsequently, the capabilities of the calorimeter to reconstruct and measure photons, light mesons, electrons and jets are discussed. The performance of the calorimeter is illustrated mainly with data obtained with test beams at the Proton Synchrotron and Super Proton Synchrotron or in proton-proton collisions at  $\sqrt{s} = 13 \text{ TeV}$ , and compared to simulations.

JOURNAL OF INSTRUMENTATION 18[8], P08007, 2023. DOI: 10.1088/1748-0221/18/08/P08007

[P277-2023] “Probing Heavy Majorana Neutrinos and the Weinberg Operator through Vector Boson Fusion Processes in Proton-Proton Collisions at  $\sqrt{s}=13 \text{ TeV}$ ”

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

The first search exploiting the vector boson fusion process to probe heavy Majorana neutrinos and the Weinberg operator at the LHC is presented.

The search is performed in the same-sign dimuon final state using a proton-proton collision dataset recorded at  $\sqrt{s} = 13$  TeV, collected with the CMS detector and corresponding to a total integrated luminosity of 138 fb<sup>-1</sup>. The results are found to agree with the predictions of the standard model. For heavy Majorana neutrinos, constraints on the squared mixing element between the muon and the heavy neutrino are derived in the heavy neutrino mass range 50 GeV-25 TeV; for masses above 650 GeV these are the most stringent constraints from searches at the LHC to date. A first test of the Weinberg operator at colliders provides an observed upper limit at 95% confidence level on the effective  $\mu\mu$  Majorana neutrino mass of 10.8 GeV.

PHYSICAL REVIEW LETTERS 131[1], 011803, 2023. DOI: 10.1103/PhysRevLett.131.011803

**[P278-2023] “Reconstruction of interactions in the ProtoDUNE-SP detector with Pandora”**

Abud, A. A.; Abi, B.; Acciarri, R.; Adriano, C.\*; Bazetto, M. C. Q.\*; Chagas, E. B. B. das\*; Holanda, P. C. de\*; Souza, G. de\*; Gelli, B.\*; Giammaria, P.\*; Guzzo, M. M.\*; Kemp, E.\*; Machado, A.\*; Peres, O. L.\*; Pimentel, V. L.\*; Prakash, S.\*; Segreto, E.\*; et al.  
DUNE Collaboration

The Pandora Software Development Kit and algorithm libraries provide pattern-recognition logic essential to the reconstruction of particle interactions in liquid argon time projection chamber detectors. Pandora is the primary event reconstruction software used at ProtoDUNE-SP, a prototype for the Deep Underground Neutrino Experiment far detector. ProtoDUNE-SP, located at CERN, is exposed to a charged-particle test beam. This paper gives an overview of the Pandora reconstruction algorithms and how they have been tailored for use at ProtoDUNE-SP. In complex events with numerous cosmic-ray and beam background particles, the simulated reconstruction and identification efficiency for triggered test-beam particles is above 80% for the majority of particle type and beam momentum combinations. Specifically, simulated 1 GeV/c charged pions and protons are correctly reconstructed and identified with efficiencies of 86.1 +/- 0.6% and 84.1 +/- 0.6%, respectively. The efficiencies measured for test-beam data are shown to be within 5% of those predicted by the simulation.

EUROPEAN PHYSICAL JOURNAL C 83[7], 618, 2023. DOI: 10.1140/epjc/s10052-023-11733-2

**[P279-2023] “Relaxation Processes in Rare-Earth-Doped  $\alpha$ -NaYF<sub>4</sub> Nanoparticles by Nuclear Magnetic Resonance Spectroscopy”**

Flores, A.F.G.\*; Munevar, J.; Oliveira, M. de; Rettori, C.\*; Urbano, R.R.\*; Queiroz, T.B. de

NaYF<sub>4</sub> nanoparticles (NPs) are among the most promising hosts for lanthanides in different applications as IR-to-UV upconversion and photodynamic therapy due to their crystal electric field properties and their low phonon energy. The efficiency in such applications depends on the dispersion of the ions and their local structure in the host. Paramagnetic nuclear magnetic resonance (NMR) has been one of the main tools to perform such studies, based on the comprehensiveness of the hyperfine interaction of the rare-earth (RE)'s unpaired electrons with the observed nuclei and its effects in NMR quantities, like paramagnetic shift, line broadening, and relaxation enhancement. Spin systems with large dipolar or quadrupolar interactions and site heterogeneity. However, it can be challenging to resolve these effects for we hereby address these issues for RE<sup>3+</sup>-doped  $\alpha$ -NaYF<sub>4</sub> NPs of small sizes and low polydispersity [ $\phi$  approximate to 7(1) nm]

with Na-23 and F-19 NMR employing high-resolution techniques associated with relaxation measurements. In particular, remarkable fast relaxation rates are found for the Gd<sup>3+</sup>-doped NPs which are rationalized in terms of Solomon's relaxation mechanism enhanced by the long electronic relaxation time of the ion.

JOURNAL OF PHYSICAL CHEMISTRY C 127[37], 18420-18430, 2023. DOI: 10.1021/acs.jpcc.3c01951

**[P280-2023] “Revealing the spatiotemporal requirements for accurate subject identification with resting-state functional connectivity: a simultaneous fNIRS-fMRI study”**

Novi, S.L.\*; Carvalho, A.C.\*; Forti, R.M.\*; Cendes, F.; Yasuda, C.L.; Mesquita, R.C.\*

Significance: Brain fingerprinting refers to identifying participants based on their functional patterns. Despite its success with functional magnetic resonance imaging (fMRI), brain fingerprinting with functional near-infrared spectroscopy (fNIRS) still lacks adequate validation. Aim: We investigated how fNIRS-specific acquisition features (limited spatial information and nonneural contributions) influence resting-state functional connectivity (rsFC) patterns at the intra-subject level and, therefore, brain fingerprinting. Approach: We performed multiple simultaneous fNIRS and fMRI measurements in 29 healthy participants at rest. Data were preprocessed following the best practices, including the removal of motion artifacts and global physiology. The rsFC maps were extracted with the Pearson correlation coefficient. Brain fingerprinting was tested with pairwise metrics and a simple linear classifier. Results: Our results show that average classification accuracy with fNIRS ranges from 75% to 98%, depending on the number of runs and brain regions used for classification. Under the right conditions, brain fingerprinting with fNIRS is close to the 99.9% accuracy found with fMRI. Overall, the classification accuracy is more impacted by the number of runs and the spatial coverage than the choice of the classification algorithm. Conclusions: This work provides evidence that brain fingerprinting with fNIRS is robust and reliable for extracting unique individual features at the intra-subject level once relevant spatiotemporal constraints are correctly employed.

NEUROPHOTONICS 10[1], 013510, 2023. DOI: 10.1117/1.NPh.10.1.013510

**[P281-2023] “Search for a charged Higgs boson decaying into a heavy neutral Higgs boson and a W boson in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for a charged Higgs boson H<sup>±</sup> decaying into a heavy neutral Higgs boson H and a W boson is presented. The analysis targets the H decay into a pair of tau leptons with at least one of them decaying hadronically and with an additional electron or muon present in the event. The search is based on proton-proton collision data recorded by the CMS experiment during 2016-2018 at  $\sqrt{s} = 13$ TeV, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. The data are consistent with standard model background expectations. Upper limits at 95% confidence level are set on the product of the cross section and branching fraction for an H<sup>±</sup> in the mass range of 300-700 GeV, assuming an H with a mass of 200 GeV. The observed limits range from 0.085 pb for an H<sup>±</sup> mass of 300 GeV to 0.019 pb for a mass of 700 GeV. These are the first limits on H<sup>±</sup> production in the H<sup>±</sup> → HW<sup>±</sup> decay channel at the LHC.

JOURNAL OF HIGH ENERGY PHYSICS [9], 032, 2023. DOI: 10.1007/JHEP09(2023)032

**[P282-2023] “Search for a high-mass dimuon resonance produced in association with b quark jets at  $\sqrt{s}=13$  TeV”**

Hayrapetyan, A.; Tumasyan, A.; Adam, W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for high-mass dimuon resonance production in association with one or more b quark jets is presented. The study uses proton-proton collision data collected with the CMS detector at the LHC corresponding to an integrated luminosity of 138 fb<sup>-1</sup> at a center-of-mass energy of 13 TeV. Model-independent limits are derived on the number of signal events with exactly one or more than one b quark jet. Results are also interpreted in a lepton-flavor-universal model with Z boson couplings to a bb quark pair (g(b)), an sb quark pair (g(b) delta(bs)), and any same-flavor charged lepton (g(l)) or neutrino pair (g(nu)), with |g(nu)| = |g(l)|. For a Z' boson with a mass mZ' = 350 GeV (2 TeV) and |delta(bs)| < 0.25, the majority of the parameter space with 0.0057 < |g(l)| < 0.35 (0.25 < |g(l)| < 0.43) and 0.0079 < |g(b)| < 0.46 (0.34 < |g(b)| < 0.57) is excluded at 95% confidence level. Finally, constraints are set on a Z' model with parameters consistent with low-energy b -> sll measurements. In this scenario, most of the allowed parameter space is excluded for a Z' boson with 350 < mZ' < 500 GeV, while the constraints are less stringent for higher mZ' hypotheses. This is the first dedicated search at the LHC for a high-mass dimuon resonance produced in association with multiple b quark jets, and the constraints obtained on models with this signature are the most stringent to date.

**JOURNAL OF HIGH ENERGY PHYSICS [10], 43, 2023. DOI: 10.1007/JHEP10(2023)043**

**[P283-2023] “Search for a vector-like quark T' tH via the diphoton decay mode of the Higgs boson in proton-proton collisions at  $\sqrt{s}\geq 13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J.W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for the electroweak production of a vector-like quark T, decaying to a top quark and a Higgs boson is presented. The search is based on a sample of proton-proton collision events recorded at the LHC at root s = 13 TeV, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. This is the first T' search that exploits the Higgs boson decay to a pair of photons. For narrow isospin singlet T' states with masses up to 1.1 TeV, the excellent diphoton invariant mass resolution of 1-2% results in an increased sensitivity compared to previous searches based on the same production mechanism. The electroweak production of a T' quark with mass up to 960 GeV is excluded at 95% confidence level, assuming a coupling strength kappa(T) = 0.25 and a relative decay width Gamma/M-T' < 5%.

**JOURNAL OF HIGH ENERGY PHYSICS [9], 057, 2023. DOI: 10.1007/JHEP09(2023)057**

**[P284-2023] “Search for CP violating top quark couplings in pp collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

Results are presented from a search for CP violation in top quark pair production, using proton-proton collisions at a center-of-mass energy of 13TeV. The data used for this analysis consist of final states with two charged leptons collected by the CMS experiment, and correspond to an integrated luminosity of 35.9 fb<sup>-1</sup>. The search uses two observables, O-1 and O-3, which are Lorentz scalars.

The observable O-1 is constructed from the four-momenta of the charged leptons and the reconstructed top quarks, while O-3 consists of the four-momenta of the charged leptons and the b quarks originating from the top quarks. Asymmetries in these observables are sensitive to CP violation, and their measurement is used to determine the chromoelectric dipole moment of the top quark. The results are consistent with the expectation from the standard model.

**JOURNAL OF HIGH ENERGY PHYSICS [7], 23, 2023. DOI: 10.1007/JHEP07(2023)023**

**[P285-2023] “Search for CP violation in t(t)over-bar H and tH production in multilepton channels in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

The charge-parity (CP) structure of the Yukawa interaction between the Higgs (H) boson and the top quark is measured in a data sample enriched in the t (t) over bar H and tH associated production, using 138 fb<sup>-1</sup> of data collected in proton-proton collisions at root s = 13TeV by the CMS experiment at the CERN LHC. The study targets events where the H boson decays via H -> WW or H -> WW or H ->tau tau and the top quarks decay via t -> Wb: the W bosons decay either leptonically or hadronically, and final states characterized by the presence of at least two leptons are studied. Machine learning techniques are applied to these final states to enhance the separation of CP-even from CP-odd scenarios. Twodimensional confidence regions are set on kappa(t) and (kappa) over tilde (t), which are respectively defined as the CP-even and CP-odd top-Higgs Yukawa coupling modifiers. No significant fractional CP-odd contributions, parameterized by the quantity |f (Htt)(CP)| are observed; the parameter is determined to be |f(CP)(Htt)| = 0.59 with an interval of (0.24, 0.81) at 68% confidence level. The results are combined with previous results covering the H -> ZZ and H -> gamma gamma decay modes, yielding two- and one-dimensional confidence regions on kappa(t) and (kappa) over tilde (t), while |f Htt CP | is determined to be |f(CP)(Htt)| = 0.28 with an interval of |f (Htt)(CP)| < 0.55 at 68% confidence level, in agreement with the standard model CP-even prediction of |f(CP)(Htt)| = 0.

**JOURNAL OF HIGH ENERGY PHYSICS [7], 092, 2023. DOI: 10.1007/JHEP07(2023)092**

**[P286-2023] “Search for direct pair production of supersymmetric partners of tau leptons in the final state with two hadronically decaying tau leptons and missing transverse momentum in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for the direct production of a pair of T sleptons, the supersymmetric partners of T leptons, is presented. Each T slepton is assumed to decay to a T lepton and the lightest supersymmetric particle (LSP), which is assumed to be stable and to not interact in the detector, leading to an imbalance in the total reconstructed transverse momentum. The search is carried out in events identified as containing two T leptons, each decaying to one or more hadrons and a neutrino, and significant transverse momentum imbalance. In addition to scenarios in which the T sleptons decay promptly, the search also addresses scenarios in which the T sleptons have sufficiently long lifetimes to give rise to nonprompt T leptons. The data were collected in proton-proton collisions at a center-of-mass energy of 13 TeV at the CERN LHC with the CMS detector in 2016-2018, and correspond to an integrated luminosity of 138 fb<sup>-1</sup>.

No significant excess is seen with respect to standard model expectations. Upper limits on cross sections for the pair production of T sleptons are obtained in the framework of simplified models. In a scenario in which the T sleptons are superpartners of left-handed T leptons, and each undergoes a prompt decay to a T lepton and a nearly massless LSP, T slepton masses between 115 and 340 GeV are excluded. In a scenario in which the lifetime of the T sleptons corresponds to  $c\tau$  1/4 0.1 mm, where  $\tau_0$  represents the mean proper lifetime of the T slepton, masses between 150 and 220 GeV are excluded.

**PHYSICAL REVIEW D 108[1], 012011, 2023. DOI: 10.1103/PhysRevD.108.012011**

**[P287-2023] "Search for Higgs boson and observation of Z boson through their decay into a charm quark-antiquark pair in boosted topologies in proton-proton collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for the standard model (SM) Higgs boson (H) produced with transverse momentum ( $p_T$ ) greater than 450 GeV and decaying to a charm quark-antiquark ( $c\bar{c}$ ) pair is presented. The search is performed using proton-proton collision data collected at  $\sqrt{s}=13$  TeV by the CMS experiment at the LHC, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. Boosted  $H \rightarrow c\bar{c}$  decay products are reconstructed as a single large-radius jet and identified using a deep neural network charm tagging technique. The method is validated by measuring the  $Z \rightarrow c\bar{c}$  decay process, which is observed in association with jets at high  $p_T$  for the first time with a signal strength of 1.00(-0.14)(+0.17) (syst) +/- 0.08(theo) +/- 0.06 (stat), defined as the ratio of the observed process rate to the SM expectation. The observed (expected) upper limit on  $\sigma(H) B(H \rightarrow c\bar{c})$  is set at 47 (39) times the SM prediction at 95% confidence level.

**PHYSICAL REVIEW LETTERS 131[4], 041801, 2023. DOI: 10.1103/PhysRevLett.131.041801**

**[P288-2023] "Search for Higgs Boson Decay to a Charm Quark-Antiquark Pair in Proton-Proton Collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for the standard model Higgs boson decaying to a charm quark-antiquark pair,  $H \rightarrow c\bar{c}$ , produced in association with a leptonically decaying V (W or Z) boson is presented. The search is performed with proton-proton collisions at  $\sqrt{s}=13$  TeV collected by the CMS experiment, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. Novel charm jet identification and analysis methods using machine learning techniques are employed. The analysis is validated by searching for  $Z \rightarrow c\bar{c}$  in VZ events, leading to its first observation at a hadron collider with a significance of 5.7 standard deviations. The observed (expected) upper limit on  $\sigma(VH)B(H \rightarrow c\bar{c})$  is 0.94 (0.50(-0.15)(+0.22)) pb at 95% confidence level (C.L.), corresponding to 14 (7.6(-2.3)(+3.4)) times the standard model prediction. For the Higgs-charm Yukawa coupling modifier,  $\kappa_c$ , the observed (expected) 95% C.L. interval is 1.1 <  $|\kappa_c|$  < 5.5 ( $|\kappa_c|$  < 3.4), the most stringent constraint to date.

**PHYSICAL REVIEW LETTERS 131[6], 061801, 2023. DOI: 10.1103/PhysRevLett.131.061801**

**[P289-2023] "Search for Higgs boson pairs decaying to  $WW^*WW^*$ ,  $WW^*\tau\tau$ , and  $\tau\tau\tau\tau$  in proton-proton collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

The results of a search for Higgs boson pair (HH) production in the  $(WWW^*)-W^*$ ,  $WW^*\tau\tau$ , and  $\tau\tau\tau\tau$  decay modes are presented. The search uses 138 fb<sup>-1</sup> of proton-proton collision data recorded by the CMS experiment at the LHC at a center-of-mass energy of 13 TeV from 2016 to 2018. Analyzed events contain two, three, or four reconstructed leptons, including electrons, muons, and hadronically decaying tau leptons. No evidence for a signal is found in the data. Upper limits are set on the cross section for nonresonant HH production, as well as resonant production in which a new heavy particle decays to a pair of Higgs bosons. For nonresonant production, the observed (expected) upper limit on the cross section at 95% confidence level (CL) is 21.3 (19.4) times the standard model (SM) prediction. The observed (expected) ratio of the trilinear Higgs boson self-coupling to its value in the SM is constrained to be within the interval -6.9 to 11.1 (-6.9 to 11.7) at 95% CL, and limits are set on a variety of new-physics models using an effective field theory approach. The observed (expected) limits on the cross section for resonant HH production range from 0.18 to 0.90 (0.08 to 1.06) pb at 95% CL for new heavy-particle masses in the range 250-1000 GeV.

**JOURNAL OF HIGH ENERGY PHYSICS [7], 095, 2023. DOI: 10.1007/JHEP07(2023)095**

**[P290-2023] "Search for high-mass exclusive  $\gamma\gamma \rightarrow WW$  and  $\gamma\gamma \rightarrow ZZ$  production in proton-proton collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS collaboration

A search is performed for exclusive high-mass  $\gamma\gamma \rightarrow WW$  and  $\gamma\gamma \rightarrow ZZ$  production in proton-proton collisions using intact forward protons reconstructed in near-beam detectors, with both weak bosons decaying into boosted and merged jets. The analysis is based on a sample of proton-proton collisions collected by the CMS and TOTEM experiments at  $\sqrt{s}=13$  TeV, corresponding to an integrated luminosity of 100 fb<sup>-1</sup>. No excess above the standard model background prediction is observed, and upper limits are set on the  $pp \rightarrow pWWp$  and  $pp \rightarrow pZZp$  cross sections in a fiducial region defined by the diboson invariant mass  $m(VV) > 1$  TeV (with  $V = W, Z$ ) and proton fractional momentum loss  $0.04 < x_1 < 0.20$ . The results are interpreted as new limits on dimension-6 and dimension-8 anomalous quartic gauge couplings.

**JOURNAL OF HIGH ENERGY PHYSICS [7], 229, 2023. DOI: 10.1007/JHEP07(2023)229**

**[P291-2023] "Search for light Higgs bosons from supersymmetric cascade decays in pp collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search is reported for pairs of light Higgs bosons (H-1) produced in supersymmetric cascade decays in final states with small missing transverse momentum. A data set of LHC pp collisions collected with the CMS detector at  $\sqrt{s}=13$  TeV and corresponding to an integrated luminosity of 138 fb<sup>-1</sup> is used. The search targets events where both H-1 bosons decay into  $b\bar{b}$  pairs that are reconstructed as large-radius jets using substructure techniques.

No evidence is found for an excess of events beyond the background expectations of the standard model (SM). Results from the search are interpreted in the next-to-minimal supersymmetric extension of the SM, where a “singlino” of small mass leads to squark and gluino cascade decays that can predominantly end in a highly Lorentz-boosted singlet-like H-1 and a singlino-like neutralino of small transverse momentum. Upper limits are set on the product of the squark or gluino pair production cross section and the square of the b (b) over bar branching fraction of the H-1 in a benchmark model containing almost mass-degenerate gluinos and light-flavour squarks. Under the assumption of an SM-like H-1  $\rightarrow$  b (b) over bar branching fraction, H-1 bosons with masses in the range 40-120 GeV arising from the decays of squarks or gluinos with a mass of 1200-2500 GeV are excluded at 95% confidence level.

**EUROPEAN PHYSICAL JOURNAL C 83[7], 571, 2023. DOI: 10.1140/epjc/s10052-023-11581-0**

**[P292-2023] “Search for medium effects using jets from bottom quarks in PbPb collisions at  $\sqrt{s_{NN}}=5.02$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

The first study of the shapes of jets arising from bottom (b) quarks in heavy ion collisions is presented. Jet shapes are studied using charged hadron constituents as a function of their radial distance from the jet axis. Lead-lead (PbPb) collision data at a nucleon-nucleon center-of-mass energy of  $\sqrt{s_{NN}}=5.02$  TeV were recorded by the CMS detector at the LHC, with an integrated luminosity of 1.69 nb<sup>-1</sup>. Compared to proton-proton collisions, a redistribution of the energy in jets to larger distances from the jet axis is observed in PbPb collisions. This medium-induced redistribution is found to be substantially larger for jets than for inclusive jets.

**PHYSICS LETTERS B 844, 137849, 2023. DOI: 10.1016/j.physletb.2023.137849**

**[P293-2023] “Search for narrow resonances in the b-tagged dijet mass spectrum in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search is performed for narrow resonances decaying to final states of two jets, with at least one jet originating from a b quark, in proton-proton collisions at  $\sqrt{s}=13$  TeV. The data set corresponds to an integrated luminosity of 138 fb<sup>-1</sup> collected with the CMS detector at the LHC. Jets originating from energetic b hadrons are identified through a b-tagging algorithm that utilizes a deep neural network or the presence of a muon inside a jet. The invariant mass spectrum of jet pairs is well described by a smooth parametrization and no evidence for the production of new particles is observed. Upper limits on the production cross section are set for excited b quarks and other resonances decaying to dijet final states containing b quarks. These limits exclude at 95% confidence level models of Z' bosons with masses from 1.8 TeV to 2.4 TeV and of excited b quarks with masses from 1.8 TeV to 4.0 TeV. This is the most stringent exclusion of excited b quarks to date.

**PHYSICAL REVIEW D 108[1], 012009, 2023. DOI: 10.1103/PhysRevD.108.012009**

**[P294-2023] “Search for new heavy resonances decaying to WW, WZ, ZZ, WH, or ZH boson pairs in the all-jets final state in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for new heavy resonances decaying to WW, WZ, ZZ, WH, or ZH boson pairs in the all-jets final state is presented. The analysis is based on proton-proton collision data recorded by the CMS detector in 2016-2018 at a centre-of-mass energy of 13 TeV at the CERN LHC, corresponding to an integrated luminosity of 138 fb<sup>-1</sup>. The search is sensitive to resonances with masses between 1.3 and 6 TeV, decaying to bosons that are highly Lorentz-boosted such that each of the bosons forms a single large-radius jet. Machine learning techniques are employed to identify such jets. No significant excess over the estimated standard model background is observed. A maximum local significance of 3.6 standard deviations, corresponding to a global significance of 2.3 standard deviations, is observed at masses of 2.1 and 2.9 TeV. In a heavy vector triplet model, spin-1 Z' and W' resonances with masses below 4.8 TeV are excluded at the 95% confidence level (CL). These limits are the most stringent to date. In a bulk graviton model, spin-2 gravitons and spin-0 radions with masses below 1.4 and 2.7 TeV, respectively, are excluded at 95% CL. Production of heavy resonances through vector boson fusion is constrained with upper cross section limits at 95% CL as low as 0.1 fb.

**PHYSICS LETTERS B 844, 137813, 2023. DOI: 10.1016/j.physletb.2023.137813**

**[P295-2023] “Search for new physics in multijet events with at least one photon and large missing transverse momentum in proton-proton collisions at 13 TeV”**

Hayrapetyan, A.; Tumasyan, A.; Adam, W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for new physics in final states consisting of at least one photon, multiple jets, and large missing transverse momentum is presented, using proton-proton collision events at a center-of-mass energy of 13 TeV. The data correspond to an integrated luminosity of 137 fb<sup>-1</sup>, recorded by the CMS experiment at the CERN LHC from 2016 to 2018. The events are divided into mutually exclusive bins characterized by the missing transverse momentum, the number of jets, the number of b-tagged jets, and jets consistent with the presence of hadronically decaying W, Z, or Higgs bosons. The observed data are found to be consistent with the prediction from standard model processes. The results are interpreted in the context of simplified models of pair production of supersymmetric particles via strong and electroweak interactions. Depending on the details of the signal models, gluinos and squarks of masses up to 2.35 and 1.43 TeV, respectively, and electroweakinos of masses up to 1.23 TeV are excluded at 95% confidence level.

**JOURNAL OF HIGH ENERGY PHYSICS [10], 046, 2023. DOI: 10.1007/JHEP10(2023)046**

**[P296-2023] “Search for new physics in the  $\tau$  lepton plus missing transverse momentum final state in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for physics beyond the standard model (SM) in the final state with a hadronically decaying tau lepton and a neutrino is presented.

This analysis is based on data recorded by the CMS experiment from proton-proton collisions at a center-of-mass energy of 13TeV at the LHC, corresponding to a total integrated luminosity of 138 fb<sup>-1</sup>. The transverse mass spectrum is analyzed for the presence of new physics. No significant deviation from the SM prediction is observed. Limits are set on the production cross section of a W' boson decaying into a tau lepton and a neutrino. Lower limits are set on the mass of the sequential SM-like heavy charged vector boson and the mass of a quantum black hole. Upper limits are placed on the couplings of a new boson to the SM fermions. Constraints are put on a nonuniversal gauge interaction model and an effective field theory model. For the first time, upper limits on the cross section of t-channel leptoquark (LQ) exchange are presented. These limits are translated into exclusion limits on the LQ mass and on its coupling in the t-channel. The sensitivity of this analysis extends into the parameter space of LQ models that attempt to explain the anomalies observed in B meson decays. The limits presented for the various interpretations are the most stringent to date. Additionally, a model-independent limit is provided.

**JOURNAL OF HIGH ENERGY PHYSICS [9], 051, 2023. DOI: 10.1007/JHEP09(2023)051**

**[P297-2023] "Search for new physics using effective field theory in 13 TeV pp collision events that contain a top quark pair and a boosted Z or Higgs boson"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A data sample containing top quark pairs ( $t\bar{t}$ ) produced in association with a Lorentz-boosted Z or Higgs boson is used to search for signs of new physics using effective field theory. The data correspond to an integrated luminosity of 138 fb<sup>-1</sup> of proton-proton collisions produced at a center-of-mass energy of 13 TeV at the LHC and collected by the CMS experiment. Selected events contain a single lepton and hadronic jets, including two identified with the decay of bottom quarks, plus an additional large-radius jet with high transverse momentum identified as a Z or Higgs boson decaying to a bottom quark pair. Machine learning techniques are employed to discriminate between  $t\bar{t}$  over  $\bar{Z}$  or  $t\bar{t}$  over  $\bar{H}$  events and events from background processes, which are dominated by  $t\bar{t}$  over  $\bar{Z}$  + jets production. No indications of new physics are observed. The signal strengths of boosted  $t\bar{t}$  over  $\bar{Z}$  and  $t\bar{t}$  over  $\bar{H}$  production are measured, and upper limits are placed on the  $t\bar{t}$  over  $\bar{Z}$  and  $t\bar{t}$  over  $\bar{H}$  differential cross sections as functions of the Z or Higgs boson transverse momentum. The effects of new physics are probed using a framework in which the standard model is considered to be the low-energy effective field theory of a higher energy scale theory. Eight possible dimension-six operators are added to the standard model Lagrangian, and their corresponding coefficients are constrained via fits to the data.

**PHYSICAL REVIEW D 108[3], 032008, 2023. DOI: 10.1103/PhysRevD.108.032008**

**[P298-2023] "Search for Nonresonant Pair Production of Highly Energetic Higgs Bosons Decaying to Bottom Quarks"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J.A.\*; et al.  
CMS Collaboration

A search for nonresonant Higgs boson (H) pair production via gluon and vector boson (V) fusion is performed in the four-bottom-quark final state, using proton-proton collision data at 13 TeV corresponding to 138 fb<sup>-1</sup> collected by the CMS experiment at the LHC. The analysis targets Lorentz-boosted H pairs identified using a graph neural network.

It constrains the strengths relative to the standard model of the H self-coupling and the quartic VVHH couplings,  $\kappa_{2V}$ , excluding  $\kappa_{2V} \neq 0$  for the first time, with a significance of 6.3 standard deviations when other H couplings are fixed to their standard model values.

**PHYSICAL REVIEW LETTERS 131[4], 041803, 2023. DOI: 10.1103/PhysRevLett.131.041803**

**[P299-2023] "Search for pair production of vector-like quarks in leptonic final states in proton-proton collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search is presented for vector-like T and B quark-antiquark pairs produced in proton-proton collisions at a center-of-mass energy of 13TeV. Data were collected by the CMS experiment at the CERN LHC in 2016-2018, with an integrated luminosity of 138 fb<sup>-1</sup>. Events are separated into single-lepton, same-sign charge dilepton, and multilepton channels. In the analysis of the single-lepton channel a multilayer neural network and jet identification techniques are employed to select signal events, while the same-sign dilepton and multilepton channels rely on the high-energy signature of the signal to distinguish it from standard model backgrounds. The data are consistent with standard model background predictions, and the production of vector-like quark pairs is excluded at 95% confidence level for T quark masses up to 1.54TeV and B quark masses up to 1.56TeV, depending on the branching fractions assumed, with maximal sensitivity to decay modes that include multiple top quarks. The limits obtained in this search are the strongest limits to date for T ( $T$ ) over  $\bar{B}$  production, excluding masses below 1.48TeV for all decays to third generation quarks, and are the strongest limits to date for B ( $B$ ) over  $\bar{B}$  production with B quark decays to  $tW$ .

**JOURNAL OF HIGH ENERGY PHYSICS [7], 020, 2023. DOI: 10.1007/JHEP07(2023)020**

**[P300-2023] "Search for supersymmetry in final states with a single electron or muon using angular correlations and heavy-object identification in proton-proton collisions at  $\sqrt{s}=13$  TeV"**

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for supersymmetry is presented in events with a single charged lepton, electron or muon, and multiple hadronic jets. The data correspond to an integrated luminosity of 138 fb<sup>-1</sup> of proton-proton collisions at a center-of-mass energy of 13TeV, recorded by the CMS experiment at the CERN LHC. The search targets gluino pair production, where the gluinos decay into final states with the lightest supersymmetric particle (LSP) and either a top quark-antiquark ( $t$  ( $\bar{t}$ ) over  $\bar{B}$ ) pair, or a light-flavor quark-antiquark ( $q$  ( $\bar{q}$ ) over  $\bar{B}$ ) pair and a virtual or on-shell W boson. The main backgrounds,  $t$  ( $\bar{t}$ ) over  $\bar{B}$  pair and  $W$ +jets production, are suppressed by requirements on the azimuthal angle between the momenta of the lepton and of its reconstructed parent W boson candidate, and by top quark and W boson identification based on a machine-learning technique. The number of observed events is consistent with the expectations from standard model processes. Limits are evaluated on supersymmetric particle masses in the context of two simplified models of gluino pair production. Exclusions for gluino masses reach up to 2120 (2050) GeV at 95% confidence level for a model with gluino decay to a  $t$  ( $\bar{t}$ ) over  $\bar{B}$  pair (a  $q$  ( $\bar{q}$ ) over  $\bar{B}$  pair and a W boson) and the LSP. For the same models, limits on the mass of the LSP reach up to 1250 (1070) GeV.

JOURNAL OF HIGH ENERGY PHYSICS [9], 149, 2023. DOI: 10.1007/JHEP09(2023)149

[P301-2023] “Search for the exotic decay of the Higgs boson into two light pseudoscalars with four photons in the final state in proton-proton collisions at  $\sqrt{s}=13$  TeV”

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for the exotic decay of the Higgs boson to a pair of light pseudoscalars, each of which subsequently decays into a pair of photons, is presented. The search uses data from proton-proton collisions at  $\sqrt{s} = 13$  TeV recorded with the CMS detector at the LHC that corresponds to an integrated luminosity of 132 fb<sup>-1</sup>. The analysis probes pseudoscalar bosons with masses in the range 15-62 GeV, coming from the Higgs boson decay, which leads to four well-isolated photons in the final state. No significant deviation from the background-only hypothesis is observed. Upper limits are set on the product of the Higgs boson production cross section and branching fraction into four photons. The observed (expected) limits range from 0.80 (1.00) fb for a pseudoscalar boson mass of 15 GeV to 0.26 (0.24) fb for a mass of 62 GeV at 95% confidence level.

JOURNAL OF HIGH ENERGY PHYSICS [7], 148, 2023. DOI: 10.1007/JHEP07(2023)148

[P302-2023] “Search for top squark pair production in a final state with at least one hadronically decaying tau lepton in proton-proton collisions at  $\sqrt{s}=13$  TeV”

Tumasyan, A.; Adam, W.; Andrejkovic, J. W.; Chinellato, J. A.\*; et al.  
CMS Collaboration

A search for pair production of the supersymmetric partner of the top quark, the top squark, in proton-proton collisions at  $\sqrt{s} = 13$  TeV is presented in final states containing at least one hadronically decaying tau lepton and large missing transverse momentum. This final state is highly sensitive to scenarios of supersymmetry in which the decay of the top squark to tau leptons is enhanced. The search uses a data sample corresponding to an integrated luminosity of 138 fb<sup>-1</sup>, which was recorded with the CMS detector during 2016-2018. No significant excess is observed with respect to the standard model predictions. Exclusion limits at 95% confidence level on the masses of the top squark and the lightest neutralino are presented under the assumptions of simplified models. The results probe top squark masses up to 1150 GeV for a nearly massless neutralino. This search covers a relatively less explored parameter space in the context of supersymmetry, and the exclusion limit is the most stringent to date for the model considered here.

JOURNAL OF HIGH ENERGY PHYSICS [7], 110, 2023. DOI: 10.1007/JHEP07(2023)110

[P303-2023] “Self-assembly of perovskite nanoplates in colloidal suspensions”

Moral, R.F.; Malfatti-Gasperini, A.A.; Bonato, L.G.\*; Vale, B.R.C.\*; Fonseca, A.F.V.; Padilha, L.A.\*; Oliveira, C.L.P.; Nogueira, A.F.

In recent years, perovskite nanocrystal superlattices have been reported with collective optical phenomena, offering a promising platform for both fundamental science studies and device engineering. In this same avenue, superlattices of perovskite nanoplates can be easily prepared on different substrates,

and they too present an ensemble optical response. However, the self-assembly and optical properties of these aggregates in solvents have not been reported to date. Here, we report on the conditions for this self-assembly to occur and show a simple strategy to induce the formation of these nanoplate stacks in suspension in different organic solvents. We combined wide- and small-angle X-ray scattering and scanning transmission electron microscopy to evaluate CsPbBr<sub>3</sub> and CsPbI<sub>3</sub> perovskite nanoplates with different thickness distributions. We observed the formation of these stacks by changing the concentration of nanoplates and the viscosity of the colloidal suspensions, without the need for antisolvent addition. We found that, in hexane, the concentration for the formation of the stacks is rather high and approximately 80 mg mL<sup>-1</sup>. In contrast, in decane, dodecane, and hexadecane, we observe a much easier self-assembly of the nanoplates, presenting a clear correlation between the degree of aggregation and viscosity. We, then, discuss the impact of the self-assembly of perovskite nanoplates on Förster resonant energy transfer. Our predictions suggest an energy transfer efficiency higher than 50% for all the donor-acceptor systems evaluated. In particular, we demonstrate how the aggregation of these particles in hexadecane induces FRET for CsPbBr<sub>3</sub> nanowires. For the  $n = 2$  nanowires (donor) to the  $n = 3$  nanowires (acceptor), the FRET rate was found to be 4.1 ns<sup>-1</sup>, with an efficiency of 56%, in agreement with our own predictions. We show a monotonic increase in the degree of aggregation of perovskite nanoplates with the viscosity of the solvent. We use SAXS to show the stacking patterns. It is a novel approach to explore the self-assembly of perovskite nanoplates.

MATERIALS HORIZONS, 10[12], 5822-5834, 2023. DOI: 10.1039/d3mh01401k

[P304-2023] “Study of charged particle production at high p<sub>T</sub> using event topology in pp, p-Pb and Pb-Pb collisions at  $\sqrt{s_{NN}}=5.02$  TeV”

Acharya, S.; Adamova, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

This letter reports measurements which characterize the underlying event associated with hard scatterings at mid-pseudo-rapidity ( $|\eta| < 0.8$ ) in pp, p-Pb and Pb-Pb collisions at centre-of-mass energy per nucleon pair,  $\sqrt{s_{NN}} = 5.02$  TeV. The measurements are performed with ALICE at the LHC. Different multiplicity classes are defined based on the event activity measured at forward rapidities. The hard scatterings are identified by the leading particle defined as the charged particle with the largest transverse momentum ( $p_T$ ) in the collision and having  $8 < p_T < 15$  GeV/c. The  $p(T)$  spectra of associated particles ( $0.5 < p_T < 6$  GeV/c) are measured in different azimuthal regions defined with respect to the leading particle direction: toward, transverse, and away. The associated charged particle yields in the transverse region are subtracted from those of the away and toward regions. The remaining jet-like yields are reported as a function of the multiplicity measured in the transverse region. The measurements show a suppression of the jet-like yield in the away region and an enhancement of high- $p(T)$  associated particles in the toward region in central Pb-Pb collisions, as compared to minimum-bias pp collisions. These observations are consistent with previous measurements that used two-particle correlations, and with an interpretation in terms of parton energy loss in a high-density quark gluon plasma. These yield modifications vanish in peripheral Pb-Pb collisions and are not observed in either high-multiplicity pp or p-Pb collisions.

PHYSICS LETTERS B 843, 137649, 2023. DOI: 10.1016/j.physletb.2022.137649

**[P305-2023] “System-size dependence of the charged-particle pseudorapidity density at  $\sqrt{s_{NN}}=5.02$  TeV for pp, p-Pb, and Pb-Pb collisions”**

Acharya, S.; Adamová, D.; Adler, A.; Chinellato, D. D.\*; Guardiano, G. G.\*; Jahnke, C.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

We present the first systematic comparison of the charged-particle pseudorapidity densities for three widely different collision systems, pp, p-Pb, and Pb-Pb, at the top energy of the Large Hadron Collider ( $\sqrt{s_{NN}} = 5.02$  TeV) measured over a wide pseudorapidity range ( $-3.5 < \eta < 5$ ), the widest possible among the four experiments at that facility. The systematic uncertainties are minimised since the measurements are recorded by the same experimental apparatus (ALICE). The distributions for p-Pb and Pb-Pb collisions are determined as a function of the centrality of the collisions, while results from pp collisions are reported for inelastic events with at least one charged particle at midrapidity. The charged-particle pseudorapidity densities are, under simple and robust assumptions, transformed to charged-particle rapidity densities. This allows for the calculation and the presentation of the evolution of the width of the rapidity distributions and of a lower bound on the Bjorken energy density, as a function of the number of participants in all three collision systems. We find a decreasing width of the particle production, and roughly a smooth ten fold increase in the energy density, as the system size grows, which is consistent with a gradually higher dense phase of matter.

**PHYSICS LETTERS B 845, 137730, 2023. DOI: 10.1016/j.physletb.2023.137730**

**[P306-2023] “Texture-based brain networks for characterization of healthy subjects from MRI”**

Silveira, R.V. da\*.; Li, L.M.; Castellano, G.\*

Brain networks have been widely used to study the relationships between brain regions based on their dynamics using, e.g. fMRI or EEG, and to characterize their real physical connections using DTI. However, few studies have investigated brain networks derived from structural properties; and those have been based on cortical thickness or gray matter volume. The main objective of this work was to investigate the feasibility of obtaining useful information from brain networks derived from structural MRI, using texture features. We also wanted to verify if texture brain networks had any relation with established functional networks. T1-MR images were segmented using AAL and texture parameters from the gray-level co-occurrence matrix were computed for each region, for 760 subjects. Individual texture networks were used to evaluate the structural connections between regions of well-established functional networks; assess possible gender differences; investigate the dependence of texture network measures with age; and single out brain regions with different texture-network characteristics. Although around 70% of texture connections between regions belonging to the default mode, attention, and visual network were greater than the mean connection value, this effect was small (only between 7 and 15% of these connections were larger than one standard deviation), implying that texture-based morphology does not seem to subside function. This differs from cortical thickness-based morphology, which has been shown to relate to functional networks. Seventy-five out of 86 evaluated regions showed significant (ANCOVA,  $p < 0.05$ ) differences between genders. Forty-four out of 86 regions showed significant (ANCOVA,  $p < 0.05$ ) dependence with age; however, the R2 indicates that this is not a linear relation. Thalamus and putamen showed a very unique texture-wise structure compared to other analyzed regions. Texture networks were able to provide useful information regarding gender and age-related differences, as well as for singling out specific brain regions. We did not find a morphological texture-based subsidy for the evaluated functional brain networks.

In the future, this approach will be extended to neurological patients to investigate the possibility of extracting biomarkers to help monitor disease evolution or treatment effectiveness.

**SCIENTIFIC REPORTS 13[1], 16421, 2023. DOI: 10.1038/s41598-023-43544-6**

**[P307-2023] “Tribocorrosion Susceptibility and Cell Viability Study of 316L Stainless Steel and Ti6Al4V Titanium Alloy with and without DLC Coatings”**

Sene, A.C.; Silva, M.G.P. da; Macario, P.F.; Vieira, A.A.; Leite, P.M.S.C.M.; Silva, N.S. da; Marques, F. das C.\*; Vieira, L.

Stainless steel (SS316L) and titanium alloy (Ti6Al4V) exhibit suitable properties for biomedical applications; however, the tribocorrosion of these materials, which is associated with metallosis, is still a significant concern. This work investigates the effectiveness of DLC smoothing coatings applied to the metals to reduce tribocorrosion and improve cell viability. The study was motivated by many reports of metallosis caused by metal debris in the soft tissues of the body. DLC coatings were produced using the plasma-enhanced chemical vapor deposition (PECVD) technique. The cytotoxicity, genotoxicity, and cell viability of metallic samples with and without DLC coatings were analyzed, considering the chemical composition of the coating and metallic components. The results show that the DLC coatings presented suitable interaction properties and no cytotoxicity or genotoxicity when exposed to the cellular environment, compared with the control group ( $p < 0.0001$ ). They also demonstrated cell viability, low friction representing a reduction of 80%, and hardness 23-26 GPa, making them ideal for use on fixed implants. It is necessary to control the thickness and roughness of the coating to avoid pinholes and increase the corrosion protection of implants. These DLC coatings with low friction coefficients could facilitate the fixation of implantable pins and screws, including Kirschner wires.

**COATINGS 13[9], 1549, 2023. DOI: 10.3390/coatings13091549**

**[P308-2023] “Tuning the topological character of half-Heusler systems: A comparative study on YTBi (T = Pd, Pt)”**

Souza, J. C.\*; Crivillero, M. V. A.; Dawczak-Debicki, H.; Ptok, A.; Pagliuso, P.G.\*; Wirth, S.

Half-Heusler systems host a plethora of different ground states, especially with nontrivial topology. However, there is still a lack of spectroscopic insight into the corresponding band inversion in this family. In this work, we locally explore the half-Heuslers YTBi (T = Pt and Pd) by means of scanning tunneling microscopy/spectroscopy. From our analysis of the (120) surface plane, we infer that the increase of the spin-orbit coupling upon going from Pd to Pt is the main player in tuning the surface states from trivial to topologically nontrivial. Our measurements unveil a  $(2 \times 1)$  reconstruction of the (120) surface of both systems. Using density functional theory calculations, we show that the observed different behavior of the local density of states near the Fermi level in these two materials is directly related to the presence of metallic surface states. Our work sheds new light on a well known tunable family of materials and opens new routes to explore the presence of topological states of matter in half-Heusler systems and its microscopic observation.

**PHYSICAL REVIEW B 108[16], 165154, 2023. DOI: 10.1103/PhysRevB.108.165154**

**[P309-2023] “Two-dimensional manganese di-telluride based triboelectric nanogenerator”**

Gowda, C.C.; Tromer, R.\*; Chandravanshi, D.; Pandey, P.; Chatopadhyay, K.; Galvao, D.S.\*; Tiwary, C.S.

Low-dimensional transition metal chalcogenides (TMDCs) have gained interest as potential energy harvesters. The structural change during dimensional reduction paves the way for better charge repositories compared to their bulk counterparts. Thin flakes of manganese di-telluride (MnTe<sub>2</sub>) were used to devise a triboelectric nanogenerator (TENG), and the device was capable of producing a maximum power density of 123 mW cm<sup>-2</sup>, with a sensitivity of similar to 408 mV kPa<sup>-1</sup>. The device also has a high surface potential of 1.02 V and surface charge density (SCD) of 2.204 mC m<sup>-2</sup>, respectively. The effect of uniaxial and biaxial strains on the two-dimensional (2D) TENG was studied using in-situ Raman spectroscopy. The enhanced outputs in the 2D device were attributed to the Te - di vacancies created during exfoliation in the flakes (DFT calculations). The potential application of the fabricated device is to be used as an energy harvester from air-conditioning (AC) ducts.

**NANO ENERGY 117, 108833, 2023. DOI: 10.1016/j.nanoen.2023.108833**

**[P310-2023] “Two-particle azimuthal correlations in  $\gamma p$  interactions using pPb collisions at  $\sqrt{s_{NN}}=8.16$  TeV”**

Tumasyan, A.; Adam, W.; Bergauer, T.; Chinellato, J. A.\*; et al. CMS Collaboration

The first measurements of the Fourier coefficients ( $V_n$  Delta) of the azimuthal distributions of charged hadrons emitted from photon-proton ( $\gamma p$ ) interactions are presented. The data are extracted from 68.8nb<sup>-1</sup> of ultra-peripheral proton-lead (pPb) collisions at  $\sqrt{s_{NN}}=8.16$  TeV using the CMS detector. The high energy lead ions produce a flux of photons that can interact with the oncoming proton. This  $\gamma p$  system provides a set of unique initial conditions with multiplicity lower than in photon-lead collisions but comparable to recent electron-positron and electron-proton data. The  $V_n$  Delta coefficients are presented in ranges of event multiplicity and transverse momentum ( $p_T$ ) and are compared to corresponding hadronic minimum bias pPb results. For a given multiplicity range, the mean  $p_T$  of charged particles is smaller in  $\gamma p$  than in pPb collisions. For both the  $\gamma p$  and pPb samples,  $V_1$  Delta is negative,  $V_2$  Delta is positive, and  $V_3$  Delta consistent with 0. For each multiplicity and  $p_T$  range,  $V_2$  Delta is larger for  $\gamma p$  events. The  $\gamma p$  data are consistent with model predictions that have no collective effects.

**PHYSICS LETTERS B 844, 137905, 2023. DOI: 10.1016/j.physletb.2023.137905**

**[P311-2023] “Unravelling the surface structure of  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> (100)”**

Kilian, A.S.; Siervo, A. de\*; Landers, R.\*; Abreu, G.J.P.; Castro, M.S.\*; Back, T.; Pancotti, A.

The present work is on a comprehensive surface atomic structure investigation of beta-Ga<sub>2</sub>O<sub>3</sub> (100). The beta-Ga<sub>2</sub>O<sub>3</sub> single crystal was studied by a structural model system in the simulations and in situ characterization via X-ray photoelectron spectroscopy (XPS), low-energy electron diffraction (LEED) and X-ray photoelectron diffraction (XPD) allowed for probing the outermost layers' properties. In situ XPD characterization allows for the collection of valuable element-specific short-range information from the beta-Ga<sub>2</sub>O<sub>3</sub> surface, and the results were compared to a systematic and precise multiple scattering simulation approach. The experiments, characterizations, and simulations indicated strong evidence of considerable structural variations in the interatomic layer's distances.

Such atomic displacement could clarify the electronic phenomena observed in theoretical studies. The comparison between experimental and theoretical XPD results involving multiple scattering calculations indicated that the beta-Ga<sub>2</sub>O<sub>3</sub> surface has two possible terminations. The best fits to the photoelectron diffraction curves are used to calculate the interplanar relaxation in the first five atomic layers. The results show good agreement with previous density functional theory calculations, establishing XPD as a useful tool for probing the atomic structure of oxide surfaces.

**RSC ADVANCES 13[40], 28042-28050, 2023. DOI: 10.1039/d3ra04682f**

## Eventos publicados

**[P312-2023] “A study of the properties of Iron oxides ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>3</sub>O<sub>4</sub>) through time domain spectroscopy in the Terahertz range”**

Budroni Netto, G.\*; Siqueira, J. de P.\*; Cruz, F. C. da\* IEEE

Terahertz time-domain spectroscopy was performed on samples of the iron oxides alpha-hematite and magnetite. We were able to obtain the complex refractive index and dielectric constants. For alpha-hematite, an AFM resonance was observed at 0.13 THz. Although we did not find any resonance for magnetite, it was possible to observe spectral changes by decreasing the temperature. This suggests that TDS-THz may be a useful tool to detect corrosion on iron materials.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230927**

**[P313-2023] “Analysis of integrated photonics with saturable absorption in the C-Band employing 2D 1T'-MoTe<sub>2</sub> monolayer”**

Volpato, M.C.\*; Assis, P.L. de\*; Frateschi, N.C.\* IEEE

We investigate the potential of 1T'-MoTe<sub>2</sub> as a saturable absorber for silicon photonics devices. By optimizing the coupling coefficient between the 2D material and the waveguide, we achieve a maximum coupling of 18%. Utilizing carrier statistics calculations, we estimate the saturation intensity per effective interaction length as 7.5MW/cm<sup>2</sup>.nm at 1560nm. Our simulation suggests that the saturation intensity in an optimized waveguide reaches approximately 13MW/cm<sup>2</sup>.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 1570911738, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230942**

**[P314-2023] “Biodegradable ball lenses made of agar”**

Rosa, L.O.; Morais, E.F.\*; Cordeiro, C.M.B.\*; Fujiwara, E. IEEE

This work reports the fabrication of agar ball lenses, an biodegradable, edible, and renewable material.

Pouring melted agar-glycerol-water solutions into vegetable oil produces transparent spheres whose refractive index and diameter change with glycerol concentration and agitation speed. Results confirm the agar lens feasibility for imaging suggesting possible applications.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230920**

**[P315-2023] “Characterizing an inhomogeneous water-carbohydrate solution using its optical activity”**

**Souza, E.A.V.\*; Osório, J.H.\*; Cordeiro, C.M.B.\***  
IEEE

We report on the characterization of the depth-dependent concentration gradient of an inhomogeneous water-sucrose solution and its evolution with time. The experimental method is simple and non-intrusive, being attractive for the characterization of liquid samples displaying optical activity.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230916**

**[P316-2023] “Curvature sensing with a hybrid-lattice hollow-core photonic crystal fiber”**

**Souza, A.D.P.\*; Cordeiro, C.M.B.\*; Amrani, F.; Delahaye, F.; Gérôme, F.; Benabid, F.; Osório, J.H.\***  
IEEE

We report on curvature sensing measurements using a hybrid Kagome-tubular hollow-core photonic crystal fiber. The sensing principle is based on bending-mediated resonant couplings between core and airy cladding modes achieved at specific curvature radii and wavelengths. We consider that our investigation identifies a promising use of hollow-core fibers in sensing, thus broadening the application framework of this family of fibers.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 1570907725, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230935**

**[P317-2023] “Large-core hollow fibers for speckle-based displacement sensing”**

**Osório, J.H.\*; Cabral, T.D.; Fujiwara, E.; Franco, M.A.R.; Amrani, F.; Delahaye, F.; Gérôme, F.; Benabid, F.; Cordeiro, C.M.B.\***  
IEEE

We study the application of a large-core hollow fiber as a platform for displacement sensing. The sensor is assembled by inserting and appropriately moving a single-mode fiber in the empty core of the hollow fiber. Such a construction allows attaining a speckled intensity profile at the hollow fiber output, which is evaluated while one controllably displaces the single-mode fiber in its interior. Our results allow identifying this scheme as a promising means for exploring the multimode characteristics of hollow fibers in sensing contexts.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 1570902665, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230969**

**[P318-2023] “Organic resist based fabrication of integrated waveguides and ring resonators in thin-film lithium niobate”**

**Mazzi, F.B.\*; Barbosa, F.A.S.\***  
IEEE

Thin-film lithium niobate (TFLN) is a promising candidate for photonic-based quantum information technology. This platform combines large nonlinear and electro-optical coefficients with the tight confinement and reduced footprint characteristic of integrated devices. Nonetheless, current high-performance devices in TFLN generally rely on the use of hydrogen-silsesquioxane (HSQ) resist, or on silicon dioxide hard-masks, adding complexity to the fabrication process. Here, we fabricate and characterize optical resonators in TFLN using readily available organic deep UV resist. This process constitutes an alternative for more accessible microfabrication of TFLN photonic devices.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230987**

**[P319-2023] “Post-processing of hollow-core photonic crystal fibers: selective hole inflation and tapering”**

**Machado, G.\*; Cordeiro, C.M.B.\*; Gerosa, R.M.\*; Amrani, F.; Gérôme, F.; Benabid, F.; Osório, J.H.\***  
IEEE

We report on post-processing experiments using hollow-core photonic crystal fibers. We show that, by simultaneously heating and internally pressurizing the fibers, we can taper or modify the sizes of the fiber microstructure features. Particularly, by employing a technique for selectively obstructing the microstructure elements, we could attain tailored modifications of the fiber architecture, namely the inflation of selected cladding tubes, which can be of interest for the development of new devices and sensors.

**2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 1570902667, 2023. DOI: 10.1109/OMN/SBFOTONIOPC58971.2023.10230974**

**[P320-2023] “Quantitative biospeckle spectral and angular analysis of tomatoes at different ripening stages”**

**Serighelli, J.F.\*; Fujiwara, E.; Cordeiro, C.M.B.\***  
IEEE

Quantitative biospeckle measurements in tomatoes at different ripening stages are reported. The biological activity was calculated with a correlation method using few seconds videos recorded with a low-cost, lensless webcam. 543 and 633 nm lasers were used as light sources similar or complementary to the tomato color. The webcam captures videos at different angles, close or away from the quasi-specular reflection.

A new metric (ratio of the biospeckle activity at two wavelengths) was proposed, allowing for differentiating biological samples at different stages.

2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 1570911200, 2023. DOI: 10.1109/OMN/SBFOTON-IOPC58971.2023.10230977

[P321-2023] “Temperature sensing with a liquid-filled hollow-core photonic crystal fiber”

Rodrigues, G.L.\*; Cordeiro, C.M.B.\*; Amrani, F.; Gérôme, F.; Benabid, F.; Osório, J.H.\*  
IEEE

We report the realization of temperature sensing measurements using a water-filled hollow-core photonic crystal fiber. The operation of the sensor relies on the thermo-optic effect-mediated spectral shifts of the fiber transmission bands due to temperature variations. The characterization of our device allowed us to estimate a sensitivity of  $(0.42 \pm 0.04)$  nm/degrees C and to identify the studied platform as a valid path for the development of fiber-based temperature sensors.

2023 INTERNATIONAL CONFERENCE ON OPTICAL MEMS AND NANOPHOTONICS, OMN AND SBFOTON INTERNATIONAL OPTICS AND PHOTONICS CONFERENCE, SBFOTON IOPC. International Conference on Optical MEMS and Nanophotonics, 2023. DOI: 10.1109/OMN/SBFOTON-IOPC58971.2023.10230983

## Correções

[Co003-2023] ‘Measurement of prompt and nonprompt charmonium suppression in PbPb collisions at 5.02 TeV (vol 78, 509, 2018)’

Sirunyan, A. M.; Tumasyan, A.; Adam, W.; Chinellato, J.A.\*; Manganote, E. J. T.\*; et al.  
CMS Collaboration

EUROPEAN PHYSICAL JOURNAL C 83[2], 145, 2023. DOI: 10.1140/epjc/s10052-023-11272-w

\*Autores da comunidade IFGW

Fonte: Web of Science on-line (WOS)

## Defesas de Dissertações do IFGW

[D023-2023] “Efeitos estruturais e magnéticos do crescimento de liga ordenada de FePt sob campo magnético controlado”

Aluno: Jose Claudio Corsaletti Filho  
Orientador: Profa. Dra. Fanny Béron  
Data: 30/11/2023

## Defesas de Teses do IFGW

[T013-2023] “Métodos de Machine Learning para reconstrução de estranheza no ALICE”

Aluno: Gabriel Reis Garcia  
Orientador: Prof. Dr. Jun Takahashi  
Data: 24/11/2023

[T014-2023] “Potencial do detector de superfície AugerPrime para estudos de composição de raios cósmicos de altíssimas energias”

Aluno: Allan Machado Payeras  
Orientador: Prof. Dr. Anderson Campos Fauth  
Data: 15/12/2023

[T015-2023] “Sondando Perovskitas de Haleto de Metal com Espectroscopia de Fotoelétrons por Microjato utilizando Raios X”

Aluno: oel Anderson Ferreira Pinheiro  
Orientador: Prof. Dr. Arnaldo Naves de Brito  
Data: 18/12/2023

Fonte: Portal IFGW/Eventos

Disponível em: [https://portal.ifi.unicamp.br/a-instituicao/eventos/month.calendar/2023/12/14/-](https://portal.ifi.unicamp.br/a-instituicao/eventos/month.calendar/2023/12/14/)

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**Fonte:** Página do PECIM

**Disponível em:** <https://www.pecim.unicamp.br/bancas>

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## Abstracta

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