Abstracta

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Artigos publicados 2025

[P374-2025] "1T′-MoTe2 as an integrated saturable absorber for photonic machine learning"

Volpato, M. C.*; Rosa, H. G.; Reep, T.; **Assis, P. L. de*; Frateschi, N. C.***

We investigate the saturable absorption behavior of a 1T '-MoTe2 monolayer integrated with a silicon nitride waveguide for applications in photonic neural networks. Using experimental transmission measurements and theoretical modeling, we characterize the nonlinear response of the material. Our model, incorporating quasi-Fermi level separation and carrier dynamics, explains these behaviors and predicts the material's absorption dependence on the carrier density. Furthermore, we demonstrate a coupling efficiency of up to 20% between the 1T '-MoTe2 monolayer and the silicon nitride waveguide, with saturation achievable at input powers as low as a few microwatts. These results suggest that 1T '-MoTe2 is a promising candidate for implementing nonlinear functions in integrated photonic neural networks.

APPLIED PHYSICS LETTERS 127[22], 221103, 2025. DOI: 10.1063/5.0292255. Acesso em: **https://doi.org/10.1063/5.0292255**

[P375-2025] "Amplitude analysis of the Ξc+ -- pK- π+ decay and Ξc+ baryon polarization measurement in semileptonic beauty-hadron decays"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.***; et al. LHCb Collaboration

An amplitude analysis of the Xi(+)(c) -> pK(-) pi(+) decay together with a measurement of the Xi(+)(c) polarization vector in semileptonic beauty-hadron decays is presented. The analysis is performed using proton-proton collision data collected by the LHCb experiment, corresponding to an integrated luminosity of 9 fb(-1). An amplitude model is developed and the resonance fractions as well as two- and three-body decay parameters are reported. A sizeable. thornc polarization is found. A large sensitivity of the Xi(c) -> pK(-)pi(+) decay to the polarization is seen, making the amplitude model suitable for Xi(+)(c) polarization measurements in other systems.

PHYSICAL REVIEW D 112[9], 2025. DOI: 10.1103/gcft-fgp1. Acesso em: **https://doi.org/10.1103/gcft-fgp1**

[P376-2025] "CdS quantum dot interlayer engineering for enhanced SnO2/perovskite interfaces in solar cells"

Fonseca, A. F. V.; Germano, G. M.; Scalon, L.; **Almeida, C. A. N. de***; Barra, A. C. C.; Ribeiro, D. S.; **Brandao, Z. C.*; Marques, F. C.***; Mora-Sero, I.; Nogueira, A. F.

Interfacial defects at the buried junction between the electron transport layer (ETL) and perovskite absorber critically hinder the performance of perovskite solar cells (PSCs). In this work, we report that a CdS quantum dot (QD) interlayer, deposited onto SnO2 via a scalable successive ionic layer adsorption and reaction (SILAR) method, provides a practical and scalable strategy to improve charge transport across this interface. The CdS QD layer not only suppresses oxygen vacancies but also reacts with hydroxyl groups on the SnO2 surface, thereby improving surface potential uniformity and enhancing the electron extraction rate. Impedance spectroscopy further confirms improved interface homogeneity and charge transport, which correlate with higher fill factor and short-circuit current density. As a result, CdS modification enables a-25 % efficiency enhancement on PSCs, highlighting the potential of QD-based interfacial engineering towards high-performance PSCs.

MATERIALS TODAY CHEMISTRY 50, 103238, 2025. DOI: 10.1016/j.mtchem.2025.103238. Acesso em: **https://doi.org/10.1016/j.mtchem.2025.103238**

[P377-2025] "Characterizing quantum internet using complex network models"

Silveira, O. J. R.*; Silva, N. B. da; Silva, S. L. L. da; Mata, A. S. da

Quantum communication is a growing area of research, with quantum internet being one of the most promising applications. Studying the statistical properties of this network is essential to understanding its connectivity and the efficiency of the entanglement distribution. However, the models proposed in the literature often assume homogeneous distributions in the connections of the optical fiber infrastructure, without considering the heterogeneity of the network. In this work, we propose new models for the quantum internet that incorporate this heterogeneity of node connections in the optical fiber network, analyzing how this characteristic influences fundamental metrics such as the degree distribution, the average clustering coefficient, the average shortest path and assortativity. Our results indicate that, compared to homogeneous models, heterogeneous networks efficiently reproduce key structural properties of real optical fiber networks, including degree distribution, assortativity, and hierarchical behavior. These findings highlight the impact of network structure on quantum communication and can contribute to more realistic modeling of quantum internet infrastructure.

EUROPEAN PHYSICAL JOURNAL-SPECIAL TOPICS, 2025. DOI: 10.1140/epjs/s11734-025-02093-x. Early Access Date: DEC 2025. Acesso em: **https://doi.org/10.1140/epjs/s11734-025-02093-x**

[P378-2025] "Chiral Phonons in Graphyne"

Mishra, S.; Chakraborty, A.; **Galvao, D. S.*;** Autreto, P. A. S.; Singh, A. K.

Chiral phonons, quantized lattice vibrations with circular polarization and nonzero angular momentum, offer exciting platforms for phononic and quantum device engineering. Graphyne, with its unique lattice geometry and valley-structured electronic bands, could be a promising candidate. However, chiral phonons in graphyne remain unexplored due to inherent inversion (P) and time-reversal (T) symmetries. Here, we demonstrate the emergence of chiral phonons in 6-6-12 and gamma-graphynes by breaking PT symmetry through atomic--selective substitutional doping while preserving rotoinversion or 3-fold rotational symmetry. Dopants, such as B and N, and ortho BN codopants induce localized structural deformations, which lift phonon mode degeneracies away from the Gamma--point, giving rise to chiral phonons. We reveal a strong correlation between chiral phonon angular momentum and dopant electron affinity. Electron-rich dopants enhance local charge density, which could strengthen electron-phonon interaction, resulting in increased phonon angular momentum. The proposed approach provides a novel pathway to control chiral phonon angular momentum, essential for advanced phononic devices.

JOURNAL OF PHYSICAL CHEMISTRY C 130[1], p. 692-698, 2025. DOI: 10.1021/acs.jpcc.5c06623. Acesso em: **https://doi.org/10.1021/acs.jpcc.5c06623**

[P379-2025] "Correcting noisy quantum gates with shortcuts to adiabaticity"

Cavalcante, M. F.*; Cakmak, B.; **Bonanca, M. V. S.***; Deffner, S.

Unitary quantum gates constitute the building blocks of quantum computing in the circuit paradigm. In this work, we engineer a locally driven two-qubit Hamiltonian whose instantaneous ground-state dynamics generates the controlled-NOT (CNOT) quantum gate. In practice, quantum gates have to be implemented in finite time, hence nonadiabatic and external noise effects debilitate gate fidelities. Here, we show that counterdiabatic control can restore gate performance with near perfect fidelities even in open quantum systems subject to decoherence. Copyright c 2025 EPLA All rights, including for text and data mining, AI training, and similar technologies, are reserved.

EPL 152[3], 48001, 2025. DOI: 10.1209/0295-5075/ae1da3. Acesso em: **https://iopscience.iop.org/article/10.1209/0295-5075/ae1da3**

[P380-2025] "D0-meson-tagged jet axes difference in proton-proton collisions at √p=5.02 TeV"

Acharya, S.; Agarwal, A.; Rinella, G. A.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
A Large Ion Collider Expt Collaboration

Heavy-flavor quarks produced in proton- proton (pp) collisions provide a unique opportunity to investigate the evolution of quark-initiated parton showers from initial hard scatterings to final-state hadrons. By examining jets that contain heavy-flavor hadrons, this study explores the effects of both perturbative and nonperturbative QCD on jet formation and structure. The angular differences between various jet axes, Delta R-axis, offer insight into the radiation patterns and fragmentation of charm quarks. The first measurement of D-0--tagged jet axes differences in pp collisions at root s = 5.02 TeV by the ALICE experiment at the LHC is presented for jets with transverse momentum p(ch jet) (T) >= 10 GeV/c and D-0 mesons with p(D0) (T) >= 5 GeV/c. In this D-0-meson-tagged jet measurement, three jet axis definitions, each with different sensitivities to soft, wide-angle radiation, are used: the standard axis, soft drop groomed axis, and winner-takes-all axis. Measurements of the radial distributions of D-0 mesons with respect to the jet axes, Delta R-axis-D(0), are reported, along with the angle, Delta R-axis, between the three jet axes. The D-0 meson emerges as the leading particle in these jets, closely aligning with the winner-takes-all axis and diverging from the standard jet axis. The results also examine how varying the sensitivity to soft radiation with grooming influences the orientation of the soft drop jet axis and uncover that charm--jet structure is more likely to survive grooming when the soft drop axis is further from the D-0 direction, providing further evidence of the dead-cone effect recently measured by ALICE.

PHYSICAL REVIEW D 112[9], 092012, 2025. DOI: 10.1103/nt4q-7t77. Acesso em: **https://doi.org/10.1103/nt4q-7t77**

[P381-2025] "Dark Energy Survey Year 3 Results: Cosmological constraints from second- and third-order shear statistics"

Gomes, R. C. H.; Sugiyama, S.; **Alsina, A. N.*;** et al.

We present a cosmological analysis of the third-order aperture mass statistic using Dark Energy Survey Year 3 (DES Y3) data. We perform a complete tomographic measurement of the three--point correlation function of the Y3 weak lensing shape catalog with the four fiducial source redshift bins. Building upon our companion methodology paper, we apply a pipeline that combines the two-point function xi(+/-) with the mass aperture skewness statistic < M-ap(3)>, which is an efficient compression of the full shear three-point function. We use a suite of simulated shear maps to obtain a joint covariance matrix. By jointly analyzing xi(+/-) and < M-ap(3)> measured from DES Y3 data with a.CDM model, we find S-8 = 0.780 +/- 0.015 andOmega(m) = 0.266(-0.040)(+0.039), yielding 111% of figure-of-merit improvement in the Omega(m)--S-8 plane relative to xi(perpendicular to) alone, consistent with expectations from simulated likelihood analyses. With a wCDM model, we find S-8 = 0.749(-0.026)(+0.027) and w(0) = -1.39 +/- 0.31, which gives an improvement of 22% on the joint S-8 -w(0) constraint. Our results are consistent with w(0) = -1. Our new constraints are compared to CMB data from the Planck satellite, and we find that with the inclusion of < M-ap(3)> the existing tension between the datasets is at the level of 2.3 sigma. We show that the third-order statistic enables us to self-calibrate the mean photometric redshift uncertainty parameter of the highest redshift bin with little degradation in the figure of merit. Our results demonstrate the constraining power of higher-order lensing statistics and establish < M-ap(3)> as a practical observable for joint analyses in current and future surveys.

PHYSICAL REVIEW D 112[12], 123515, 2025. DOI: 10.1103/sxlz-t9gb. Acesso em: **https://doi.org/10.1103/sxlz-t9gb**

[P382-2025] "Deuteron identification via time of flight with LHCb"

Aaij, R.; Abdelmotteleb, A. S. W.; Beteta, C. A.; **Magalhaes, P. C.*; Van Hulse, C. B.*;** et al.
LHCb Collaboration

It is shown that the timing capabilities of the LHCb detector operated during the LHC Run 2 can be used to identify light ion particles with momenta of a fewGeV/c. This is achieved by estimating the particle time of flight through a newly developed technique. A dedicated reconstruction procedure and a neural--network-based estimator of the particle speed have been developed to enable deuteron identification by suppressing the abundant background from lighter particles. The performance of the identification procedure is demonstrated in a sample of proton-helium collisions at root s(NN) = 110 GeV, where the production of deuteron and triton particles is observed. This novel approach opens the way to study deuteron and antideuteron production for different collision systems at different energy scales, exploiting the rich dataset collected by the LHCb experiment.

EUROPEAN PHYSICAL JOURNAL C 85[11], 1329, 2025. DOI: 10.1140/epjc/s10052-025-14776-9. Acesso em: **https://doi.org/10.1140/epjc/s10052-025-14776-9**

[P383-2025] "Dielectron production in central Pb-Pb collisions at √sNN=5.02 TeV"

Acharya, S.; Adamova, D.; Rinella, G. A.; **Chinellato, D. D.*; Guardiano, G. G.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
Collaboration, A

The first measurement of the e(+) e(-) pair production at midrapidity and low invariant mass in central Pb-Pb collisions at root sNN = 5.02 TeV at the Large Hadron Collider is presented. The yield of e(+)e(-) pairs is compared with a cocktail of expected hadronic decay contributions in the invariant mass (m(ee)) and pair transverse momentum (p(T,ee)) ranges m(ee) < 3.5 GeV/c(2) and p(T, ee) < 8 GeV/c. For 0.18 < m(ee) < 0.5 GeV/c(2) the ratio of data to the cocktail of hadronic contributions amounts to 1.40 +/- 0.11 (stat.) +/- 0.23 (syst.) +/- 0.16 (cocktail) and 1.42 +/- 0.11 (stat.) +/- 0.23 (syst.)(+0.24) (-0.29) (cocktail), including or not including medium effects in the estimation of the heavy-flavor background, respectively. It is consistent with predictions from two different models for an additional contribution of thermal e(+)e(-) pairs from the hadronic and partonic phases. In the intermediate-mass range (1.2 < mee < 2.6 GeV/c(2)), the pair transverse impact parameter of the e(+)e(-) pairs (DCA(ee), where "DCA" denotes "distance of closest approach") is used for the first time in Pb-Pb collisions to separate displaced dielectrons from heavy-flavor hadron decays from a possible (thermal) contribution produced at the interaction point.

The data are consistent with a suppression of e(+)e(-) pairs from cc and an additional prompt component. Finally, the first direct--photon measurement in the 10% most central Pb-Pb collisions at root sNN = 5.02 TeV is reported via the study of virtual direct photons in the transverse momentum range 1 < pT < 5 GeV/c. A model including prompt photons, as well as photons from the preequilibrium and fluid-dynamic phases, can reproduce the result, while being at the upper edge of the data uncertainties.

PHYSICAL REVIEW C 112[5], 054906, 2025. DOI: 10.1103/xl6m-vbqk. Acesso em: **https://doi.org/10.1103/xl6m-vbqk**

[P384-2025] "EEG Monitoring of Temporal Anticipation in Coincidence Anticipation Timing Tasks: A Scoping Review With Recommendations"

Santos, A. F. dos; **Melo, G. C. de*; Castellano, G.*;** Forner-Cordero, A.

Background: Coincidence anticipation timing (CAT) tasks require individuals to synchronize their movement with an external moving stimulus. Electroencephalography (EEG), due to its high temporal resolution, offers a valuable tool for investigating the neural processes underlying temporal anticipation in these tasks. Objectives: This scoping review aims to map the existing literature on EEG monitoring of temporal anticipation during CAT tasks, identify methodological patterns, evaluate the consistency of reported EEG markers, and highlight potential gaps. Eligibility criteria: Studies were included if they examined EEG activity related to anticipatory processes during CAT tasks in human participants.Sources of evidence: Studies were obtained from PubMed, Web of Science, and Scopus. A systematic search was conducted in May 2024 and updated in October 2025. Charting methods: Data were charted across studies, focusing on participant characteristics, protocols, EEG methodologies, and reported outcomes. Results: Eleven studies met our criterion. Substantial methodological variability was identified in participant setup, task design, EEG acquisition, and data analysis strategies. Although some EEG markers have been recurrently explored, no neural features were consistently assessed across all studies, limiting the identification of robust markers of temporal anticipation. Reporting gaps were observed regarding participant characteristics, anticipation type, and error metrics. Conclusions: The field remains exploratory, with considerable heterogeneity across studies. To support more reliable comparisons and advance progress, this review proposes practical methodological recommendations focused on standardizing CAT task design and EEG procedures. These guidelines aim to enhance research quality and contribute to a more cohesive understanding of the neural correlates of temporal anticipation.

BRAIN AND BEHAVIOR 15[12], e71123, 2025. DOI: 10.1002/brb3.71123. Acesso em: **https://doi.org/10.1002/brb3.71123**

[P385-2025] "Effect of Bias Voltage Deposition and Hydrogen Etching on a-SiCx:H Interlayer to Tailor a-C:H Film Adhesion on the Ti6Al4V Substrate"

Goldbeck, M. C.; Weber, J. S.; Perotti, B. L.; **Boeira, C. D.*; Leidens, L. M.*; Alvarez, F.*;** Fukumasu, N.; Michels, A. F.; Figueroa, C. A.

Hydrogenated amorphous carbon (a-C:H) is a low-friction, high hardness, and chemically inert material belonging to the diamond-like carbon group. This film can cover the poor tribological properties of Ti6Al4V, potentially extending the application of this alloy to the tribological area. However, the adhesion of this film on many metallic substrates, such as Ti6Al4V, is low due to its thermal expansion mismatch and high residual stress. To mitigate these phenomena, an intermediary film, known as an interlayer, can be applied. In this study, the plasma-enhanced chemical vapor deposition technique was used to plasma etch Ti6Al4V substrates, deposit hydrogenated amorphous silicon carbide (a-SiCx:H) interlayers from tetramethylsilane, and deposit a-C:H films. Different bias voltages were applied in the interlayer deposition, and different H-2 relative flows were used to feed the etching stage. Optical emission spectroscopy was used as a plasma diagnostic tool. The films were analyzed with physicochemical and microstructural characterizations, and their adhesion was evaluated through scratch tests. It was found that the interlayer thickness reached its maximum by using 600 V. Higher bias voltages produced interlayers with a higher carbon content and lower silicon content. The films' adhesion to the substrate was not affected by changes in bias voltage applied in the interlayer deposition. Increasing the H-2 relative flow up to 40% in the etching stage enhanced the films' adhesion, while the delamination occurred at the a-SiCx:H/Ti6Al4V interface.

ACS APPLIED ENGINEERING MATERIALS 4[1], p. 59-70, 2025. DOI: 10.1021/acsaenm.5c00771. Acesso em: **https://doi.org/10.1021/acsaenm.5c00771**

[P386-2025] "Effect of Co/Cu Ratio and Na Promotion on CO2 Hydrogenation to Alcohols over CoCu/MgAl2O4 Catalysts"

Ferreira, L. E. R.; Strapasson, G. B.; **Kuhl-Soares, G.*; Rodella, C. B.; Muraca, D.***; Rossi, L. M.; Zanchet, D.

CO2 is one of the primary greenhouse gases, and its catalytic hydrogenation to ethanol represents a promising strategy for both CO2 mitigation and the production of value-added chemicals. However, the high thermodynamic stability of CO2, along with the challenges of C-C coupling and selectivity control, makes this transformation particularly demanding. In this work, we investigate a series of Co10-xCux/MgAl2O4 catalysts (x = 0, 1, 5, 9, and 10, with total metal loading of 10 wt %) as catalysts for CO2 hydrogenation to alcohols, exploring the impact of chemical composition and metal-oxide interfacial properties. Insights from related reactions, such as ethanol steam reforming (ESR) and the reverse water gas shift (RWGS) reaction at ambient pressure, were used to support the understanding of Co and Cu site roles in CO2 hydrogenation. Among the tested catalysts, prereduced Co5Cu5 exhibited the highest performance under high--pressure conditions, achieving productivities of 29 mg MeOH g(CoCu)(-1) h(-1) and 6 mg EtOH g(CoCu)(-1) h(-1). A prereduction step led to the formation of a CoCu alloy and modifications in the Co/Cu surface ratio, which contributed to enhanced catalytic activity. Co5Cu5 displayed the best balance between activity and selectivity, while Na promotion enabled C2+ alcohol formation, demonstrating the tandem action of Cu-0 and CoCu alloy sites. These findings highlight the synergistic effects of Co--Cu interactions and alkali metal promotion in tuning catalyst reducibility and improving selectivity toward higher alcohols.

ACS SUSTAINABLE CHEMISTRY & ENGINEERING 13[51], p. 21970-21983, 2025. DOI: 10.1021/acssuschemeng.5c08369. Acesso em: **https://doi.org/10.1021/acssuschemeng.5c08369**

[P387-2025] "Emerging panorama of functional near-infrared spectroscopy in Latin America"

Guevara, E.; **Mesquita, R. C.***; Orihuela-Espina, F.

Neurophotonics Associate Editors Edgar Guevara and Rickson C. Mesquita, along with Felipe Orihuela-Espina, share their perceptions of the evolution of functional near-infrared spectroscopy in Latin America based on a retrospective literature review and the narratives of three other scientists from the region. © 2025 The Authors.

NEUROPHOTONICS 13[Supp 1], S13002, 2025. DOI: 10.1117/1.NPh.13.S1.S13002. Acesso em: **https://doi.org/10.1117/1.NPh.13.S1.S13002**

[P388-2025] "Energy Spectrum of Ultrahigh-Energy Cosmic Rays across Declinations -90° to +44.8° as Measured at the Pierre Auger Observatory"

Abdul Halim, A.; Abreu, P.; Aglietta, M.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

The energy spectrum of cosmic rays above 2.5EeV has been measured across the declination range -90°≤delta≤+44.8° using 310000 events accrued at the Pierre Auger Observatory from an exposure of (104900±3100)km^{2}sryr. No significant variations of energy spectra with declination are observed, after allowing or not for nonuniformities across the sky arising from the well-established dipolar anisotropies in the arrival directions of ultrahigh-energy cosmic rays. The instep feature in the spectrum at ~10EeV reported previously is now established at a significance above 5sigma. Within the statistics, the energy spectra are indistinguishable across declinations so disfavoring an origin for the instep from a few distinctive sources.

PHYSICAL REVIEW LETTERS 135[24], 241002, 2025. DOI: 10.1103/p4l5-hxlf. Acesso em: **https://doi.org/10.1103/p4l5-hxlf**

[P389-2025] "Evaluation of the Potential Carrier and Controlled Release of Antibiotics by Zinc, Nickel, and Cobalt Ferrite Nanoparticles Encapsulated with Silica and Functionalized with Moxifloxacin Hydrochloride"

Abreu, A. S.; Ferreira, S. R. R.; Cabral, N. G.; França, R. P.; Rezende, H. H. A.; **Landers, R.***; Pancotti, A.

Bacterial resistance represents a significant global health threat associated with the development of microbial resistance genes. Nanomedicine emerges as a promising approach to address this challenge by using engineered nanomaterials such as ferrites. This study functionalizes zinc, nickel, and cobalt ferrite nanoparticles with moxifloxacin hydrochloride, a broad-spectrum antibiotic active against both Gram-positive and Gram-negative bacteria. The functionalization follows established methodologies to maximize chemical interactions between nanoparticles and the antibiotic, which are analyzed using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Photoelectron Spectroscopy (XPS), X-ray Diffraction (XRD), Transmission Electron Microscopy (TEM), and X-ray Fluorescence (XRF). Antibiotic release is evaluated in phosphate buffer, and data are analyzed using Analysis of Variance. Antimicrobial activity is assessed through agar disc diffusion against Staphylococcus aureus and Pseudomonas aeruginosa strains. The sol-gel synthesis and functionalization method efficiently produces nanoparticles with suitable sizes for biomedical applications. All synthesized nanoparticles inhibit bacterial growth at different concentrations, confirming their potential as antibiotic carrier systems for controlled drug delivery. These findings highlight the importance of ferrite-based nanostructures as multifunctional platforms for developing innovative antimicrobial strategies in response to the growing challenge of bacterial resistance.

PARTICLE & PARTICLE SYSTEMS CHARACTERIZATION, 2025. DOI: 10.1002/ppsc.202500167. Early Access Date: DEC 2025. Acesso em: **https://doi.org/10.1002/ppsc.202500167**

[P390-2025] "Evidence for Similar Collectivity of High Transverse-Momentum Particles in p-Pb and Pb-Pb Collisions"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

Charged hadron elliptic anisotropies (v(2)) are presented over a wide transverse momentum (p(T)) range for proton-lead (pPb) and lead-lead (PbPb) collisions at nucleon-nucleon center-of-mass energies of 8.16 and 5.02 TeV, respectively. The data were recorded by the CMS experiment and correspond to integrated luminosities of 186 and 0.607 nb(-1) for the pPb and PbPb systems, respectively. A four-particle cumulant analysis is performed using subevents separated in pseudorapidity to effectively suppress noncollective effects. At high pT (p(T) > 8 GeV), significant positive v(2) values that are similar between pPb and PbPb collisions at comparable charged particle multiplicities are observed. This observation suggests a common origin for the multiparticle collectivity for high-p(T) particles in the two systems.

PHYSICAL REVIEW LETTERS 135[7], 071903, 2025. DOI: 10.1103/t5kp-vsv7. Acesso em: **https://doi.org/10.1103/t5kp-vsv7**

[P391-2025] "Experimental Measurement of the Reappearance of Rabi Rotations in Semiconductor Quantum Dots"

Hanschke, L.; Bracht, T. K.; Schöll, E.; Bauch, D.; Berger, E.; Kallert, P.; Peter, M.; Garcia Jr, A. J.; **Silva, S. F. C. da***; Manna, S.; Rastelli, A.; Schumacher, S.; Reiter, D. E.; Jöns, K. D.

Phonons in solid-state quantum emitters play a crucial role in their performance as photon sources in quantum technology. For resonant driving, phonons dampen the Rabi oscillations, resulting in reduced state-preparation fidelities. The phonon spectral density, which quantifies the strength of the carrier-phonon interaction, is nonmonotonic as a function of energy. As one of the most prominent consequences, this should lead to the reappearance of Rabi rotations for increasing pulse power, according to the theoretical predictions in Vagov et al. [Phys. Rev. Lett. 98, 227403 (2007)]. In this Letter, we present the experimental demonstration of the reappearance of Rabi rotations for a resonantly driven quantum dot.

PHYSICAL REVIEW LETTERS 135[26], 263602, 2025. DOI: 10.1103/s212-43gs. Acesso em: **https://doi.org/10.1103/s212-43gs**

[P392-2025] "Exploring nuclear structure with multiparticle azimuthal correlations at the LHC"

Acharya, S.; Agarwal, A.; **Guardiano, G. G.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
ALICE Collaboration

Details of the nuclear structure of Xe-129, such as the quadrupole deformation and the nuclear diffuseness, are studied by extensive measurements of anisotropic-flow-related observables in Xe-Xe collisions at a centre-of-mass energy per nucleon pair root S-NN = 5.44 TeV with the ALICE detector at the LHC. The results are compared with those from Pb-Pb collisions at root S-NN = 5.02 TeV for a baseline, given that the Pb-208 nucleus exhibits a very weak deformation. Furthermore, comprehensive comparisons are performed with a state-of-the-art hybrid model using IP-Glasma+MUSIC+UrQMD. It is found that among various IP-Glasma+MUSIC+UrQMD calculations with different values of nuclear parameters, the one using a nuclear diffuseness parameter of a(0) = 0.492 and a nuclear quadrupole deformation parameter of beta(2) = 0.207 provides a better description of the presented flow measurements. These studies represent the first systematic exploration of nuclear structure at TeV energies, utilizing a comprehensive set of anisotropic flow observables. The measurements serve as a critical experimental benchmark for rigorously testing the interplay between nuclear structure inputs and heavy-ion theoretical models.

PHYSICS LETTERS B 869, 139855, 2025. DOI: 10.1016/j.physletb.2025.139855. Acesso em: **https://doi.org/10.1016/j.physletb.2025.139855**

[P393-2025] "Femtoscopic study of the proton-proton and proton-deuteron systems in heavy-ion collisions at the LHC"

Acharya, S.; Rinella, G. A.; Aglietta, L.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.*;** et al.
ALICE Collaboration

This work reports femtoscopic correlations of p-p ((p) over tilde-(p) over bar) and p-d ((p) over bar-(d) over bar) pairs measured in Pb-Pb collisions at centerof-mass energy per nucleon root s(NN) = 5.02 TeV in the ALICE Collaboration. A fit to the measured proton-proton correlation functions allows one to extract the dependence of the nucleon femtoscopic radius of the particleemitting source on the pair transverse mass (m(T)) and on the average charge particle multiplicity < dN(ch)/dn >(1/3) for three centrality intervals (0 - 10%, 10 - 30%, 30 - 50%). In both cases, the expected power-law and linear scalings are observed, respectively. The measured p-d correlations can be described by both two- and threebody calculations, indicating that the femtoscopy observable is not sensitive to the short-distance features of the dynamics of the p-(p-n) system, due to the large inter-particle distances in Pb-Pb collisions at the LHC. Indeed, in this study, the minimum measured femtoscopic source sizes for protons and deuterons have a minimum value at 2.73(-0.05)(+0.05) and 3.10(-0.86)(+1.04) fm, respectively, for the 30-50% centrality collisions. Moreover, the m(T)-scaling obtained for the p-p and p-d systems is compatible within 1 sigma of the uncertainties. These findings provide new input for fundamental studies on the production of light (anti)nuclei under extreme conditions.

PHYSICS LETTERS B 871, 139921, 2025. DOI: 10.1016/j.physletb.2025.139921. Acesso em: **https://doi.org/10.1016/j.physletb.2025.139921**

[P394-2025] "First measurement of D*+ vector meson spin alignment in Pb-Pb collisions at √sNN = 5.02 TeV"

Acharya, S.; Agarwal, A.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.*;** et al.
ALICE Collaboration

The first measurement of prompt D*+-meson spin alignment in ultrarelativistic heavy-ion collisions with respect to the direction orthogonal to the reaction plane is presented. The spin alignment is quantified by measuring the element rho(00) of the diagonal spin-density matrix for prompt D*+ mesons with 4 < p(T)< 30 GeV/c in two rapidity intervals, |y| < 0.3 and 0.3 < |y| < 0.8, in central (0-10%) and midcentral (30-50%) Pb-Pb collisions at TeV. Evidence of spin alignment rho(00)> 1/3 has been found for p(T)> 15 GeV/c and 0.3 < |y| < 0.8 with a significance of 3.1 sigma. The measured spin alignment of prompt D*+ mesons is compared with the one of inclusive J/psi mesons measured at forward rapidity (2.5 < y < 4).

JOURNAL OF HIGH ENERGY PHYSICS [10], 94, 2025. DOI: 10.1007/JHEP10(2025)094. Acesso em: **https://doi.org/10.1007/JHEP10(2025)094**

[P395-2025] "First observation of the Λb0 -- Λc+Ds-K+K- decay and search for pentaquarks in the Λc+Ds- system"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.***; et al.
LHCb Collaboration

The Lambda(0)(b) -> Lambda D-+(c)s(-) K+ K- decay is observed for the first time using the data sample from proton-proton collisions recorded at a center-of-mass energy of 13 TeV with the LHCb detector, corresponding to an integrated luminosity of 6 fb-1. The ratio of branching fraction to that of Lambda(0)(b) -> Lambda D-+(c)s(-) decays is measured as 0.0141 +/- 0.0019 +/- 0.0012, where the first uncertainty is statistical and the second systematic. A search for hidden-charm pentaquarks with strangeness is performed in the Lambda D-+(c)s(-) system. No evidence is found, and upper limits on the production ratio of Pc (c) over bars(4338)(0) and Pc (c) over bars(4459)(0) pentaquarks relative to the Lambda D-+(c)s(-) final state are set at the 95% confidence level as 0.12 and 0.20, respectively.

PHYSICAL REVIEW D 112[5], 052013, 2025. DOI: 10.1103/b28d-z2xc. Acesso em: **https://doi.org/10.1103/b28d-z2xc**

[P396-2025] "First-principles and machine learning investigation of the structural and optoelectronic properties of dodecaphenylyne: a novel carbon allotrope"

Lima, K. A. L.*; Laranjeira, J. A. S.; Martins, N. F.; Sambrano, J. R.; Dias, A. C.; Ribeiro Junior, L. A.; **Galvao, D. S.***

We report the computational discovery and characterization of Dodecaphenylyne (DP), a novel carbon allotrope with a unique geometric structure. The structural, dynamic, mechanical, electronic, and optical properties of DP were evaluated using density functional theory (DFT) and a machine learning interatomic potential trained specifically for this material. The formation energy of -7.98 eV per atom indicates high dynamic stability, further supported by the absence of imaginary phonon modes and the preservation of structural integrity up to 1000 K in ab initio molecular dynamics (AIMD) simulations. Both DFT and AIMD simulations were performed within the generalized gradient approximation using the PBE functional. Mechanical analysis reveals high in-plane stiffness with directional dependence: Young's modulus values of 469.09 GPa and 600.41 GPa along the x and y directions, respectively. Electronic band structure and projected density of states analyses confirm the DP semiconducting character. Calculations of carrier mobility using the deformation potential theory reveal pronounced anisotropy, with maximum values reaching up to 30.6 x 104 cm2 V-1 s-1 (electrons, e) and 8.4 x 104 cm2 V-1 s-1 (holes, h), much higher than the observed for other 2D materials. DP also exhibits anisotropic optical absorption in the visible and ultraviolet spectrum, highlighting its potential for optoelectronic applications.

NANOSCALE 18[2], p. 1033-1044, 2025. DOI: 10.1039/d5nr02744f. Acesso em: **https://doi.org/10.1039/D5NR02744F**

[P397-2025] "Frequency as a Clock: Synchronization and Intrinsic Recovery in Graphene Transistor Dynamics"

Lopez-Richard, V.; Silva, I. R. F. E.; **Rodrigues, G. L.*; Oliveira, R. F. de*;** Watanabe, K.; Taniguchi, T.; Cadore, A. R.

Hysteresis and memory effects in graphene field-effect transistors (GFETs) offer unique opportunities for neuromorphic computing, sensing, and memory applications, yet their physical origins remain debated due to competing volatile and nonvolatile interpretations. Here, we present a unified dynamic model that captures the essential physics of the GFET response under periodic gate modulation, accounting for both intrinsic relaxation processes and externally driven charge transfer. By modeling nonequilibrium carrier dynamics as a competition between injection and reabsorption rates, we uncover two distinct regimes: one governed by intrinsic, frequency-independent relaxation and another exhibiting frequency-locked behavior where the response is tied to the external drive. This distinction resolves apparent nonvolatile effects and explains loop invariance in floating-gate structures via displacement--current-driven charge injection. Our framework predicts the evolution of the hysteresis loop shape, amplitude, and direction across a wide range of driving conditions, offering a versatile tool for interpreting experimental results and guiding the design of next-generation graphene-based electronic systems.

JOURNAL OF PHYSICAL CHEMISTRY C 130[3], p.1347-1356, 2025. DOI: 10.1021/acs.jpcc.5c06937. Acesso em: **https://doi.org/10.1021/acs.jpcc.5c06937**

[P398-2025] "Hormonal long-acting reversible contraceptives use and potential impact on environment: A mathematical model"

Bahamondes, L.; Pacagnella, R. C.; Marcelino, A. C.; Zulo, J.; Torezzan, C.; Juliato, C. T.; **Tessler, L. R.***

Objective: To estimate the environmental waste footprint impact of disposable waste from contraceptive packaging and menstrual hygiene products among users of long-acting reversible contraceptives (LARCs). Methods: This mathematical modeling study was conducted at the University of Campinas, Brazil, to assess the potential environmental waste footprint generated from cardboard and plastic packaging and the use of menstrual hygiene products among 169 097 copper intrauterine device (Cu-IUD), 69 601 levonorgestrel 52 mg IUD (hormonal--IUD), and 4857 etonogestrel implant (ENG-implant) users. The duration of use was estimated using couple-years of protection: 4.6, 4.8, 2.5, and 0.06 years for the Cu-IUD, hormonal- -IUD, ENG-implant, and combined oral contraceptives (COCs), respectively. The number of menstrual hygiene products potentially used by each group was estimated. For comparison, a theoretical group of 100 000 COC users and nonusers of contraception were included to estimate the annual waste footprint. Results: On an annual basis, Cu-IUD users generated minimal plastic waste (0.6 g) but used approximately 344.8 menstrual pads. Hormonal-IUD users produced 13.8 g of cardboard and 6.9 g of plastic packaging waste and used an estimated 127.0 pads. ENG-implant users generated 25.7 g of cardboard and 28.3 g of plastic waste and used 89.7 pads. Nonusers of contraception were estimated to use 325 pads annually and generated no contraceptive packaging waste. Conclusion: Use of hormonal LARCs is associated with a substantially lower annual environmental waste footprint impact compared with COCs and nonuse of contraception, owing to reduced solid waste generation and fewer disposable menstrual hygiene products used.

INTERNATIONAL JOURNAL OF GYNECOLOGY & OBSTETRICS, 2025. DOI: 10.1002/ijgo.70734, Early Access Date: DEC 2025. Acesso em: **https://doi.org/10.1002/ijgo.70734**

[P399-2025] "Identification of low-momentum muons in the CMS detector using multivariate techniques in proton-proton collisions at √s=13.6 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.*;** et al. CMS Collaboration

"Soft" muons with a transverse momentum below 10 GeV are featured in many processes studied by the CMS experiment, such as decays of heavy-flavor hadrons or rare tau lepton decays. Maximizing the selection efficiency for these muons, while simultaneously suppressing backgrounds from long-lived light--flavor hadron decays, is therefore important for the success of the CMS physics program. Multivariate techniques have been shown to deliver better muon identification performance than traditional selection techniques. To take full advantage of the large data set currently being collected during Run 3 of the CERN LHC, a new multivariate classifier based on a gradient--boosted decision tree has been developed. It offers a significantly improved separation of signal and background muons compared to a similar classifier used for the analysis of the Run 2 data. The performance of the new classifier is evaluated on a data set collected with the CMS detector in 2022 and 2023, corresponding to an integrated luminosity of 62 fb(-1).

JOURNAL OF INSTRUMENTATION 20[4], P04021, 2025. DOI: 10.1088/1748-0221/20/04/P04021. Acesso em: **https://iopscience.iop.org/article/10.1088/1748-0221/20/04/P04021**

[P400-2025] "Inclusive B-meson flavour-tagging algorithm at LHCb"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.***; et al. LHCb Collaboration

A new algorithm is developed to identify the flavour of neutral B mesons at production in pp collisions by utilising all tracks from the hadronisation process. The algorithm is calibrated separately for B-0 and B-s(0) mesons using B-0 -> J/psi K+pi(-) and B-s(0) -> D-s(-)pi(+) decays from pp collision data collected by the LHCb experiment at a centre-of-mass energy of 13TeV. This new algorithm improves the tagging power by 35% for B-0 mesons and 20% for B-0 s mesons when compared to the combined performance of the existing LHCb flavour-tagging algorithms.

JOURNAL OF HIGH ENERGY PHYSICS [11], 41, 2025. DOI: 10.1007/JHEP11(2025)041. Acesso em: **https://doi.org/10.1007/JHEP11(2025)041**

[P401-2025] "Investigating the exclusive toponium production at the LHC and FCC"

Francener, R.*; Gonçalves, V. P.; Martins, D. E.

An exploratory study of the exclusive toponium production in pp, pPb, and PbPb collisions at the center-of-mass energies of the Large Hadron Collider (LHC) and Future Circular Collider (FCC) is performed. Assuming that the toponium is a pseudoscalar tt<overline> state, we consider its exclusive production by photon and gluon-induced interactions. Results for the total cross sections and associated rapidity distributions are presented, and the number of events at the LHC and FCC are estimated.

PHYSICAL REVIEW D 112[9], 094050, 2025. DOI: 10.1103/s4gj-5tpn. Acesso em: **https://doi.org/10.1103/s4gj-5tpn**

[P402-2025] "Liposome Adsorption Dynamics Induced by Gold Surface Functionalization"

Casagrande, P. S.*; Gomes, W. E.; Salgado, C. M.; **Teschke, O.*; Burguim, J. A. F.*; Soares, D. M.***

Early disease detection is vital. Biosensors using phospholipid films or core-shell lipid-based nanostructures can aid this process. This study examined the influence of gold surface functionalization with self-assembled monolayers (SAMs) on liposome adsorption using Atomic Force Microscopy and Quartz Crystal Microbalance. Comparing hydrophobic octanethiol and hydrophilic 3-mercaptopropionic acid (3-MPA) SAMs, we found that liposome adsorption on the hydrophilic surface occurred significantly faster, requiring only 20 seconds, compared to hydrophobic surfaces which took over 1,000 seconds. Furthermore, the hydrophilic surface exhibited a higher adsorbed mass of approximately 200 ng, suggesting multilayer formation, while hydrophobic surfaces showed around 150 ng of deposited liposomes. These results highlight the crucial role of surface wettability, dictated by SAM polarity, in controlling the kinetics and extent of lipid bilayerformation for applications in biosensors and drug delivery nanotechnology.

ANAIS DA ACADEMIA BRASILEIRA DE CIENCIAS 97, e20241411, Suplemento: 4, 2025. DOI: 10.1590/0001-3765202520241411. Acesso em: **https://doi.org/10.1590/0001-3765202520241411**

[P403-2025] "Measurement of isolated prompt photon production in pp and p-Pb collisions at the LHC"

Acharya, S.; Agarwal, A.; Rinella, G. A.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.*;** et al.
ALICE Collaboration

This paper presents the measurement of the isolated prompt photon inclusive production cross section in pp and p-Pb collisions by the ALICE Collaboration at the LHC. The measurement is performed in p-Pb collisions at centre-of-mass energies per nucleon pair of root s(NN) = 5.02 TeV and 8.16 TeV, as well as in pp collisions at root s = 5.02 TeV and 8 TeV. The cross section is obtained at midrapidity (|y| < 0.7) using a charged-track based isolation momentum p(T)(iso, ch) T < 1.5GeV/c in a cone with radius R = 0.4. The data for both collision systems are well reproduced by perturbative QCD (pQCD) calculations at next--to-leading order (NLO) using recent parton distribution functions for free (PDF) and bound (nPDF) nucleons. Furthermore, the nuclear modification factor RpA for both collision energies is consistent with unity for p(T) > 20 GeV/c. However, deviations from unity (R-pA < 1) of up to 20% are observed for p(T) < 20 GeV/c with limited significance, indicating the possible presence of nuclear effects in the initial state of the collision. The suppression increases with decreasing p(T) with a significance of 2.3 sigma for a non-zero slope and yields R-pA < 1 with a significance of 1.8s at root s(NN) = 8.16 TeV for pT < 20 GeV/c. In addition, a significance of 1.1 sigma is observed for R-pA < 1 at the lower collision energy root s(N)N = 5.02 TeV for p(T) < 14 GeV/c. The magnitude and shape of the suppression are consistent with pQCD predictions at NLO using nPDFs that incorporate nuclear shadowing effects in the Pb nucleus.

EUROPEAN PHYSICAL JOURNAL C 85[12], 1407, 2025. DOI: 10.1140/epjc/s10052-025-14802-w. Acesso em: **https://doi.org/10.1140/epjc/s10052-025-14802-w**

[P404-2025] "Measurement of light-by-light scattering and the Breit-Wheeler process, and search for axion-like particles in ultraperipheral PbPb collisions at √sNN=5.02 TeV"

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

Measurements of light-by-light scattering (LbL, gamma gamma -> gamma gamma) and the Breit-Wheeler process (BW, gamma gamma -> e(+)e(-)) are reported in ultraperipheral PbPb collisions at a centre-of-mass energy per nucleon pair of 5.02 TeV. The data sample, corresponding to an integrated luminosity of 1.7 nb(-1), was collected by the CMS experiment at the CERN LHC in 2018. Events with an exclusively produced gamma gamma or e(+)e(-) pair with invariant masses m(gamma gamma,ee) > 5 GeV, along with other fiducial criteria, are selected. The measured BW fiducial production cross section, sigma(fid)(gamma gamma -> e(+)e(-)) = 263.5 +/- 1.8(stat) +/- 17.8(syst) mu b, as well as the differential distributions for various kinematic observables, are in agreement with leading-order quantum electrodynamics predictions complemented with final-state photon radiation. The measured differential BW cross sections allow discrimination between different theoretical descriptions of the photon flux of the lead ion. In the LbL final state, 26 exclusive diphoton candidate events are observed compared with 12.0 +/- 2.9 expected for the background. Combined with previous results, the observed significance of the LbL signal with respect to the background-only hypothesis is above five standard deviations. The measured fiducial LbL scattering cross section, sigma(fid)(gamma gamma -> gamma gamma) = 107 +/- 24(stat) +/- 13(syst) nb, is in agreement with next- to-leading-order predictions. Limits on the production of axion-like particles coupled to photons are set over the mass range 5-100 GeV, including the most stringent limits to date in the range of 5-10 GeV.

JOURNAL OF HIGH ENERGY PHYSICS [8], 006, 2025. DOI: 10.1007/JHEP08(2025)006. Acesso em: **https://doi.org/10.1007/JHEP08(2025)006**

[P405-2025] "Measurement of the inclusive t(t)over-bar cross section in final states with at least one lepton and additional jets with 302 pb-1 of pp collisions at √s=5.02 TeV"

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

A measurement of the top quark pair (t (t) over bar over bar) production cross section in proton-proton collisions at a centre-of--mass energy of 5.02TeV is presented. The data were collected at the LHC in autumn 2017, in dedicated runs with low-energy and low-intensity conditions with respect to the default configuration, and correspond to an integrated luminosity of 302 pb(-1). The measurement is performed using events with one electron or muon, and multiple jets, at least one of them being identified as originating from a b quark (b tagged). Events are classified based on the number of all reconstructed jets and of b-tagged jets. Multivariate analysis techniques are used to enhance the separation between the signal and backgrounds. The measured cross section is 62.5 +/- 1.6 (stat)(-2.5)(+2.6) (syst) +/- 1.2 (lumi) pb. A combination with the result in the dilepton channel based on the same data set yields a value of 62.3 +/- 1.5 (stat)+/- 2.4 (syst)+/- 1.2 (lumi) pb, to be compared with the standard model prediction of 69.5(-3.7)(+3.5) pb at next-to-next--to-leading order in perturbative quantum chromodynamics.

JOURNAL OF HIGH ENERGY PHYSICS [4], 099, 2025. DOI: 10.1007/JHEP04(2025)099. Acesso em: **https://doi.org/10.1007/JHEP04(2025)099**

[P406-2025] "Measurement of WWZ and ZH Production Cross Sections at √s=13 and 13.6 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.*;** et al.
CMS Collaboration

A measurement is presented of the cross section in proton--proton collisions for the production of two W bosons and one Z boson. It is based on data recorded by the CMS experiment at the CERN LHC at center-of-mass energies root s = 13 and 13.6 TeV, corresponding to an integrated luminosity of 200 fb(-1). Events with four charged leptons (electrons or muons) in the final state are selected. Both nonresonant WWZ production and ZH production, with the Higgs boson decaying into two W bosons, are reported. For the first time, the two processes are measured separately in a simultaneous fit. Combining the two modes, signal strengths relative to the standard model (SM) predictions of 0.75(-0.29)(+0.34) and 1.74(-0.60)(+0.71) are measured for root s = 13 and 13.6 TeV, respectively. The observed (expected) significance for the triboson signal is 3.8 (2.5) standard deviations for root s = 13.6 TeV, thus providing the first evidence for triboson production at this center-of-mass energy. Combining the two modes and the two center-of-mass energies, the inclusive signal strength relative to the SM prediction is measured to be 1.03(-0.28)(+0.31), with an observed (expected) significance of 4.5 (5.0) standard deviations.

PHYSICAL REVIEW LETTERS 135[9], 091802, 2025. DOI: 10.1103/6z3d-zjw4. Acesso em: **https://doi.org/10.1103/6z3d--zjw4**

[P407-2025] "Measurement of ω meson production in pp and p-Pb collisions at √sNN=5.02 TeV"

Acharya, S.; Adamova, D.; Rinella, G. A.; **Jahnke, C*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
ALICE Collaboration

We present the measurement of the p(T)-differential production cross section of omega mesons in pp and p-Pb collisions at root s(NN) = 5.02 TeV at midrapidity by ALICE.

In addition, the first measurement of the nuclear modification factor R-pPb for omega mesons at LHC energies is presented, complementing the existing measurements of lighter neutral mesons such as the pi(0) and eta. Within the measured p(T) range, the R-pPb of omega mesons is compatible with no cold nuclear matter effects within the uncertainties, consistent with previous measurements at lower energies. The omega/pi(0) ratio is presented for both collision systems, showing no collision system dependence within the uncertainties. The comparison to previously published omega/pi(0) ratios at lower and higher collision energies in pp collisions suggests a decreasing trend of the ratio above p(T) = 4 GeV/c with increasing collision energy. The data in both collision systems are compared to predictions from PYTHIA 8, EPOS LHC, and DPMJET event generators, revealing significant shortcomings in these models' ability to describe the production of omega mesons.

PHYSICAL REVIEW C 112[4], 044904, 2025. DOI: 10.1103/ls6w-x1bb. Acesso em: **https://doi.org/10.1103/ls6w-x1bb**

[P408-2025] "Measurements of inclusive and differential Higgs boson production cross sections at √s=13.6 TeV in the H -- γγ decay channel"

Hayrapetyan, A.; Makarenko, V.; **Chinellato, J. A.***; et al.
CMS Collaboration

Inclusive and differential cross sections for Higgs boson production in proton-proton collisions at a centre-of-mass energy of 13.6TeV are measured using data collected with the CMS detector at the LHC in 2022, corresponding to an integrated luminosity of 34.7 fb(-1). Events with the diphoton final state are selected, and the measured inclusive fiducial cross section is sfid = 74 +/- 11 (stat)(-4)(+5) (syst) fb, in agreement with the standard model prediction of 67.8 +/- 3.8 fb. Differential cross sections are measured as functions of several observables: the Higgs boson transverse momentum and rapidity, the number of associated jets, and the transverse momentum of the leading jet in the event. Within the uncertainties, the differential cross sections agree with the standard model predictions.

JOURNAL OF HIGH ENERGY PHYSICS 070, 2025. DOI: 10.1007/JHEP09(2025)070. Acesso em: **https://doi.org/10.1007/JHEP09(2025)070**

[P409-2025] "Metal Defects in MAPbI3 Perovskites: Uncovering the Roles of Ni, Cu, Ag, and Au"

Chagas, L. G.; Morais, A. de; Ribeiro, I. C.; **Brandao, Z. C.*; Marques, F. C.***; Santos, R. M. dos; Silva, J. L. F. da; Freitas, J. N. de; Lima, M. P.

In perovskite solar cells, understanding how transition metals penetrate the perovskite layer and affect its degradation and optoelectronic properties is crucial for designing more stable devices. Here, we combine experiments and density functional theory to investigate the interaction of Ni, Cu, Ag, and Au with MAPbI3. Our simulations show that Au and Ni spontaneously incorporate into MAPbI3, as revealed by their negative formation energies. Although Au, Cu, and Ag prefer interstitial configurations, Au behaves distinctly, indicating that the atomic radius plays a more decisive role than the valence configuration. Ni, in turn, preferentially substitutes Pb sites without introducing midgap states despite its partially filled 3d shell. Experimentally, X-ray photoelectron spectroscopy, current-voltage measurements, and UV-vis absorption reveal that all metals diffuse into MAPbI3, but only Ag and Cu form semiconductor halide phases that degrade device performance. In contrast, Au and Ni migrate without compromising optical absorption or charge transport, consistent with theoretical predictions. In general, these results highlight Au and Ni as promising contact materials for perovskite solar cells, as their incorporation avoids detrimental electronic or radiative effects compared to other metals.

ACS OMEGA 10[49], p. 60886-60899, 2025. DOI: 10.1021/acsomega.5c09558. Acesso em: **https://doi.org/10.1021/acsomega.5c09558**

[P410-2025] "Monitoring temperature dependence in the ultraviolet photoabsorption spectra of carbon dioxide"

Falkowski, A. G.*; Randi, P. A. S.; Bettega, M. H. F.

Photoabsorption cross sections of CO2 were investigated over a temperature range from 150 K to 800 K using the nuclear ensemble approach to evaluate its ability to capture temperature-dependent spectral changes. At each temperature, 1001 geometries were sampled from a Wigner distribution. For each geometry, the vertical excitation energies and oscillator strengths of the first 20 electronically excited states were computed and employed in the calculation of photoabsorption cross sections, considering only electronic transitions. The underlying electronic structure calculations were performed at the TD-DFT/CAMB3LYP/aug-cc-pVTZ and TD-DFT/omega B97X/aug-cc-pVTZ levels of theory. The results reveal that, as temperature increases, the onset of the lower absorption band shifts to lower energies, while the intensity of the second band grows. These trends are in good agreement with previous experimental data from the literature Venot et al. (2018), highlighting the nuclear ensemble approach effectiveness in reproducing the temperature dependence of CO2's photoabsorption cross sections.

JOURNAL OF QUANTITATIVE SPECTROSCOPY & RADIATIVE TRANSFER 347, 109630, 2025. DOI: 10.1016/j.jqsrt.2025.109630. Acesso em: **https://doi.org/10.1016/j.jqsrt.2025.109630**

[P411-2025] "Multiplicity dependence of Ξc+ and Ξc0 production in pp collisions at √s=13 TeV"

Abualrob, I. J.; Acharya, S.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
ALICE Collaboration

The first measurement at midrapidity (vertical bar y vertical bar < 0.5) of the production yield of the strange-charm baryons Xi(+)(c) and Xi(0)(c) as a function of transverse momentum (p(T)) in different charged-particle multiplicity classes in proton-proton collisions at root s = 13TeV with the ALICE experiment at the LHC is reported. The Xi(+)(c) baryon is reconstructed via the Xi(+)(c) -> Xi(-) pi(+)pi(+) decay channel in the range 4 < p(T) < 12 GeV/c, while the Xi(0)(c) baryon is reconstructed via both the Xi(0)(c) -> Xi(-) pi(+) and Xi(0)(c) -> Xi(-) e(+) nu(e) decay channels in the range 2 < p(T) < 12 GeV/c. The baryon-to-meson (Xi(0,+)(c) /D-0) and the baryon-to-baryon (Xi(0,+)(c) /Lambda(+)(c)) production yield ratios show no significant dependence on multiplicity. In addition, the observed yield ratios are not described by theoretical predictions that model charm-quark fragmentation based on measurements at e(+)e(-) and e(-)p colliders, indicating differences in the charm-baryon production mechanism in pp collisions. A comparison with different event generators and tunings, including different modelling of the hadronisation process, is also discussed. Moreover, the branching-fraction ratio of BR(Xi(0)(c) -> Xi(-) e(+) nu(e))/BR(Xi(0)(c) -> Xi(-) pi(+)) is measured as 0.825 +/- 0.094 (stat.) +/- 0.081 (syst.). This value supersedes the previous ALICE measurement, improving the statistical precision by a factor of 1.6.

JOURNAL OF HIGH ENERGY PHYSICS [12], 038, 2025. DOI: 10.1007/JHEP12(2025)038. Acesso em: **https://doi.org/10.1007/JHEP12(2025)038**

[P412-2025] "Neuromuscular characteristics of eccentric, concentric and isometric contractions of the knee extensors"

Ruas, C. V.*; Taylor, J. L.; Latella, C.; Haff, G. G.; Nosaka, K.

Purpose: We compared voluntary drive and corticospinal responses during eccentric (ECC), isometric (ISOM) and concentric (CON) muscle contractions to shed light on neurophysiological mechanisms underpinning the lower voluntary drive in a greater force production in ECC than other contractions. Methods: Sixteen participants (20-33 years) performed ISOM and isokinetic (30 degrees/s) CON and ECC knee extensor contractions (110 degrees-40 degrees knee flexion) in which electromyographic activity (EMG) was recorded from vastus lateralis. Voluntary activation (VA) was measured during ISOM, CON and ECC maximal voluntary contractions (MVCs). Transcranial magnetic stimulation elicited motor-evoked potentials (MEPs) and corticospinal silent periods (CSP) during MVCs and submaximal (30%) contractions, and short-interval intracortical inhibition (SICI) in submaximal contractions. Results: MVC torque was greater (P < 0.01) during ECC (302.6 +/- 90.0 Nm) than ISOM (269.8 +/- 81.5 Nm) and CON (235.4 +/- 78.6 Nm), but VA was lower (P < 0.01) for ECC (68.4 +/- 14.9%) than ISOM (78.3 +/- 13.1%) and CON (80.7 +/- 15.4%). In addition, EMG/torque was lower (P < 0.02) for ECC (1.9 +/- 1.1 mu V center dot Nm(-1)) than ISOM (2.2 +/- 1.2 mu V center dot Nm(-1)) and CON (2.7 +/- 1.6 mu V center dot Nm(-1)), CSP was shorter (p < 0.04) for ECC (0.097 +/- 0.03 s) than ISOM (0.109 +/- 0.02 s) and CON (0.109 +/- 0.03 s), and MEP amplitude was lower (P < 0.01) for ECC (3.46 +/- 1.67 mV) than ISOM (4.21 +/- 2.33 mV) and CON (4.01 +/- 2.06 mV). Similar results were found for EMG/torque and CSP during 30% contractions, but MEP and SICI showed no differences among contractions (p > 0.05). Conclusions: The lower voluntary drive indicated by reduced VA during ECC may be partly explained by lower corticospinal excitability, while the shorter CSP may reflect extra muscle spindle excitation of the motoneurons from vastus lateralis muscle lengthening.

EUROPEAN JOURNAL OF APPLIED PHYSIOLOGY 125[3], p. 671-686, 2025. DOI: 10.1007/s00421-024-05626-9. Acesso em: **https://doi.org/10.1007/s00421-024-05626-9**

[P413-2025] "Non-local X-ray intermolecular radiative decay probes solvation shell of ions in water"

Söderström, J.; Cornetta, L. M.; Ekholm, V.; Carravetta, V.; **Brito, A. N. de*; et al.**

Aqueous solutions are crucial in chemistry, biology, environmental science, and technology. The chemistry of solutes is influenced by the surrounding solvation shell of water molecules, which have different chemical properties than bulk water due to their different electronic and geometric structure. It is experimentally challenging to selectively investigate this property-determining electronic and geometric structure. Here, we report experimental results on the non-local X-ray emission process Intermolecular Radiative Decay, for the prototypical ions Na+ and Mg2+ in water. We show that, in Intermolecular Radiative Decay, an electron from the solvation shell fills a core hole in the solute, and the released energy is emitted as an X-ray photon. We interpret the underlying mechanism using theoretical calculations, and show how Intermolecular Radiative Decay will allow us to meet the challenge of selectively probing the solvation shell from within.

NATURE COMMUNICATIONS 16[1], 10046, 2025. DOI: 10.1038/s41467-025-65581-7. Acesso em: **https://doi.org/10.1038/s41467-025-65581-7**

[P414-2025] "Observation of the Charged-Particle Multiplicity Dependence of σψ(2S)/σJ/ψ in p-Pb Collisions at 8.16 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

Bound states of charm and anticharm quarks, known as charmonia, have a rich spectroscopic structure that can be used to probe the dynamics of hadron production in high-energy hadron collisions. Here, the cross section ratio of excited (psi(2S)) and ground state (J/psi) vector mesons is measured as a function of the charged-particle multiplicity in proton-lead (pPb) collisions at a center-of-mass (CM) energy per nucleon pair of 8.16 TeV. The data corresponding to an integrated luminosity of 175 nb(-1) were collected using the CMS detector. The ratio is measured separately for prompt and nonprompt charmonia in the transverse momentum range 6.5 < p(T) < 30 GeV and in four rapidity ranges spanning -2.865 < y(CM) < 1.935. For the first time, a statistically significant multiplicity dependence of the prompt cross section ratio is observed in proton-nucleus collisions. There is no clear rapidity dependence in the ratio. The prompt measurements are compared with a theoretical model which includes interactions with nearby particles during the evolution of the system. These results provide additional constraints on hadronization models of heavy quarks in nuclear collisions.

PHYSICAL REVIEW LETTERS 135[9], 092301, 2025. DOI: 10.1103/c9wp-5tq3. Acesso em: **https://doi.org/10.1103/c9wp-5tq3**

[P415-2025] "Observation of the Ω(2012) baryon at the LHC"

Acharya, S.; Agarwal, A.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
ALICE Collaboration

A signal consistent with the Omega(2012) baryon has been observed with a significance of 15s in pp collisions at root s = 13 TeV at the LHC. In this paper, the analysis technique is described and measurements of the mass and width of the Omega(2012) are reported, along with the first measurement of its transversemomentum spectrum and yield. This paper corroborates the observation by the Belle Collaboration of this excited Omega state and the observation that the Omega(2012) has a rather narrow width for a strongly decaying resonance. The yield measurement is combined with a statistical thermal model calculation of strange baryon yield ratios to obtain estimates of the Omega(2012)(-) -> Xi(K) over bar branching ratios. These results will improve our understanding of the internal structure and mass spectrum of excited baryon states and serve as a baseline for searches regarding modifications of these properties in high-temperature media.

PHYSICAL REVIEW D 112[9], 092002, 2025. DOI: 10.1103/v4mh-3r8z. Acesso em: **https://doi.org/10.1103/v4mh-3r8z**

[P416-2025] "Observation of Λ Hyperon Local Polarization in p-Pb Collisions at √sNN=8.16 TeV"

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

The polarization of the Lambda and (Lambda) over bar hyperons along the beam direction has been measured in proton--lead (p-Pb) collisions at a center-of-mass energy per nucleon pair of 8.16 TeV. The data were obtained with the CMS detector at the LHC and correspond to an integrated luminosity of 186.0 +/- 6.5 nb(-1). A significant azimuthal dependence of the hyperon polarization, characterized by the second-order Fourier sine coefficient P-z,P-s2, is observed. The P-z,P-s2 values decrease as a function of charged particle multiplicity, but increase with transverse momentum. A hydrodynamic model that describes the observed P-z,P-s2 values in nucleus--nucleus collisions by introducing vorticity effects does not reproduce either the sign or the magnitude of the p-Pb results.

These observations pose a challenge to the current theoretical implementation of spin polarization in heavy ion collisions and offer new insights into the origin of spin polarization in hadronic collisions at LHC energies.

PHYSICAL REVIEW LETTERS 135[13], 132301, 2025. DOI: 10.1103/6ywq-gm61. Acesso em: **https://doi.org/10.1103/6ywq-gm61**

[P417-2025] "Operation and performance of the CMS silicon strip tracker with proton-proton collisions at the CERN LHC"

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

Salient aspects of the commissioning, calibration, and performance of the CMS silicon strip tracker are discussed, drawing on experience during operation with proton-proton collisions delivered by the CERN LHC. The data were obtained with a variety of luminosities. The operating temperature of the strip tracker was changed several times during this period and results are shown as a function of temperature in several cases. Details of the system performance are presented, including occupancy, signal-to-noise ratio, Lorentz angle, and single--hit spatial resolution. Saturation effects in the APV25 readout chip preamplifier observed during early Run 2 are presented, showing the effect on various observables and the subsequent remedy. Studies of radiation effects on the strip tracker are presented both for the optical readout links and the silicon sensors. The observed effects are compared to simulation, where available, and they generally agree well with expectations.

JOURNAL OF INSTRUMENTATION 20[8], P08027, 2025. DOI: 10.1088/1748-0221/20/08/P08027. Acesso em: **https://iopscience.iop.org/article/10.1088/1748-0221/20/08/P08027**

[P418-2025] "Phase behavior of a machine-learning potential trained on stress-strain curves: The case of superionic water ice"

Zavaroni, M. M. R.; Matusalem, F.; Macollunco, O. S. C.; **Leandro, J. P.***; Ruestes, C. J.; **Koning, M. de***

We analyze the transferability of a Deep Potential Machine Learning (DP-ML) model trained to reproduce stress-strain curves of high-temperature/high-pressure crystalline phases of water, determining the coexistence lines for the phase transitions between the insulating ice X and the superionic ice XVIII and that between ice XVIII and its melt. Using a set of various free-energy calculation techniques, we find the resulting coexistence lines to be in good agreement with previous data, indicating that the deformation-trained DP-ML model also transfers to thermodynamic properties. This suggests that the inclusion of deformed solid states in training sets may also be a beneficial general strategy in the development of ML interaction models for other condensed-matter systems. Furthermore, the DP-ML model should be useful to investigate other aspects of the considered phase transitions. One of these involves the possible characterization of the XVIII-liquid transition as weakly first-order, with its potentially associated continuous-like behavior. This is an interesting prospect since it might be the first example of such a transition in a three-dimensional structural solid-liquid transformation.

JOURNAL OF CHEMICAL PHYSICS 163[22], 224507, 2025. DOI: 10.1063/5.0300848. Acesso em: **https://doi.org/10.1063/5.0300848**

[P419-2025] "Photovoltaic and gas sensing properties of the novel bimetallic Janus ScNbCO2 MXene"

Aparicio-Huacarpuma, B. D. ; Laranjeira, J. A. S.; Martins, N. F.; Gonzalo, F. M.; **Lima, K. A. L.*;** Silva, A. M. A.; Sambrano, J. R.; Junior, L. A. R.

We report a first-principles investigation of the bimetallic Janus MXene ScNbCO2, addressing its multifunctional potential for gas sensing and photovoltaic applications. The monolayer is dynamically and thermally stable, exhibiting a semiconducting direct band gap of 1.90 eV and strong visible-light absorption enhanced by excitonic effects. Gas adsorption studies reveal selective and reversible interactions for NH3 and toluene, with adsorption energies of -0.63 and -0.66 eV and recovery times of milliseconds at 300 K, while H2O and CO display weak physisorption (-0.34 and -0.13 eV), confirming high surface selectivity. Charge density difference analysis indicates localized donor-acceptor charge transfer for NH3 and pi-d coupling for toluene. Photovoltaic simulations yield power conversion efficiencies of 29.27% (Shockley-Queisser) and 20.68% (SLME with BSE), surpassing several reported Janus MXenes. These results establish ScNbCO2 as a robust and versatile 2D material for selective sensing and high-efficiency optoelectronic devices.

SURFACES AND INTERFACES 78, 108135, 2025. DOI: 10.1016/j.surfin.2025.108135. Acesso em: **https://doi.org/10.1016/j.surfin.2025.108135**

[P420-2025] "Precision measurement of the Ξ0b baryon lifetime"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.*;** et al.
LHCb Collaboration

A sample of pp collision data, corresponding to an integrated luminosity of 5.4 fb(-1) and collected by the LHCb experiment during LHC Run 2, is used to measure the ratio of the lifetime of the Xi(0)(b) baryon to that of the Lambda(0)(b) baryon, r(tau) equivalent to tau(Xi 0b)/tau(Lambda 0b). The value r(tau)(Run 2) = 1.004 +/- 0.009 +/- 0.006 is obtained, where the first uncertainty is statistical and the second systematic. This value is averaged with the corresponding value from Run 1 to obtain r(tau) = 1.004 +/- 0.008 +/- 0.005. Multiplying by the known value of the Lambda(0)(b) lifetime yields tau(Xi 0b) = 1.475 +/- 0.012 +/- 0.008 +/- 0.009 ps, where the last uncertainty is due to the limited knowledge of the Lambda(0)(b) lifetime. This measurement improves the precision of the current world average of the Xi(0)(b) lifetime by about a factor of two, and is in good agreement with the most recent theoretical predictions.

PHYSICAL REVIEW D 112, 052012, 2025. DOI: 10.1103/sllb-p3j8. Acesso em: **https://doi.org/10.1103/sllb-p3j8**

[P421-2025] "Probing Gluon Fluctuations in Nuclei with the First Energy-Dependent Measurement of Incoherent J/ψ Photoproduction in Ultraperipheral PbPb Collisions"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

Incoherent J/psi photoproduction in heavy ion ultraperipheral collisions (UPCs) provides a sensitive probe of localized, fluctuating gluonic structures within heavy nuclei. This Letter reports the first measurement of the photon-nucleon center--of-mass energy (W-gamma N) dependence of this process in PbPb UPCs at a nucleon-nucleon center-of-mass energy of 5.02 TeV, using 1.52 nb(-1) of data recorded by the CMS experiment. The measurement covers a wide W-gamma N range of approximate to 40-400 GeV, probing gluons carrying a fraction x of nucleon momentum down to an unexplored regime of 6.5 x 10(-5). Compared to baseline predictions neglecting nuclear effects, the measured cross sections exhibit significantly greater suppression at lower x.Additionally,

the ratio of incoherent to coherent photoproduction is found to be constant across the probed W-gamma N and x range, disfavoring the establishment of the black disk limit. This Letter provides critical insights into the x-dependent evolution of fluctuating gluonic structures within nuclei and calls for further advancements in theoretical models incorporating nuclear shadowing and gluon saturation.

PHYSICAL REVIEW LETTERS 135[11], 112301, 2025. DOI: 10.1103/w9kp-f8xr. Acesso em: **https://doi.org/10.1103/w9kp-f8xr**

[P422-2025] "Proton reconstruction with the TOTEM Roman pot detectors for high-ß* LHC data"

Hayrapetyan, A.; Tumasyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration; CMS Collaboration; TOTEM Collaboration

The TOTEM Roman pot detectors are used to reconstruct the transverse momentum of scattered protons and to estimate the transverse location of the primary interaction. This paper presents new methods of track reconstruction, measurements of strip-level detection efficiencies, cross-checks of the LHC beam optics, and detector alignment techniques, along with their application in the selection of signal collision events. The track reconstruction is performed by exploiting hit cluster information through a novel method using a common polygonal area in the intercept-slope plane. The technique is applied in the relative alignment of detector layers with mu m precision. A tag-and-probe method is used to extract strip-level detection efficiencies. The alignment of the Roman pot system is performed through time-dependent adjustments, resulting in a position accuracy of 3 mu m in the horizontal and 60 mu m in the vertical directions. The goal is to provide an optimal reconstruction tool for central exclusive physics analyses based on the high-beta* data-taking period at root s = 13 TeV in 2018.

JOURNAL OF INSTRUMENTATION 20[4], P04012, 2025. DOI: 10.1088/1748-0221/20/04/P04012. Acesso em: **https://iopscience.iop.org/article/10.1088/1748-0221/20/04/P04012**

[P423-2025] "Quantum teleportation with dissimilar quantum dots over a hybrid quantum network"

Laneve, A.; Ronco, G.; **Silva, S. F. C. da***; et al.

Photonic quantum information processing in metropolitan quantum networks lays the foundation for cloud quantum computing, secure communication, and the realization of a global quantum internet. This paradigm shift requires on-demand and high-rate generation of flying qubits and their quantum state teleportation over long distances. Despite the last decade has witnessed an impressive progress in the performances of deterministic photon sources, the exploitation of distinct quantum emitters to implement a quantum relay among distant parties has remained elusive. Here, we overcome this challenge by using dissimilar quantum dots whose electronic and optical properties are engineered by light-matter interaction, multi-axial strain and magnetic fields so as to make them suitable for the teleportation of polarization qubits.This is demonstrated in a quantum network harnessing both fiber connections and a 270 m free-space optical link connecting two buildings of the Sapienza University campus in Rome. The protocol exploits GPS-assisted synchronization, ultra-fast single photon detectors as well as stabilization systems that compensate for atmospheric turbulence.The achieved teleportation state fidelity reaches up to 82 +/- 1%, above the classical limit by more than 10 standard deviations. Our field demonstration of all-photonic quantum teleportation opens a new route to implement solid-state based quantum relays and builds the foundation for practical quantum networks.

NATURE COMMUNICATIONS 16[1], 10028, 2025. DOI: 10.1038/s41467-025-65911-9. Acesso em: **https://doi.org/10.1038/s41467-025-65911-9**

[P424-2025] "Search for a heavy pseudoscalar Higgs boson decaying to a 125 GeV Higgs boson and a Z boson in final states with two tau and two light leptons in proton-proton collisions at √s = TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

A search for a heavy pseudoscalar Higgs boson, A, decaying to a 125 GeV Higgs boson h and a Z boson is presented. The h boson is identified via its decay to a pair of tau leptons, while the Z boson is identified via its decay to a pair of electrons or muons. The search targets the production of the A boson via the gluon-gluon fusion process, gg -> A, and in association with bottom quarks, . The analysis uses a data sample corresponding to an integrated luminosity of 138 fb(-1) collected with the CMS detector at the CERN LHC in proton-proton collisions at a centre-of-mass energy of TeV. Constraints are set on the product of the cross sections of the A production mechanisms and the A -> Zh decay branching fraction. The observed (expected) upper limit at 95% confidence level ranges from 0.049 (0.060) pb to 1.02 (0.79) pb for the gg -> A process and from 0.053 (0.059) pb to 0.79 (0.61) pb for the process in the probed range of the A boson mass, m(A), from 225 GeV to 1 TeV. The results of the search are used to constrain parameters within the benchmark scenario of the minimal supersymmetric extension of the standard model. Values of tan beta below 2.2 are excluded in this scenario at 95% confidence level for all m(A) values in the range from 225 to 350 GeV.

JOURNAL OF HIGH ENERGY PHYSICS [10], 74, 2025. DOI: 10.1007/JHEP10(2025)074. Acesso em: **https://doi.org/10.1007/JHEP10(2025)074**

[P425-2025] "Search for a Neutral Gauge Boson with Nonuniversal Fermion Couplings in Vector Boson Fusion Processes in Proton-Proton Collisions at √s=13 TeV"

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

The first search for a heavy neutral spin-1 gauge boson (Z ') with nonuniversal fermion couplings produced via vector boson fusion processes and decaying to tau leptons or W bosons is presented. The analysis is performed using LHC data at root s = 13 TeV, collected from 2016 to 2018 with the CMS experiment and corresponding to an integrated luminosity of 138 fb(-1). The data are consistent with the standard model predictions. Upper limits are set on the product of the cross section for production of the Z ' boson and its branching fraction to tau tau or WW. The presence of a Z ' boson decaying to tau(+)tau(-) (W+W-) is excluded for masses up to 2.45(1.60) TeV, depending on the Z ' boson coupling to standard model weak bosons, and assuming a Z ' -> tau(+)tau(-) (W+W-) branching fraction of 50%.

PHYSICAL REVIEW LETTERS 135[6], 061803, 2025. DOI: 10.1103/srvm-f1h3. Acesso em: **https://doi.org/10.1103/srvm-f1h3**

[P426-2025] "Search for CP violation in events with top quarks and Z bosons at √s=13 and 13.6 TeV"

Hayrapetyan, A.; Makarenko, V.; **Chinellato, J. A.***; et al.
CMS Collaboration

A search for the violation of the charge-parity (CP) symmetry in the production of top quarks in association with Z bosons is presented,

using events with at least three charged leptons and additional jets. The search is performed in a sample of proton-proton collision data collected by the CMS experiment at the CERN LHC in 2016-2018 at a center-of-mass energy of 13 TeV and in 2022 at 13.6 TeV, corresponding to a total integrated luminosity of 173 fb(-1). For the first time in this final state, observables that are odd under the CP transformation are employed. Also for the first time, physics-informed machine-learning techniques are used to construct these observables. While for standard model (SM) processes the distributions of these observables are predicted to be symmetric around zero, CP-violating modifications of the SM would introduce asymmetries. Two CP-odd operators O-Wt(I) and O-tZ(I) in the SM effective field theory are considered that may modify the interactions between top quarks and electroweak bosons. The obtained results are consistent with the SM prediction within two standard deviations, and exclusion limits on the associated Wilson coefficients of -2.7 < c(tW)(I) < 2.5 and -0.2 < c(tZ)(I) < 2.0 are set at 95% confidence level. The largest discrepancy is observed in CtZI where data is consistent with positive values, with an observed local significance with respect to the SM hypothesis of 2.5 standard deviations, when only linear terms are considered.

PHYSICS LETTERS B 869, 139857, 2025. DOI: 10.1016/j.physletb.2025.139857. Acesso em: **https://doi.org/10.1016/j.physletb.2025.139857**

[P427-2025] "Search for dark matter produced in association with one or two top quarks in proton-proton collisions at √s=13 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.*;** et al.
CMS Collaboration

A search is performed for dark matter (DM) produced in association with a single top quark or a pair of top quarks using the data collected with the CMS detector at the LHC from proton-proton collisions at a center-of-mass energy of 13TeV, corresponding to 138 fb(-1) of integrated luminosity. An excess of events with a large imbalance of transverse momentum is searched for across 0, 1 and 2 lepton final states. Novel multivariate techniques are used to take advantage of the differences in kinematic properties between the two DM production mechanisms. No significant deviations with respect to the standard model predictions are observed. The results are interpreted considering a simplified model in which the mediator is either a scalar or pseudoscalar particle and couples to top quarks and to DM fermions. Axion-like particles that are coupled to top quarks and DM fermions are also considered. Expected exclusion limits of 410 and 380 GeV for scalar and pseudoscalar mediator masses, respectively, are set at the 95% confidence level. A DM particle mass of 1 GeV is assumed, with mediator couplings to fermions and DM particles set to unity. A small signal-like excess is observed in data, with the largest local significance observed to be 1.9 standard deviations for the 150 GeV pseudoscalar mediator hypothesis. Because of this excess, mediator masses are only excluded below 310 (320) GeV for the scalar (pseudoscalar) mediator. The results are also translated into model-independent 95% confidence level upper limits on the visible cross section of DM production in association with top quarks, ranging from 1 pb to 0.02 pb.

JOURNAL OF HIGH ENERGY PHYSICS [8], 085, 2025. DOI: 10.1007/JHEP08(2025)085. Acesso em: **https://doi.org/10.1007/JHEP08(2025)085**

[P428-2025] "Search for dark matter production in association with a single top quark in proton-proton collisions at √s=13 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

A search for the production of a single top quark in association with invisible particles is performed using proton-proton collision data collected with the CMS detector at the LHC at root s = 13 TeV, corresponding to an integrated luminosity of 138 fb(-1). In this search, a flavor-changing neutral current produces a single top quark or antiquark and an invisible state nonresonantly. The invisible state consists of a hypothetical spin-1 particle acting as a new mediator and decaying to two spin-1/2 dark matter candidates. The analysis searches for events in which the top quark or antiquark decays hadronically. No significant excess of events compatible with that signature is observed. Exclusion limits at 95% confidence level are placed on the masses of the spin-1 mediator and the dark matter candidates, and are compared to constraints from the dark matter relic density measurements. In a vector (axial-vector) coupling scenario, masses of the spin-1 mediator are excluded up to 1.85 (1.85) TeV with an expectation of 2.0 (2.0) TeV, whereas masses of the dark matter candidates are excluded up to 0.75 (0.55) TeV with an expectation of 0.85 (0.65) TeV.

JOURNAL OF HIGH ENERGY PHYSICS [9], 141, 2025. DOI: 10.1007/JHEP09(2025)141. Acesso em: **https://doi.org/10.1007/JHEP09(2025)141**

[P429-2025] "Search for flavor-changing neutral current interactions of the top quark mediated by a Higgs boson in proton-proton collisions at 13 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.*;** et al.

CMS Collaboration; CMS Collaboration

A search for flavor-changing neutral current interactions of the top quark (t) and the Higgs boson (H) is presented. The search is based on proton-proton collision data collected in 2016-2018 at a center-of-mass energy of 13 TeV with the CMS detector at the LHC, and corresponding to an integrated luminosity of 138 fb(-1). Events containing a pair of leptons with the same-sign electric charge and at least one jet are considered. The results are used to constrain the branching fraction (B) of the top quark decaying to a Higgs boson and an up (u) or charm (c) quark. No significant excess above the estimated background was found. The observed (expected) upper limits at a 95% confidence level are found to be 0.072% (0.059%) for B(t -> Hu) and 0.043% (0.062%) for B(t -> Hc). These results are combined with two other searches performed by the CMS Collaboration for flavor--changing neutral current interactions of top quarks and Higgs bosons in final states where the Higgs boson decays to either a pair of photons or a pair of bottom quarks. The resulting observed (expected) upper limits at the 95% confidence level are 0.019% (0.027%) for B(t -> Hu) and 0.037% (0.035%) for B(t -> Hc).

PHYSICAL REVIEW D 112[3], 032008, 2025. DOI: 10.1103/95q6--vvlp. Acesso em: **https://doi.org/10.1103/95q6-vvlp**

[P430-2025] "Search for New Resonances Decaying to Pairs of Merged Diphotons in Proton-Proton Collisions at √s=13 TeV"

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

A search is presented for an extended Higgs sector with two new particles, X and., in the process X ->phi phi ->(gamma gamma) (gamma gamma).Novel neural networks classify events with diphotons that are merged and determine the diphoton masses. The search uses LHC proton-proton collision data at root s = 13 TeV collected with the CMS detector, corresponding to an integrated luminosity of 138 fb(-1). No evidence of such resonances is seen. Upper limits are set on the production cross section for m(X) between 300 and 3000 GeV and m.=m(X) between 0.5% and 2.5%, representing the most sensitive search in this channel.

PHYSICAL REVIEW LETTERS 134[4], 041801, 2025. DOI: 10.1103/PhysRevLett.134.041801. Acesso em: **https://doi.org/10.1103/PhysRevLett.134.041801**

[P431-2025] "Search for the decay B0 -- φφ"

Aaij, R.; Abdelmotteleb, A. S. W.; Beteta, C. A.; **Magalhaes, P. C.*;** et al.
LHCb Collaboration

A search for the decay B-0 -> phi phi is made using pp collision data collected with the LHCb detector at centre-of-mass energies of 7, 8 and 13TeV, corresponding to an integrated luminosity of 9 fb(-1). No significant signal is observed, and an upper limit on the branching fraction of 1.3 (1.4) x 10(-8) at 90 (95)% confidence level is set. This result supersedes the previous LHCb study and improves the upper limit by a factor of two.

JOURNAL OF HIGH ENERGY PHYSICS [12], 026, 2025. DOI: 10.1007/JHEP12(2025)026. Acesso em: **https://doi.org/10.1007/JHEP12(2025)026**

[P432-2025] "Search for vector-like leptons with long-lived particle decays in the CMS muon system in proton-proton collisions at √s=13 TeV"

Chekhovsky, V.; Hayrapetyan, A.; **Chinellato, J. A.***; et al.
CMS Collaboration

A first search is presented for vector-like leptons (VLLs) exclusively decaying into a light long-lived pseudoscalar boson and a standard model tau lepton. The pseudoscalar boson is assumed to have a mass below the tau(+)tau(-) threshold, so that it decays exclusively into two photons. It is identified using the CMS muon system. The analysis is carried out using a data set of proton-proton collisions at a center-of-mass energy of 13 TeV collected by the CMS experiment in 2016-2018, corresponding to an integrated luminosity of 138 fb(-1). Selected events contain at least one pseudoscalar boson decaying electromagnetically in the muon system and at least one hadronically decaying tau lepton. No significant excess of data events is observed compared to the background expectation. Upper limits are set at 95% confidence level on the vector-like lepton production cross section as a function of the VLL mass and the pseudoscalar boson mean proper decay length. The observed and expected exclusion ranges of the VLL mass extend up to 700 and 670 GeV, respectively, depending on the pseudoscalar boson lifetime.

JOURNAL OF HIGH ENERGY PHYSICS [8], 156, 2025. DOI: 10.1007/JHEP08(2025)156. Acesso em: **https://doi.org/10.1007/JHEP08(2025)156**

[P433-2025] "Soft phonon mode as the origin of the reduced thermal conductivity in Ta-based trirutiles"

Tartaglia, R.*; Lima, A. F.; Prasai, N.; Christian, A. B.; Neumeier, J. J.; Cohn, J. L.; **Granado, E.***

Ta-based trirutiles of the series ATa(2)O(6) (A = Ni, Co) reportedly present suppressed thermal conductivity (kappa) values compared to their Sb-based counterparts. Particularly, the kappa values at room temperature for Ta-based samples are in the range observed in materials already employed as thermoelectric devices, suggesting they are potential candidates as a starting point for thermoelectric applications. Here, we investigate their phonon dynamics through a combination of Raman scattering measurements with density functional theory (DFT) calculations. For the Ta-based compounds only, our results reveal the presence of an E-g low-energy optical phonon that softens by similar to 10 cm(-1) upon cooling from 300 to 15 K, indicating this is a zone-center soft mode associated with an unrealized structural phase transition. The soft mode enhances the phonon density of states at low energies, as directly manifested in the second-order Raman scattering data and also captured by DFT phonon calculations. These results provide insights into the low kappa -values of Ta-based trirutiles and place zone-center soft phonons as a key ingredient for the development of novel thermoelectric materials.

APPLIED PHYSICS LETTERS 127[26], 262201, 2025. DOI: 10.1063/5.0306933. Acesso em: **https://doi.org/10.1063/5.0306933**

[P434-2025] "Spatial and temporal evaluations of the liquid argon purity in ProtoDUNE-SP"

Abbaslu, S.; Abud, A. A.; **Adriano, C.*; Merlo, R. Borges*; Aguiar, R. de*; Holanda, P. C. de*; Mendonca, A. P. A. de*; Gelli, B.*; Gratieri, D. R.*; Guzzo, M. M.*; Kemp, E.*; Machado, A. A.*; Marques, F. das C.*; Peres, O. L. G.*; Pimentel, V. L.*; Paixao, L. G. P.*; Segreto, E.*;** et al.
DUNE Collaboration

Liquid argon time projection chambers (LArTPCs) rely on highly pure argon to ensure that ionization electrons produced by charged particles reach readout arrays. ProtoDUNE Single-Phase (ProtoDUNE-SP) was an approximately 700-ton liquid argon detector intended to prototype the Deep Underground Neutrino Experiment (DUNE) Far Detector Horizontal Drift module. It contains two drift volumes bisected by the cathode plane assembly, which is biased to create an almost uniform electric field in both volumes. The DUNE Far Detector modules must have robust cryogenic systems capable of filtering argon and supplying the TPC with clean liquid. This paper will explore comparisons of the argon purity measured by the purity monitors with those measured using muons in the TPC from October 2018 to November 2018. A new method is introduced to measure the liquid argon purity in the TPC using muons crossing both drift volumes of ProtoDUNE-SP. For extended periods on the timescale of weeks, the drift electron lifetime was measured to be above 30 ms using both systems. A particular focus will be placed on the measured purity of argon as a function of position in the detector.

JOURNAL OF INSTRUMENTATION 20[9], P09008, 2025. DOI: 10.1088/1748-0221/20/09/P09008. Acesso em: **https://iopscience.iop.org/article/10.1088/1748-0221/20/09/P09008**

[P435-2025] "Storing quantum coherence in a quantum dot nuclear spin ensemble for over 100 milliseconds"

Dyte, H. E.; Manna, S.; **Silva, S. F. C. da*;** Rastelli, A.; Chekhovich, E. A.

States with long coherence are a crucial requirement for qubits and quantum memories. Nuclear spins in epitaxial GaAs/AlGaAs quantum dots are a great candidate, offering excellent isolation from external environments and on-demand coupling to optical flying qubits. However, coherence times are limited to less than or similar to 1 ms by the dipole-dipole interactions between the nuclei and by the nuclear quadrupolar coupling to inhomogeneous crystal strain. Here, we combine strain engineering of the nuclear spin ensemble and tailored dynamical decoupling sequences to achieve nuclear spin coherence times exceeding 100 ms. Recently, a reversible transfer of quantum information into nuclear spin ensembles has been demonstrated in quantum dots: our results provide a path to develop this concept into a functioning solid-state quantum memory suitable for quantum repeaters in optical quantum communication networks.

NATURE COMMUNICATIONS 17[1], 239, 2025. DOI: 10.1038/s41467-025-66948-6. Acesso em: **https://doi.org/10.1038/s41467-025-66948-6**

[P436-2025] "Study of charm mixing and CP violation with D0-- K±π--π±π-- decays"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.*; Lopes, F. C. L.***; et al.

A study of charm mixing and CP violation in D0 -- K±π --π ±π -- decays is performed using data collected by the LHCb experiment in proton-proton collisions from 2015 to 2018, corresponding to an integrated luminosity of 6 fb−1 . The ratio of promptly produced D0 -- K+π −π +π − to D0 -- K−π +π −π + decay rates is measured as a function of D0 decay time, both inclusive over phase space and in bins of phase space. Taking external inputs for the D0 -D¯ 0 mixing parameters x and y allows constraints to be obtained on the hadronic parameters of the charm decay. When combined with previous measurements from charmthreshold experiments and at LHCb, improved knowledge is obtained for these parameters, which is valuable for studies of the angle γ of the Unitarity Triangle. An alternative analysis is also performed, in which external inputs are taken for the hadronic parameters, and the mixing parameters are determined, including Δx and Δy, which are nonzero in the presence of CP violation. It is found that x = 0.85+0.15 −0.24 %, y = 0.21+0.29 −0.27 %, Δx = (−0.02 ± 0.04) % and Δy = 0.02+0.04 −0.03%. These results are consistent with previous measurements and the hypothesis of CP conservation.

JOURNAL OF HIGH ENERGY PHYSICS [12], 153, 2025. DOI: 10.1007/JHEP12(2025)153. Acesso em: **https://doi.org/10.1007/JHEP12(2025)153**

[P437-2025] "Study of (pT) and its higher moments, and extraction of the speed of sound in Pb-Pb collisions with ALICE"

Abualrob, I. J.; Acharya, S.; Rinella, G. A.; **Jahnke, C.*; Liveraro, G. S. S.*; Takahashi, J.***; et al.
ALICE Collaboration

Ultrarelativistic heavy-ion collisions produce a state of hot and dense strongly interacting QCD matter called quark-gluon plasma (QGP). On an event-by-event basis, the volume of the QGP in ultracentral collisions is mostly constant, while its total entropy can vary significantly due to quantum fluctuations, leading to variations in the temperature of the system. Exploiting this unique feature of ultracentral collisions allows for the interpretation of the correlation of the mean transverse momentum (< p(T)>) of produced charged hadrons and the number of charged hadrons as a measure for the speed of sound, cs. This speed is related to the rate at which compression waves travel in the QGP and is determined by fitting the relative increase in < p(T)> with respect to the relative change in the average charged-particle density (< dN(ch)/d eta >) measured at mid-rapidity. This study reports the event-average.p(T). of charged particles as well as the variance, skewness, and kurtosis of the event-by-event transverse momentum per charged particle ([p(T)]) distribution in ultracentral Pb-Pb collisions at a center-of-mass energy of 5.02TeV per nucleon pair using the ALICE detector. Different centrality estimators based on charged-particle multiplicity or the transverse energy of the event are used to select ultracentral collisions. By ensuring a pseudorapidity gap between the region used to define the centrality and the region used to perform the measurement, the influence of biases and their potential effects on the rise of the mean transverse momentum is tested. The measured c(s)(2) is found to strongly depend on the exploited centrality estimator and ranges between 0.1146 +/- 0.0028 (stat.)+/- 0.0065 (syst.) and 0.4374 +/- 0.0006 (stat.)+/- 0.0184 (syst.).

JOURNAL OF HIGH ENERGY PHYSICS [11], 76, 2025. DOI: 10.1007/JHEP11(2025)076. Acesso em: **https://doi.org/10.1007/JHEP11(2025)076**

[P438-2025] "Superconductivity in pure hafnium kagome electride under high pressure"

Pereira, Z. S.*; Cabral, L.; **Silva, E. Z. da***

Superconductivity in pure omega-Hf under high pressures (40-60 GPa) was investigated using density functional theory (DFT) combined with the Migdal-Eliashberg theory. The results indicate that interstitial anionic electrons (IAE) in pure omega-Hf exhibit both kagome and hexagonal electride structures, with interstitial electrons distributed across two distinct crystal planes. The results also show that spin-orbit coupling significantly modifies the conduction electronic band-structure, inducing a Van-Hove singularity at the Fermi level, which enhances the superconducting critical temperature (Tc) from approximately 3.0 K to 5.3 K at 60 GPa. In addition, interstitial electrons in the valence band at the Fermi level also contribute to superconductivity. These Tc values agree well with previously reported experimental results. Furthermore, we demonstrate that crystal planes hosting anionic interstitial electrons exhibit anisotropy and low work function of 3.01 eV along the [001] direction, consistent with the characteristics of electride materials.

PHYSICAL REVIEW B 112[22], 224506, 2025. DOI: 10.1103/gbrd-kp9f. Acesso em**: https://doi.org/10.1103/gbrd-kp9f**

[P439-2025] "Synchronization of identical oscillators on a sphere: Exact results with external forces and higher-order interactions"

Costa, G. S.; **Novaes, M.*;** Fariello, R.; **Aguiar, M. A. M. de***

We study the dynamics of the Kuramoto model on the sphere under higher-order interactions and an external periodic force. For identical oscillators, we introduce a novel way to incorporate three- and four-body interactions into the dynamics of the order parameter, allowing for a full dimensional reduction of this system. We discuss how such reduction can be implemented in two different ways and how they are related. When restricted to the equator, the dynamics is similar to that of the usual Kuramoto model, up to an interesting renormalization of the coupling constants. Outside this plane, the motion reduces to a two-parameter set of periodic orbits. We also locate the bifurcation curves of the system as functions of different parameters.

PHYSICAL REVIEW E 112[5], 054216, 2025. DOI: 10.1103/cz3j-lwcg. Acesso em: **https://doi.org/10.1103/cz3j-lwcg**

[P440-2025] "Targeted search for point sources of neutrons using data from the Pierre Auger Observatory(*)"

Franco, D. de O.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

Since the arrival directions of neutral particles point directly to their origin, they can be used to investigate sources of ultra-high-energy cosmic rays (UHECRs). The emission of UHECRs from a source is expected to be accompanied by the production of neutrons in its vicinity in nuclear interactions and via photo-pion production. Free neutrons undergo beta-decay and travel a mean distance of 9.2x(E/EeV) kpc. Therefore, neutron fluxes in the EeV range could be detected on Earth from sources of UHECRs in our Galaxy. Using cosmic ray data from the Surface Detector of the Pierre Auger Observatory, the largest cosmic ray detector in the world, we investigate neutron fluxes from Galactic candidate sources. Since we cannot distinguish between air showers initiated by protons and neutrons, a neutron flux could be identified as an excess of cosmic ray events around the direction of the candidate source. We look for excesses by comparing the observed signal with the background contribution.

As candidate sources, we select objects of astrophysical interest, such as pulsars, microquasars, and magnetars. We also consider the Galactic center and the Crab Nebula as targets, as well as a subset of the gamma-ray emitters detected by LHAASO. We consider cosmic ray events with declinations from -90 degrees up to +45 degrees and energies starting at 0.1 EeV. Although we do not find evidence of a significant excess of events that could indicate a neutron flux from any of the tested targets, we establish the upper limit of the neutron flux in each investigated case.

NUOVO CIMENTO C-COLLOQUIA AND COMMUNICATIONS IN PHYSICS 48[3], 130, 2025. DOI: 10.1393/ncc/i2025-25130-2. Acesso em: **https://www.sif.it/riviste/sif/ncc/econtents/2025/048/03/article/54**

[P441-2025] "Temperature and Strain Characterization of Tapered Fiber Bragg Gratings"

Moura, C. C. de; Oliveira, V. de; Kalinowski, H. J.; **Biazoli, C. R.***

This work presents a systematic experimental investigation of tapered fiber Bragg gratings (tFBGs) fabricated from standard SMF-28 fiber with waist diameters ranging from 30 to 115 mu m. The effects of taper geometry on strain and temperature sensitivities were evaluated using UV inscription through two phase masks to ensure reproducibility. The maximum strain sensitivity achieved was 25.38 +/- 0.06 pm/N for the 30 mu m waist, corresponding to 20.84 +/- 0.05 pm/mu epsilon-an enhancement of more than 1600% compared to a standard untapered FBG. In contrast, the thermal sensitivity remained nearly constant at similar to 12.5 pm/degrees C for all diameters, confirming that the temperature response is governed by the intrinsic thermo-optic and thermal-expansion properties of silica and is not significantly affected by taper geometry. The measured strain sensitivity exhibited a clear inverse-square dependence on the waist diameter, in excellent agreement with a simple axial-stress model. Consistent Bragg responses obtained using different phase-mask pitches further validated the repeatability of both the tapering and inscription processes. These results demonstrate that tapering standard telecom fiber provides a low-cost, scalable, and robust method to significantly enhance FBG strain sensitivity while preserving thermal stability, enabling compact and high-performance sensors for structural and industrial monitoring applications.

SENSORS 25[24], 7520, 2025. DOI: 10.3390/s25247520. Acesso em: **https://doi.org/10.3390/s25247520**

[P442-2025] "Universality of scaled particle spectra in ultrarelativistic heavy-ion collisions"

Muncinelli, C. D.*; Gardim, F. G.; Chinellato, D. D.; Denicol, G. S.; Giannini, A.; Luzum, M.; Noronha, J.; Silva, T. N. da; **Takahashi, J.*; Torrieri, G.***
ExTrEMe Collaboration

We study the transverse momentum spectra of identified particles in ultrarelativistic collisions of large and small collision systems. In order to isolate information contained in the momentum dependence, we propose to scale the spectra by the total particle number and mean transverse momentum, global quantities which are already well studied. We observe an interesting, nearly universal, centrality-independent shape in the scaled spectra, similar to scalings that have been studied previously. This scaling behavior breaks down at large transverse momentum and for very small systems, such as those produced in p - p collisions. We perform hybrid hydrodynamic simulations and show that, in these simulations, a centrality-independent shape is a consequence of an event-by-event independence. Our results motivate further theoretical and experimental investigations of the regime of validity of this scaling phenomenon and their physical interpretation at different collision energies and systems.

PHYSICAL REVIEW C 112[6], 064922, 2025. DOI: 10.1103/2yqq--qfwd. Acesso em: **https://doi.org/10.1103/2yqq-qfwd**

[P443-2025] "Vacuum fluctuations and the renormalized stress-energy tensor on a cone with arbitrary boundary conditions"

Pitelli, J. P. M.; **Mosna, R. A.*;** Ramos, V. H. M.; Barata, J. C. A.

We analyze the vacuum fluctuations and the stress-energy tensor of a scalar field of mass M in a conical spacetime, where the topological singularity at the apex requires boundary conditions for the field equation. The necessity of boundary conditions was established by Kay and Studer in the early 1990s, while for M = 0 stability is achieved only under Dirichlet boundary conditions, and for M > q the field is stable and a localized mode emerges. This mode admits a natural interpretation as a covariant model of an extended particle detector, which allows us to investigate how such detectors modify the local vacuum structure. In this framework, the renormalized stress-energy tensor offers a natural way to quantify the influence of the detector on the surrounding spacetime.

PHYSICAL REVIEW D 112[12], 125011, 2025. DOI: 10.1103/6fjz--y6y6. Acesso em: **https://doi.org/10.1103/6fjz-y6y6**

Eventos publicados 2025

[P444-2025] "20 years of Arrival Direction Studies at the Pierre Auger Observatory"

Stadelmaier, M.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.*;** et al.
Pierre Auger Collaboration

The Pierre Auger Observatory is the largest detector for ultrahigh -energy astroparticles in the world. Located in Argentina, it observes cosmic rays from approximately 80% of the sky, including the Galactic Center. The Observatory is sensitive to cosmic rays at energies of approximately 10 PeV up to the highest energies, and significant discoveries in cosmic ray research were made with the collected data; for example, the discovery of a modulation in right ascension above 8 EeV with a current significance of 6.9 sigma, suggesting an extragalactic origin of ultrahigh -energy cosmic rays. Furthermore, searches for localized and intermediate -scale excesses are ongoing. We present the latest results of searches for anisotropy in the Auger data, and we outline future prospects using novel analysis methods and the data from Phase II of the Observatory.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI-MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012008, 2025. DOI: 10.1088/1742-6596/3053/1/012008. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012008**

[P445-2025] "Astrophysical interpretations of the data measured at the Pierre Auger Observatory"

Bister, T.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

The Pierre Auger Observatory measures several characteristics of ultra-highenergy cosmic rays (UHECRs), in particular the energies, the depths of shower maximum of the air-shower profiles,

and the arrival directions. Using the energy spectrum and the distributions of depths of shower maximum in a combined fit, the parameters of homogeneously distributed UHECR sources can be constrained. We find that the data are well reproduced if two extragalactic populations of sources are considered, one emitting a soft spectrum dominating below the ankle, and one with a very hard spectrum and mixed composition dominating at the highest energies. In the case of very strong extragalactic magnetic fields between the closest sources and Earth, the spectral index of the high-energy population can be much softer and even in agreement with the expectations from shock acceleration. When taking into account also the arrival directions, it is revealed that adding a population of nearby starburst galaxies to the homogeneous background leads to an improvement of the model likelihood to the 4.5a significance level. The energy-dependent arrival directions at the highest energies are well described by flux contributions from the starburst galaxy catalog or the nearby radio galaxy Centaurus A.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI-MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012007, 2025. DOI: 10.1088/1742-6596/3053/1/012007. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012007**

[P446-2025] "Auger Open Data and the Pierre Auger Observatory International Masterclasses"

Santos, E.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.*;** et al.
Pierre Auger Collaboration

The Pierre Auger Observatory has a public data policy following the FAIR principles (Findable, Accessible, Interoperable, and Reusable). We aim to share the data with the scientific community as part of the multi-messenger effort at different levels and for educational activities to engage the general public. Following the first portal created in 2007, a new portal hosted at https : //opendata. auger. org was established in February 2021. The portal is regularly updated and comprises 10% of the recorded cosmic-ray data organized in various datasets, each with a specific DOI provided by Zenodo. Moreover, a catalog with the 100 most energetic events is available. The portal adopts a "dual" concept, offering not only the download of public data but also a series of Jupyter notebooks. These notebooks allow the general public to reproduce some of the most important results obtained by the Pierre Auger Collaboration and understand the main mechanisms governing the development of the extensive air showers produced by the interaction of cosmic rays in the Earth's atmosphere. In 2023, the Pierre Auger Observatory joined the International Particle Physics Outreach Group (IPPOG). The successful debut enrolled 550 high-school students at 12 research institutions from 5 countries and was repeated this year, embracing yet more students and countries worldwide. During this day, the participants attend seminars about cosmic rays and are asked to reconstruct subsets of public data events using an Auger 3-D event display. Finally, they participate in a Zoom session with scientists at the Auger site.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI-MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012040, 2025. DOI: 10.1088/1742-6596/3053/1/012040. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012040**

[P447-2025] "Energy spectrum and mass composition of cosmic rays from Phase I data measured using the Pierre Auger Observatory"

Novotny, V.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.*;** et al.
Pierre Auger Collaboration

The Pierre Auger Observatory concluded its first phase of data taking after seventeen years of operation. The dataset collected by its surface and fluorescence detectors (SD and FD) provides us with the most precise estimates of the energy spectrum and mass composition of ultra-high energy cosmic rays yet available. We present measurements of the depth of shower maximum, the main quantity used to derive species of primary particles, determined either from the direct observation of longitudinal profiles of showers by the FD, or indirectly through the analysis of signals in the SD stations. The energy spectrum of primaries is also determined from both FD and SD measurements, where the former exhibits lower systematic uncertainty in the energy determination while the latter exploits unprecedentedly large exposure. The data for primaries with energy below 1 EeV are also available thanks to the high--elevation telescopes of FD and the denser array of SD, making measurements possible down to 6 PeV and 60 PeV, respectively.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI--MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, Volume: 3053, Número do artigo: 012009, 2025. DOI: 10.1088/1742-6596/3053/1/012009. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012009**

[P448-2025] "Machine Learning Applications at the Pierre Auger Observatory"

Kubatova, M.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

The Pierre Auger Observatory is utilised to study the extensive air showers produced by ultra-high-energy cosmic rays. In this contribution, we provide an overview of the machine-learning techniques used by the Pierre Auger Collaboration to improve the understanding of data measured by the surface detector of the Observatory. The three methods presented use the spatial and temporal information contained in the signals measured by the surface detector stations. The first method demonstrates the application of deep learning techniques to reconstruct the energy of the cosmic ray. It has the potential to improve upon the standard technique by reducing the dependency of the energy on the primary mass. One of the primary objectives of the Observatory is to understand the evolution of the mass composition with energy. We can achieve this using observables such as the depth of the shower maximum and the number of muons reaching the ground. In the second method presented, long short--term memory and convolutional neural networks are employed to determine the depth of the shower maximum. The third work focuses on estimating both the depth of the shower maximum and the number of muons combining signals from the upgraded stations of the surface detector. Transformer networks are used for this purpose. Using simulations, we study the potential for an accurate reconstruction of the primary mass by combining the measurements of the shower maximum and the muon number.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI-MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012011, 2025. DOI: 10.1088/1742-6596/3053/1/012011. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012011**

[P449-2025] "Searches for ultra -high energy gamma -ray at the Pierre Auger Observatory and implications on super--heavy dark matter"

Deligny, O.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

The first interactions of photon-induced showers are of electromagnetic nature, and the transfer of energy to the hadron/muon channel is reduced with respect to the bulk of hadron--induced showers. This results in a lower number of secondary muons. Additionally, as the development of photon showers is delayed by the typically small multiplicity of electromagnetic interactions, their maximum of shower development is deeper in the atmosphere than for showers initiated by hadrons. These salient features have enabled searches for photon showers at the Pierre Auger Observatory. They have led to stringent upper limits on ultra -high-energy gamma-ray fluxes over four orders in magnitude in energy. These limits are not only of considerable astrophysical interest, but they also allow us to constrain beyond-standard-physics scenarios. For instance, dark matter particles could be superheavy, provided their lifetime is much longer than the age of the universe. Constraints on specific extensions of the Standard Model of particle physics that meet the lifetime requirement for a superheavy particle will be presented. They include limits on instanton strength as well as on mixing angle between active and sterile neutrinos.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI--MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012016, 2025. DOI: 10.1088/1742-6596/3053/1/012016. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012016**

[P450-2025] "Status and Performance of the Radio Detector of the Pierre Auger Observatory"

Saharan, M.; **Arbeletche, L. B.*; Chinellato, J. A.*; Dobrigkeit, C.*; Fauth, A. C.*; Payeras, A. M.*; Akim, J. V. R.***; et al.
Pierre Auger Collaboration

The Pierre Auger Observatory is a ground-based hybrid detector that measures cosmic rays above 10(17) eV with an array of 1661 water-Cherenkov detector (WCD) stations spread over 3000 km(2) and overlooked by 27 fluorescence telescopes. Over the last two decades, it has contributed significantly to our understanding of cosmic rays and multi-messenger astroparticle physics. However, fundamental questions about the origin, composition, acceleration mechanism, and propagation of ultra-high energy cosmic rays remain unanswered. The ongoing AugerPrime upgrade will improve the estimation of the mass composition of cosmic rays at the highest energies, which is closely related to other open questions and will improve multi-messenger capabilities. For inclined air showers with zenith angles greater than 65 degrees, this will be achieved by using the newly added Radio Detector (RD) antenna array. The RD consists of an antenna installed on top of each WCD to measure the radio emission from the air showers in the 30-80 MHz band. For inclined showers, the WCD predominantly measures the muonic component, and the RD measures the electromagnetic component. Over 700 fully upgraded stations are now taking data in the field, and the upgrade is expected to be completed this year. Currently, the RD collects data when triggered by the WCD. For inclined showers induced by neutral particles, especially photons, the muon content is often insufficient to trigger the WCD. Therefore, an RD trigger is also under development to enhance sensitivity to neutral particles. In this contribution, we present an overview of the RD upgrade and its expected performance for cosmic rays and photons. The significance of the RD in the current era of multi-messenger astroparticle physics is also discussed.

13TH COSMIC-RAY INTERNATIONAL STUDIES AND MULTI-MESSENGER ASTROPARTICLE CONFERENCE, Série de livros: Journal of Physics Conference Series, 3053, 012010, 2025. DOI: 10.1088/1742-6596/3053/1/012010. Acesso em: **https://iopscience.iop.org/article/10.1088/1742-6596/3053/1/012010**

Meeting Abstract 2025

[M001-2025] "Choroid plexus volumetry and multi-echo ASL analysis in multiple sclerosis (MS) and neuromyelitis optica spectrum disorders (NMOSD)"

Rimkus, C.; **Paschoal, A.***; Pastorello, B.; Avolio, I.; Pereira, S. L. A.; Callegaro, D.; Otaduy, M.

MULTIPLE SCLEROSIS JOURNAL Resumo do encontro: P1460, 31[3], p. 1043-1044, 2025. Suplemento: S

Carta 2025

[Ca002-2025] "Vascular reactivity in post-COVID-19 patients: analysis and correlation with functional capacity"

Silva, L. I. P.; Pereira, M. C.; **Mesquita, R. C.*;** Vian, B. S.; Ratti, L. dos S. R.

Fonte: JORNAL BRASILEIRO DE PNEUMOLOGIA 51[5], e20250268, 2025. DOI: 10.36416/1806-3756/e20250268. Acesso em: **https://jornaldepneumologia.com.br/details/4159/en-US**

Artigos publicados 2026

[P001-2026] "Abnormal crack coalescence and ductility in graphene"

Jin, S.; Hong, J. W.; Daraio, C.; **Fonseca, A. F.***

Crack coalescence is a critical component in the study of mechanical resistance and the stability of materials. In the particular case of graphene, despite the extensive investigation of the formation and behavior of individual cracks in graphene, the study of crack coalescence within its structure remains unexplored. In this study, we investigate the interaction between two preexisting cracks and their effect on the mechanical properties of graphene using molecular dynamics simulations. The behavior of zigzag and armchair graphene structures with cracks separated by distances (Wgap) is analyzed under tensile loading. The findings reveal that crack coalescence, defined as the formation of a new crack from two existing crack tips, occurs for lower values of the distance between cracks, Wgap, resulting in a decline in the strength of structures. As Wgap increases, the stress-strain curves shift upward, with the peak stress rising in the absence of crack coalescence. The effective stress intensity factor formulated in this study exhibits a clear upward trend with increasing Wgap. Furthermore, an increase in Wgap induces a transition in fracture behavior from crack coalescence to independent propagation with intercrack undulation. This shift in fracture behavior demonstrates a brittle-to-ductile transition, as evidenced by increased energy absorption and delayed failure. A design guideline for the initial crack geometry is suggested by correlating peak stress with Wgap, within a certain range. The findings offer insights into the fracture mechanics of graphene, emphasizing the impact of crack interaction and geometry on strength. This provides design guidelines for graphene-based structures with enhanced mechanical performance.

INTERNATIONAL JOURNAL OF MECHANICAL SCIENCES 309, 111025, 2026. DOI: 10.1016/j.ijmecsci.2025.111025. Acesso em: **https://doi.org/10.1016/j.ijmecsci.2025.111025**

[P002-2026] "Amorphous Hydrogenated Silicon Carbide Interlayers: Chemical, Optical, and Tribological Behavior for Improving Adhesion of Carbon-Based Films to Ferrous Alloy"

Piroli, V.; Goldbeck, M. C.; Weber, J. S.; **Cemin, F.*;** Perotti, B. L.; Boeira, C. D.; **Alvarez, F.*;** Fukumasu, N. K.; Zanatta, A. R.; Michels, A. F.; Figueroa, C. A.

Diamond-like carbon thin films have been gaining attention in the last years due to their unique properties, such as low friction coefficient and high wear resistance. However, the lack of adhesion between DLC coatings and ferrous alloys complicates their wider industrial application. Amorphous hydrogenated silicon carbide (a-SiCx:H) interlayers can be used as a solution for adhesion issues. Nonetheless, for interlayers produced with tetramethylsilane, deposition temperatures higher than 300 degrees C may degrade the previous heat treatment of the substrate. This work aims to verify the influence of chemical, optical, morphological, and tribological properties in the adhesion of a-C:H/a-SiCx:H/AISI 4140 steel structures deposited with 0.8 Pa as background pressure and low interlayer deposition temperatures (T <= 200 degrees C). The results showed that both chemical and morphological properties strongly modify the adhesion behavior at low deposition temperatures. The optical absorption edge of the samples takes place in energies around 3.5 (or similar to 350 nm) and similar to 1.5 eV (or similar to 850 nm) for the a-SiCx:H interlayer (mainly deposited at 150 degrees C) and a-C:H film deposited for 60 min, respectively. When the a-SiCx:H temperature increased from 85 degrees C to 200 degrees C, the oxygen content at the interfaces and in the interlayer decreased as well as the density of defects observed in the a-C:H surface.

SURFACE AND INTERFACE ANALYSIS, 2026. DOI: 10.1002/sia.70047 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1002/sia.70047**

[P003-2026] "An Atomistic Investigation of Cobalt's Nanoindentation Response with An Angular Dependent Potential"

Oliveira, D. S.; Kuritza, D. P.; Padilha, J. E.; **Cotta, M. A.***

Cobalt and its alloys are essential in many advanced technologies and understanding their mechanical properties at the nanoscale is crucial for designing next-generation materials. In this work, an angular-dependent potential for cobalt was developed by fitting to a reference data set of atomic forces, energies, and stress tensors derived from first-principles density functional theory calculations. The potential's performance was systematically evaluated against experimental data and two established classical potentials-an embedded-atom method potential and a modified embedded-atom method potential-across a range of structural, mechanical, thermal, and defect properties for both HCP and FCC phases, as well as the liquid state. The ADP model demonstrates a favorable balance between accuracy and computational cost, exhibiting a mean absolute percentage error of 6.3% for mechanical and elastic properties. Large-scale molecular dynamics simulations of nanoindentation on the (0001) basal plane of HCP cobalt were performed to investigate the atomistic mechanisms of plastic deformation. The simulations reveal that plasticity initiates with the nucleation of <a>-type dislocations on basal planes, followed by the activation of pyramidal <c+a> slip and a localized, reversible HCP-to-FCC phase transformation under high pressure. The critical shear stress for dislocation nucleation was found to decrease with increasing indenter radius, converging to a value of (13.7 +/- 0.6) GPa.

ACS OMEGA, 2026. DOI: 10.1021/acsomega.5c11093 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1021/acsomega.5c11093**

[P004-2026] "Antagonistic interactions and their impact on species formation and biodiversity maintenance"

Godoy, I. B. S. de; **Aguiar, M. A. M. de***

In antagonistic interactions, adaptive responses to reciprocal attacks can drive the cyclical dynamics of the "arms race". Since attack and defense mechanisms are linked to gene expression, which may also affect mate choice, these interactions can drive speciation on an evolutionary scale. Mathematical and computational models play an important role in the investigation of this type of dynamics, since experiments or observations that uncover such long term effects are not generally possible. Although previous works have explored the roles of spatial scale and phylogenetic association on antagonistic interactions, the role of such ecological interactions on the evolutionary dynamics is still not clear. This article aims to analyze how antagonistic interactions between consumers and resources influence consumer diversity, population dynamics, and speciation. Using an IBM model, we analyze the formation of species and the maintenance of biodiversity across extended temporal scales. We considered that resources can have two phenotypes describing two potential niches for the consumers. We demonstrated that the coexistence of consumers and resources occurs under conditions of low resource mutation and that diversity is generally reduced when the two initial phenotypes of the consumers are similar. Our results also indicate that niche separation is likely when initial niche distance is sufficiently large. In contrast, when the initial phenotypes are similar, niche width tends to expand while separating from each other. These simulations effectively illustrate the impacts of the "arms race" between consumers and resources and their coevolution.

ECOLOGICAL COMPLEXITY 65, 101156, 2026. DOI: 10.1016/j.ecocom.2026.101156. Acesso em: **https://doi.org/10.1016/j.ecocom.2026.101156**

[P005-2026] "Assigning entities to teams as a hypergraph discovery problem"

Arruda, G. F. De*; He, W.; Heydaribeni, N.; Javidi, T.; Moreno, Y.; Eliassi-Rad, T.

Assigning agents to teams under strict task and effort constraints is crucial in business, science, and engineering, where disruptions can cause significant losses. Current methods do not explore hypergraph-based solutions that explicitly optimize algebraic connectivity under constraints, leaving unresolved how to systematically form robust, recoverable teams. We present a hypergraph-based team assignment algorithm where nodes represent agents and hyperedges represent tasks. The search is guided by input constraints and aims to optimize resilience and diffusion by maximizing the algebraic connectivity of an edge-dependent, vertex-weighted hypergraph. We employ constrained simulated annealing to find a satisfactory hypergraph by enforcing both the minimum effort required for task completion and the maximum effort agents can exert. We evaluate robustness by assessing solution recovery after node removal attacks. Our results demonstrate that the hypergraph formulation yields more robust solutions than the bipartite formulation and the greedy approach.

COMMUNICATIONS PHYSICS 9[1], 42, 20226. DOI: 10.1038/s42005-025-02474-7. Acesso em: **https://doi.org/10.1038/s42005-025-02474-7**

[P006-2026] "A concise review of recently synthesized 2D carbon allotropes: Amorphous carbon, graphynes, biphenylene and fullerene networks"

Paupitz, R.; **Fonseca, A. F.*;** Bessa, M.; **Fabris, G. S. L.***; Cunha, W. F. da; Machado, L. D.; Pereira Junior, M. L.; Ribeiro Junior, L. A.; **Galvão, D. S.***

Two-dimensional (2D) carbon allotropes have received considerable attention due to their unique properties and potential applications in several fields, including electronics, catalysis, energy storage, and sensing.

Following the experimental realization of graphene, numerous other 2D carbon structures have been proposed and, in some cases, successfully synthesized. This work presents a concise review of the recently experimentally realized 2D carbon allotropes beyond graphene, including monolayer amorphous carbon, graphynes, biphenylene-, and fullerene-based networks. For each class, we discuss structural characteristics, theoretical predictions, and synthesis methods, with emphasis on the interplay between theory and experiment. We also highlight instances where experimental studies overlooked relevant theoretical contributions. Finally, we identify theoretically predicted structures that remain unexplored experimentally, suggesting opportunities for synthesis-driven investigations.

CARBON, 252, 121320, 2026. DOI: 10.1016/j.carbon.2026.121320. Acesso em: **https://doi.org/10.1016/j.carbon.2026.121320**

[P007-2026] "Biasing from galaxy trough and peak profiles with the DES Y3 redMaGiC galaxies and the weak lensing mass map"

Hang, Q.; Jeffrey, N.; Whiteway, L.; **Navarro-Alsina, A.***; et al. DES Collaboration

We measure the correspondence between the distribution of galaxies and matter around troughs and peaks in the projected galaxy density, by comparing redMaGiC galaxies (0 . 15 < z < 0 . 65) to weak lensing mass maps from the Dark Energy Survey (DES) Y3 data release. We obtain stacked profiles, as a function of angle theta, of the galaxy density contrast delta(g) and the weak lensing convergence kappa, in the vicinity of these identified troughs and peaks, referred to as 'void' and 'cluster' superstructures. The ratio of the profiles depend mildly on theta, indicating good consistency between the profile shapes. We model the amplitude of this ratio using a function F(eta, theta) that depends on cosmological parameters eta, scaled by the galaxy bias. We construct templates of F(eta, theta) using a suite of N-body (Gower Street) simulations forward-modelled with DES Y3-like noise and systematics. We discuss and quantify the caveats of using a linear bias model to create galaxy maps from the simulation dark matter shells. We measure the galaxy bias in three lens tomographic bins (near to far): 2.32(-0.27)(+0.86), 2.18(-0.23)(+0.86),1.86(-0.23)(+0.82) for voids, and 2.46(-0.27)(+0.73), 3.55(-0.55)(+0.96), 4.27(-1.14)(+0.36) for clusters, assuming the best-fitting Planck cosmology. Similar values with similar to 0.1cr shifts are obtained assuming the mean DES Y3 cosmology. The biases from troughs and peaks are broadly consistent, although a larger bias is derived for peaks, which is also larger than those measured from the DES Y3 3 x 2-point analysis. This method shows an interesting avenue for measuring field-level bias that can be applied to future lensing surveys.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 546[2], stag006, 2026. DOI: 10.1093/mnras/stag006. Acesso em: **https://doi.org/10.1093/mnras/stag006**

[P008-2026] "Brain Functional Connectivity is Altered in Professional Footballers With Previous Hamstring Injury"

Carneiro, P. P.*; Correia, J. P.; **Castellano, G.***; Freitas, S. R.

Purpose: To investigate how hamstring injuries affect brain functional connectivity (FC) and identify potential biomarkers for injury assessment and rehabilitation. Methods: Brain activity was recorded during a rigorous motor task using electroencephalography in 129 footballers. Demographic, anthropometric, injury, and football-related data were also collected. Brain FC was calculated separately for the rest and activity periods. A 2-way mixed analysis of variance was conducted for group comparisons, and a partial correlation analysis examined links between FC and injury parameters. Results: The execution of the motor task led to a significant decrease in alpha-band FC during activity compared with rest (injured: P < .0001, eta(2)(p)=.38; control: P < .001, eta(2)(p)=.11). Injured players showed significantly lower FC during activity (P = .006, eta 2p=.07), as well as a greater decrease from rest to activity (P < .001, eta(2)(p)=.13), particularly in the frontal (P < .001, eta(2)(p)=.17) and temporal (P = .03, eta 2p=.08) regions. There were significant inverse correlations between the injury severity index and global (P = .003, r = -.58), frontal (P < .001, r = -.72), and parietal (P = .015, r = -.59) connectivity. Conclusion: Reduced FC in footballers with previous hamstring injury suggests an increased cognitive effort required for task execution, namely, in regions associated with motor planning and movement sequencing. The correlation analysis results point to a relationship between age and severity of the injury and the degree of this increase in cognitive effort.

INTERNATIONAL JOURNAL OF SPORTS PHYSIOLOGY AND PERFORMANCE 21[1], p. 18-26, 2026. DOI: 10.1123/ijspp.2024-0559. Acesso em: **https://doi.org/10.1123/ijspp.2024-0559**

[P009-2026] "Characterization of sugarcane distilled beverage using impedimetric electronic tongue and chemometrics"

Silva, T. A. da; Raj, D. R. K.; **Gonçalves, M. H.*; Braunger, M. L.*; Riul Jr., A.*; Rodrigues, V.***; Alcarde, A. R.; Barbin, D. F.

Sugarcane spirit (or cacha & ccedil;a) is a Brazilian alcoholic beverage made from fermented sugarcane juice whose economy and production have grown worldwide. It has distinct characteristics, demanding several chemical analyses to determine its quality and to identify adulteration. In this work, we evaluated the use of a microfluidic electronic tongue, comprising different sensing units, as a tool for analyzing cacha & ccedil;a. Reference analyses performed were pH, soluble solids content, total titratable acidity, furfural, and alcohol content and its several types (ethanol, methanol, and propanol). Several commercial and artisanal samples were tested; with e-tongue results compared using qualitative and quantitative multivariate analysis. Results indicate that the microfluidic e-tongue having the greatest sample differentiation was an e-tongue with silver nanoparticles (NPs) (15 times the concentration) in the sensing units. Artificial neural networks (ANN) model indicated higher calibration (R-2 > 0.90) and prediction (R-2 > 0.80) values for most chemical compounds. The work demonstrates potential of microfluidics integrated e-tongue for rapid quality control of alcoholic beverages.

JOURNAL OF FOOD COMPOSITION AND ANALYSIS 149, 108679, 2026. DOI: 10.1016/j.jfca.2025.108679. Acesso em: **https://doi.org/10.1016/j.jfca.2025.108679**

[P010-2026] "Chiral Symmetry in Implicit Regularization: A Review"

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

Chiral interactions pose significant challenges for regularization due to the gamma 5 Dirac matrix, which is intrinsically four--dimensional. Dimensional regularizations, while widely employed in gauge theories, encounter challenges when treating gamma 5 in d not equal 4 dimensions, potentially leading to violations of chiral symmetry and the emergence of spurious anomalies. In this work, we examine aspects of Implicit Regularization, a framework formulated to operate in the physical dimension, thereby potentially avoiding ambiguities associated with gamma 5. We discuss its implementation and implications for symmetry preservation in chiral gauge theories.

SYMMETRY-BASEL 18[1], 160, 2026. DOI: 10.3390/sym18010160. Acesso em: **https://doi.org/10.3390/sym18010160**

[P011-2026] "Closure temperature for the fission-track systems"

Rufino, M.*; Lixandrao Filho, A. L.*; Guedes, S.*

We introduce a novel analytical equation (AE) for computing closure temperature (Tc) in fission-track (FT) systems, grounded in a rigorous physicochemical framework. By extending Dodson's foundational concept to the complex, non-first--order kinetics characteristic of fission-track annealing, this work overcomes historical barriers to a direct analytical formulation in FT thermochronology. To date, most Tcestimates for fission track systems have relied on numerical simulations based on the Principle of Equivalent Time (PET). However, a recently developed physicochemical framework allows modeling variable thermal histories without relying on PET. In this study, we employ this framework to construct an analytical equation for computing closure temperature in the fission--track system. The resulting Tcvalues are then compared with previously published results to assess accuracy and consistency. The analytical formulation is simpler, faster to compute, and more easily automated. However, the practical accuracy of this analytical solution is intrinsically linked to the quality and advancements of the empirical annealing models and bias models (track length to density relationships) upon which it relies.

CHEMICAL GEOLOGY 701, 123195, 2026. DOI: 10.1016/j.chemgeo.2025.123195. Acesso em: **https://doi.org/10.1016/j.chemgeo.2025.123195**

[P012-2026] "Dark Energy Survey Year 3 results: wCDM cosmology from simulation-based inference with persistent homology on the sphere"

Prat, J.; Gatti, M.; Doux, C.; **Navarro-Alsina, A.***; et al.
DES Collaboration

We present cosmological constraints from Dark Energy Survey Year 3 (DES Y3) weak lensing data using persistent homology, a topological data analysis technique that tracks how features like clusters and voids evolve across density thresholds. For the first time, we apply spherical persistent homology to galaxy survey data through the algorithm TOPOS2, which is optimized for curved-sky analyses and HEALPIX compatibility. Employing a simulation-based inference framework with the Gower Street simulation suite - specifically designed to mimic DES Y3 data properties - we extract topological summary statistics from convergence maps across multiple smoothing scales and redshift bins. After neural network compression of these statistics, we estimate the likelihood function and validate our analysis against baryonic feedback effects, finding minimal biases (under 0.3 sigma) in the Omega(m) - S-8 plane. Assuming the wCold Dark Matter model, our combined Betti numbers and second moments analysis yields S-8 = 0.821 +/- 0.018 and Omega(m) = 0.304 +/- 0.037 - constraints 70 per cent tighter than those from cosmic shear two-point statistics in the same parameter plane. Our results demonstrate that topological methods provide a powerful and robust framework for extracting cosmological information, with our spherical methodology readily applicable to upcoming Stage IV wide-field galaxy surveys.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 545[3], staf2152, 2026. DOI: 10.1093/mnras/staf2152. Acesso em: **https://doi.org/10.1093/mnras/staf2152**

[P013-2026] "Defect-Engineered Layer-Dependent Nonlinear Optical Response in 2D Muscovite for Efficient Optical Limiting"

Mitra, D.; **Fabris, G. S. L.*;** Oliveira, R. B. de; Sadhukhan, R.; Sarkar, J. K.; Ferrer, M. M.; Pereira Jr., M. L.; Mahapatra, P. L.; Goswami, D. K.; Costin, G.; **Galvao, D. S.***; Tiwary, C. S.; Datta, P. K.

Light-matter interactions in 2D materials gain significant interest due to their distinctive optical and electronic properties. Recently, silicates emerge as a promising new class of 2D materials, but their nonlinear optical properties remain largely unexplored. This study demonstrates the layer-dependent nonlinear absorption and optical limiting capabilities of 2D muscovite, a silicate mineral, using femtosecond laser excitation at 450 nm. The two-photon absorption (TPA) coefficient is highly sensitive to the number of layers, increasing markedly from (3.91 +/- 0.06) x103 cm GW-1 in multilayer structures to (6.94 +/- 0.17) x 105 cm GW-1 in the monolayer limit at a peak intensity 68 GW cm-2, highlighting a pronounced layer--dependent enhancement in nonlinear absorption. Additionally, monolayer muscovite exhibits an optical limiting threshold of 1.46 mJ cm- 2, outperforming graphene and other 2D dichalcogenides. This enhanced TPA results from quantum confinement and intrinsic lattice defects that facilitate nonlinear optical transitions. Density functional theory reveals that liquid-phase exfoliation disrupts potassium interlayers and induces oxygen vacancies, creating mid-gap electronic states that significantly enhance TPA. These insights open new avenues for designing low-fluence, high-efficiency optical limiters using 2D silicates.

ADVANCED OPTICAL MATERIALS, 2026. DOI: 10.1002/adom.202502660 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1002/adom.202502660**

[P014-2026] "Differential balanced transimpedance amplifier for low-capacitance measurements in real-time monitoring of metal nanoparticle deposition"

Hossack, S. M. V. R.*; Hensel, R. C.; Pimentel, V. L.; **Rodrigues, V.***

Impedance measurements are crucial in various fields such as sensor transduction, process monitoring, and control systems, yet measuring low values of capacitance (similar to 1 pF) in electrically noisy environments remains a challenge, particularly at an affordable cost. This paper presents a differential transimpedance amplifier (TIA)-based electronic circuit, which incorporates three blocks: two TIAs and a differential circuit with fine-tuning for null adjustment. The differential configuration improves common-mode noise rejection, allowing the system to operate reliably even in high-interference environments, which represents its main novelty. Detailed characterization of the circuit is provided, including its frequency-dependent response and baseline noise analysis. The circuit is suitable for frequencies below 20 kHz for samples with capacitance below 1 nF, though this capability varies depending on the capacitance being measured. The primary application demonstrated in this study is the real-time monitoring of silver nanoparticle (NP) deposition using a gas aggregation source. Capacitance measurements effectively tracked the deposition progress, even in electrically noisy environments, confirming the circuit's ability to suppress external disturbances while maintaining picofarad--level sensitivity. Results show that the system can accurately monitor capacitance changes from the very initial stages of NP deposition, making it a valuable tool for in-situ real-time monitoring. The findings highlight the setup's precision and its potential for applications requiring detailed capacitance measurements. This work presents a robust and reliable method for NP deposition monitoring, emphasizing its differential noise--rejection performance and low-cost implementation, which is essential for advancing research and development in nanotechnology and materials science. Future improvements aim to enhance integration with other characterization techniques.

MEASUREMENT SCIENCE AND TECHNOLOGY 37[7], 075003, 2026. DOI: 10.1088/1361-6501/ae1fa8. Acesso em: **https://iopscience.iop.org/article/10.1088/1361-6501/ae1fa8**

[P015-2026] "Effect of tube radius on the adsorption of chlorothalonil on single-walled carbon and boron nitride nanotubes surfaces: A theoretical study for environmental remediation"

Ferreira, F. G. de S.; Silva, C. V. C. R. da; Guerini, S.; **Lima, K. A. L.*; Galvao, D. S.*;** Matos, J. M. E. de; Souza, A. A. de

The interaction of the pollutant chlorothalonil (CLT) with single-walled carbon nanotubes (CNTs) and boron nitride nanotubes (BNNTs) was investigated using density functional theory (DFT) calculations with the SIESTA software. Structural, energetic, and electronic properties were analyzed to characterize the effects of the interaction on the nanotube surfaces. Adsorption energy increases with increasing nanotube radius, attributed to enhanced pi-pi stacking interactions. The results indicate that both CNTs and BNNTs can physically adsorb CLT, but BNNTs are more promising candidates for CLT detection and removal in contaminated environments. Nanotube radius strongly affects all electronic and energetic properties. Molecular dynamics simulations performed in GROMACS confirmed the stability of CLT adsorbed on CNT and BNNT surfaces in aqueous solution.

COMPUTATIONAL AND THEORETICAL CHEMISTRY 1256, 115626, 2026. DOI: 10.1016/j.comptc.2025.115626. Acesso em: **https://doi.org/10.1016/j.comptc.2025.115626**

[P016-2026] "Eugenol as a synergistic adjuvant to conventional antibiotics against multidrug-resistant Klebsiella pneumoniae: An integrated in vitro and quantum-based in silico approach"

Barros, A. V. de; Veras, B. O. de; Menezes, G. de L.; **Bezerra, K. S.***; Santos, P. E. M. dos; de Sá, R. A. de C. C.; Fulco, U. L.; **Galvao, D. S.***; Paiva, P. M. G.; Malafaia, G.; Silva, M. V. da; Coutinho, H. D. M.; Oliveira, M. B. M. de

The escalating antimicrobial resistance of Klebsiella pneumoniae poses a critical public health challenge, demanding innovative therapeutic strategies. This study investigated the antibacterial activity of eugenol (EOL) and its potential as a resistance-modulating agent when combined with conventional antibiotics-amoxicillin (AXL), azithromycin (AZT), cephalexin (CEF), and ciprofloxacin (CIP)-against clinical multidrug-resistant isolates. EOL exhibited intrinsic antibacterial activity with MIC values ranging from 1024 to 2048 mu g/mL. Checkerboard assays revealed synergistic interactions between EOL and AXL or AZT (FICI <= 0.5), while combinations with CEF and CIP were indifferent. These synergistic effects were corroborated by growth inhibition curves, time-kill kinetics, and biofilm suppression assays, all of which demonstrated a marked reduction in bacterial viability and biofilm formation. Molecular docking and quantum mechanical calculations further elucidated the enhanced binding affinities and intermolecular interactions between AXL-EOL complexes and key resistance-related targets (KPC, LpxC, and particularly the quorum-sensing regulator SdiA), with interaction energies reaching up to-52.06 kcal/mol. Altogether, the findings underscore the potential of EOL as a potent adjuvant that augments the efficacy of conventional antibiotics, offering a promising pathway toward the development of targeted therapies against multidrug-resistant K. pneumoniae.

MICROBIAL PATHOGENESIS 210, 108126, 2026. DOI: 10.1016/j.micpath.2025.108126. Acesso em: **https://doi.org/10.1016/j.micpath.2025.108126**

[P017-2026] "Exclusive photoproduction of excited ρmesons decaying to four pions in ultraperipheral Pb-Pb collisions at √sNN=5.02 TeV"

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

The intense photon fluxes from relativistic nuclei provide an opportunity to study photonuclear interactions in ultraperipheral collisions. In particular, it allows for the investigations of excited, light-flavour vector mesons. The measurement of coherently photoproduced pi(+)pi(-)pi(+)pi(-) final states in ultraperipheral Pb-Pb collisions at root s(NN) = 5.02 TeV is presented for the first time. The cross section, d sigma/dy, times the branching ratio (rho -> pi(+)pi+pi(-)pi(-)) is found to be 47.8 +/- 2.3 (stat.) +/- 7.7 (syst.) mb in the rapidity interval |y| < 0.5. The invariant mass distribution is not well described with a single Breit-Wigner resonance without an interference term. Including interference with a non-resonant contribution results in the mass and width values being too far from those reported in PDG, while the production of two interfering resonances, rho(1450) and rho(1700), also provides a good description of the data. The values of the masses (m) and widths (Gamma) of the resonances extracted from the fit assuming two interfering resonances are m(1) = 1385 +/- 14 (stat.) +/- 3 (syst.) MeV/c(2), Gamma(1) = 431 +/- 36 (stat.) +/- 82 (syst.) MeV/c(2), m2 = 1663 +/- 13 (stat.) +/- 22 (syst.) MeV/c(2) and Gamma(2) = 357 +/- 31 (stat.) +/- 49 (syst.) MeV/c(2), respectively. The measured cross sections times the branching ratios are compared to recent theoretical predictions.

PHYSICS LETTERS B 872, 140006, 2026. DOI: 10.1016/j.physletb.2025.140006. Acesso em: **https://doi.org/10.1016/j.physletb.2025.140006**

[P018-2026] "Exploring the nature of phonon-qubit-photon coupling in a hybrid circuit"

Neto, O. P. de Sa; Rossatto, D. Z.; Sohail, A.; **Oliveira, M. C. de***

The Interaction between photons and phonons mediated by a third medium has significant potential for various applications in quantum information technology. Inspired by experimental investigations obtained on hybrid circuits, we aimed to develop a comprehensive theory for analytically calculating the transmission and reflection spectra, as well as obtaining eigenenergies of the circuits associated with this interaction. When analyzing the transmission spectra, we observed an intriguing correlation between the eigenenergies and the spectral peaks. This observation suggests the possibility of a deeper understanding of the stationary states involved in this unique hybrid circuit. Through this analysis, we aim not only to describe the observed phenomena but also to provide valuable insights for quantum technology. Copyright c 2026 EPLA All rights, including for text and data mining, AI training, and similar technologies, are reserved.

EPL 153[1], 18001, 2026. DOI: 10.1209/0295-5075/ae253c. Acesso em: **https://iopscience.iop.org/article/10.1209/0295-5075/ae253c**

[P019-2026] "Fluctuation theorems with optical tweezers: theory and practice"

Martins, T. T.; Malavazi, A. H. A.; **Kamizaki, L. P.***; Petrosyan, A.; Besga, B.; Ciliberto, S.; Muniz, S. R.

Fluctuation theorems, such as the Jarzynski equality and the Crooks relation, are effective tools connecting non-equilibrium work statistics and equilibrium free energy differences. However, detailed hands-on, reproducible protocols for implementing and analyzing these relations in real experiments remain scarce. This tutorial provides an end-to-end workflow for measuring, validating, and applying fluctuation theorems using a single-beam optical tweezers setup. It introduces the foundational ideas and consolidates practical calibration (PSD-based trap stiffness and position sensitivity), protocol design (forward/reverse finite-time drives over multiple amplitudes and durations), and robust estimators for free energy difference and dissipated work, highlighting finite sampling and rare event effects.

We demonstrate the procedures using an extensive set of measured trajectories under different conditions and provide openly accessible datasets and Python code, enabling new researchers or educators to reproduce the results with minimal effort. Beyond pedagogical validation, we discuss how these recipes translate to broader soft-matter and mesoscopic contexts. By combining user-friendly instruments with clear and transparent analysis, this work promotes the education and reliable adoption of stochastic thermodynamic methods in the curricula of physics and chemistry, as well as among emerging research teams.

EUROPEAN PHYSICAL JOURNAL PLUS 141[1], 71, 2026. DOI: 10.1140/epjp/s13360-025-07181-4. Acesso em: **https://doi.org/10.1140/epjp/s13360-025-07181-4**

[P020-2026] "From a network to a networking: The evolution of the Latin American Giant Observatory"

Sarmiento-Cano, C.; Asorey, H.; Audelo, M.; **Fauth, A. C.***; Cazar-Ramírez, D.; Gulisano, A. M.; Lopez-Rodriguez, J. A.; Mayo-Garcia, R.; Molina, J.; Otiniano, L.; Sacahui, J. R.; Secchia-Gonzalez, G.; Sidelnik, I.; Núñez, L. A.

The Latin American Giant Observatory (LAGO) is a collaborative initiative that deploys a network of lowcost, autonomous Water Cherenkov Detectors across Latin America and Spain. Initially focused on detecting gamma-ray bursts at high-altitude sites, LAGO has evolved into a multidisciplinary forum for astroparticle physics, space weather studies, and environmental monitoring. Its detectors operate from sea level to over 4300 meters above sea level (m a.s.l.) in diverse geomagnetic and atmospheric conditions. The ARTI-MEIGA simulation framework is a key development that models the entire cosmic-ray interaction chain, enabling site-specific simulations to be integrated into FAIR-compliant workflows. LAGO also plays a significant role in regional education and training through partnerships with ERASMUS+ projects, positioning itself as a hub for research capacity building. New contributions emerging from the collaboration include volcano muography, neutron hydrometry for precision agriculture, and space weather monitoring in the South Atlantic Magnetic Anomaly. LAGO demonstrates how Cherenkov-based detection and open science can drive scientific discovery and practical innovation.

NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 1086, 171328, 2026. DOI: 10.1016/j.nima.2026.171328. Acesso em: **https://doi.org/10.1016/j.nima.2026.171328**

[P021-2026] "From Glaphene to Glaphynes: A Hybridization of Two-Dimensional Silica Glass and Graphynes"

Fabris, G. S. L.*; Oliveira, R. B. De; Pereira, M. L.; Vajtai, R.; Ajayan, P. M.; **Galvao, D. S.***

Hybrid two-dimensional (2D) materials have attracted increasing interest as platforms for tailoring electronic properties through interfacial design. Very recently, a hybrid 2D material termed glaphene, which combines monolayers of 2D silica glass and graphene, was experimentally realized. Inspired by glaphenes, we proposed a class of similar structures named glaphynes, which are formed by stacking SiO2 monolayers onto alpha-, beta-, and gamma-graphynes. Graphynes are 2D carbon allotropes with the presence of acetylenic groups (triple bonds). The glaphynes' structural and electronic properties were investigated using the self-consistent-charge density functional tight-binding (SCC-DFTB) method, as implemented in the DFTB+ package. Our analysis confirms their energetic and structural stability. We have observed that in the case of glaphynes, the electronic proximity effect can indeed open the electronic band gap, but not for all cases, even with the formation of Si-O-C bonds between silica and graphynes.

ACS NANO, 2026. DOI: 10.1021/acsnano.5c16085 Early Access Date: FEB 2026. Acesso em: **https://doi.org/10.1021/acsnano.5c16085**

[P022-2026] "From a Thornton and Marion's textbook problem to physical model: exploring coupled oscillatorsin classical mechanics"

Aranda, P. A. P. T.*; Fonseca, A. F.*

Problem 12-3 of Chapter 12 in Thornton and Marion's fifth edition of Classical Dynamics of Particles and Systems, calls for the solution of a pair of equations of motion for a system of one-dimensional coupled harmonic oscillators of mass and natural frequency. The solution to this problem can be easily found by employing the theoretical approaches delineated in the chapter. However, the problem statement itself contains an implicit puzzle. The text asserts that the coupled equations of motion are derived when a mass is added to both oscillators, which, in turn, are coupled in a certain way that is not specified. In this study, we demonstrate that if the two original harmonic oscillators with added mass are coupled by a spring of force constant given by, the coupled equations of motion of problem 12-3 are obtained. A concise discussion is presented regarding the solutions of Problem 12-3 and an experimental proposal for the implementation of the aforementioned system. The pedagogical implications of the study are discussed.

REVISTA BRASILEIRA DE ENSINO DE FÍSICA 48, e20250448, 2026. DOI: 10.1590/1806-9126-RBEF-2025-0448. Acesso em: **https://doi.org/10.1590/1806-9126-RBEF-2025-0448**

[P023-2026] "Higher-dimensional Euclidean and non-Euclidean structures in planar circuit quantum electrodynamics"

Saa, A; **Miranda, E.*; Rouxinol, F.***

We demonstrate that a recent proposal for simulating planar hyperbolic lattices using circuit quantum electrodynamics can be extended to include higher-dimensional lattices in both Euclidean and non-Euclidean spaces by allowing circuits that involve more than three polygons at each vertex. The quantum dynamics of these circuits, which we are developing with current technology, are governed by effective tight-binding Hamiltonians that correspond to higher-dimensional Kagom é-like structures (such as n-dimensional zeolites). These structures are known for exhibiting strong frustration and flat bands. We analyze the spectra of both hyperbolic and positive-curvature lattices and derive exact expressions for the fraction of flat-band states. Our findings significantly broaden the possibilities for realizing non-Euclidean geometries using circuit quantum electrodynamics, a research direction we are actively pursuing in microwave-guide circuits constructed with sputtered niobium films on silicon substrates.

PHYSICAL REVIEW B 113[3], 035108, 2026. DOI: 10.1103/z2zk-m4c3. Acesso em: **https://doi.org/10.1103/z2zk-m4c3**

[P024-2026] "Impedance based electronic tongue applied for sensory profiling of black tea with sweeteners"

Raj, D. R. K.; Medeiros, A. C. de; Bolini, H. M. A.; Del Valle, M.; Barbon Jr., S.; **Riul Jr., A.*;** Barbin, D. F.

The inherent complexities of sensory analysis necessitate technologies such as electronic tongues to support product development. This study employs an impedimetric electronic tongue to characterize sweetened black tea and evaluate its agreement with human sensory perception. Black tea exhibits a sensory matrix in which bitterness strongly interferes with sucrose perception, complicating panel-based quantification. Consumer testing shows that all sucrose concentrations tested (2.5-12 g/100 mL) fall within the ideal sweetness range for approximately 40 % of assessors. Temporal dominance of sensations (TDS) confirms that bitterness dominates between 4-60 s, delaying sweetness perception until sucrose concentrations reach >= 10 %. Trained panelists identify 7.5 % sucrose as the ideal reference, enabling sucrose-equivalence calculations that reveal marked potency differences among sweeteners (e.g., sucralose 522-fold, neotame 5796-fold more potent than sucrose). The electronic tongue effectively discriminates majority of the sweeteners, with PCA of the optimized sensor configuration explaining 99.98 % of total variance and the bare sensor achieving the highest silhouette value (0.87), indicating clear clustering. Regression models yield high linearity (R-2 > 0.96) and detection limits of 2.00-2.12 g/L for sweetener quantification. While classification accuracy is limited by imbalanced intensity classes (overall accuracy = 58 %), the system reflects the sensory dominance patterns observed in TDS. Overall, the impedimetric electronic tongue provides reproducible, quantitative measurements that complement sensory analysis and offer a cost-efficient tool for evaluating sweeteners in complex, bitterness-dominated beverages.

JOURNAL OF FOOD COMPOSITION AND ANALYSIS 149, 108812, 2026. DOI: 10.1016/j.jfca.2025.108812. Acesso em: **https://doi.org/10.1016/j.jfca.2025.108812**

[P025-2026] In situ or ex situ? Choosing the best path for the synthesis of thermoresponsive ferrogels for remotely triggered controlled release applications"

Jara, D.; Coppola, R.; **Fabris, F.***; Basso, G.; **Muraca, D.***; González, J. S.; Zélis, P. M.; Ybarra, G.; Tancredi, P.

This study presents and compares the preparation, characterization, and performance of three poly(Nisopropylacrylamide)/alginate ferrogels containing magnetic nanoparticles (NPs) incorporated through either in situ or ex situ methods, which are intended to act as nanoheaters capable of triggering the polymer's hydrophilic-hydrophobic transition. The ex situ ferrogels were fabricated with bare or citrate-coated NPs with a crystallite length of 11 nm, a size known to ensure good heating performance under alternating magnetic fields. In contrast, the in situ NPs were smaller, around 8 nm, likely due to the synthesis temperature and the restraints experienced by the precursors within the hydrogel. All three ferrogels showed strong thermoresponsive behavior, expelling over 80 % of water once the polymer transition temperature was reached. Under magnetic heating, ex situ systems displayed rapid temperature rise and fast deswelling, while the in situ system heated more slowly due to its reduced NPs size and lower heating efficiency. Nevertheless, the latter still achieved significant water expulsion, suggesting localized heating effects sufficient to induce the polymer transition without a rapid bulk temperature increase. Overall, both approaches are effective for preparing functional thermoresponsive ferrogels, but each method offers advantages and limitations that should be considered based on the intended application.

POLYMER 345, 129596, 2026. DOI: 10.1016/j.polymer.2026.129596. Acesso em: **https://doi.org/10.1016/j.polymer.2026.129596**

[P026-2026] "Integrating epidemiological evidence and immunodiagnostic development for early diagnosis of Bothrops spp. envenomation in Brazil"

Fonseca, M. F.; Becker-Finco, A.; Prado-Costa, B.; Coelho, G. R.; Weber-Lima, M. M.; **Muzzi, J. C. D.***; Jiacomini, I. G.; Beltramino, M.; Freitas-de-Sousa, L. A.; Clissa, P. B.; Moura, J. F. de; Alvarenga, L. M.

Snakebite envenoming remains a major public health issue in Brazil, with Bothrops genus responsible for most cases. To support public health planning, we analyzed epidemiological data from Parana State and reported, for the first time, a species-level identification of snakes responsible for accidents in this region. The results revealed that Bothrops jararaca accounted for over 85% of cases, followed by Bothrops jararacussu, reinforcing their epidemiological and clinical relevance. Based on this evidence, two monoclonal antibodies were produced by hybridoma technology for application in a diagnostic tool for early identification of Bothrops spp. envenomation. The antibodies were sequenced and immunochemically characterized, and both specifically recognized bothropic metalloproteinases. When applied in a competitive ELISA, the assay detected venom concentrations as low as 60 ng/mL in sera spiked with B. jararaca and Bothrops alternatus and showed no reactivity with other medically relevant genera. Although detection of B. jararacussu, Bothrops moojeni and Bothrops neuwiedi required higher concentrations, these venoms remained detectable, indicating potential for broader application. Further optimization could enhance its sensitivity, enabling more effective detection across a wider spectrum of species. Together, these findings provide novel epidemiological and immunodiagnostic insights, that can guide the development of improved diagnostic platforms for Bothrops spp. envenoming.

TOXICON 274, 109022, 2026. DOI: 10.1016/j.toxicon.2026.109022. Acesso em: **https://doi.org/10.1016/j.toxicon.2026.109022**

[P027-2025] "Interplay of sync and swarm: Theory and application of swarmalators"

Sar, G. K.; O'Keeffe, K.; **Lizárraga, J. U. F.*; Aguiar, M. A. M. de***; Bettstetter, C.; Ghosh, D.

Swarmalators, entities that combine the properties of swarming particles with synchronized oscillations, represent a novel and growing area of research in the study of collective behavior. This review provides a comprehensive overview of the current state of swarmalator research, focusing on the interplay between spatial organization and temporal synchronization. After a brief introduction to synchronization and swarming as separate phenomena, we discuss the various mathematical models that have been developed to describe swarmalator systems, highlighting the key parameters that govern their dynamics. The review also discusses the emergence of complex patterns, such as clustering, phase waves, and synchronized states, and how these patterns are influenced by factors such as interaction range, coupling strength, and frequency distribution. Recently, some minimal models were proposed that are solvable and mimic real-world phenomena. The effect of predators in the swarmalator dynamics is also discussed. Finally, we explore potential applications in fields ranging from robotics to biological systems, where understanding the dual nature of swarming and synchronization could lead to innovative solutions. By synthesizing recent advances and identifying open challenges, this review aims to provide a foundation for future research in this interdisciplinary field.

PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS 1167, p. 1-52, 2026. DOI: 10.1016/j.physrep.2026.01.002. Acesso em: **https://doi.org/10.1016/j.physrep.2026.01.002**

[P028-2026] "Investigating nuclear effects in lepton-ion DIS at the LHC"

Francener, R.*; Gonçalves, V. P.; **Gratieri, D. R.***

Recent studies have demonstrated that the far-forward physics program of the Large Hadron Collider (LHC) can be useful to probe the hadron structure with GeV-TeV neutrinos and muons. In particular, these studies indicate that the measurement of the muon-ion and neutrino-ion cross-sections by the same experiment is feasible. In this paper, we investigate the impact of nuclear effects on the muon-tungsten (mu W) and neutrino-tungsten (nu W) deep inelastic scattering (DIS) events at FASER nu and its proposed upgrade FASER nu 2. We estimate the rates associated with the inclusive cross-sections and for events with a charm tagged in the final state considering different parameterizations for the nuclear parton distribution functions. These results point out that muon and neutrino--induced interactions probe complementary kinematical ranges and that a simultaneous analysis of associated events will allow to test the universality (or not) of the nuclear effects. Moreover, we propose the study of the ratio between the charm tagged and inclusive events in order to discriminate between the distinct modeling of the nuclear effects at small-x. Our results indicate that a future experimental reconstruction of mu W and nu W DIS events at the LHC is a promising way to improve our understanding of nuclear effects and decrease the current uncertainties in parton distribution functions.

JOURNAL OF HIGH ENERGY PHYSICS [1], 149, 2026. DOI: 10.1007/JHEP01(2026)149. Acesso em: **https://doi.org/10.1007/JHEP01(2026)149**

[P029-2026] "Kagome topology in two-dimensional noble--metal monolayers"

Bastos, C. M. O.; Santos, E. J. A. dos; Laranjeira, J. A. dos S.; **Lima, K. A. L.***; Dias, A. C.; **Galvao, D. S.***; Ribeiro Junior, L. A.

Two-dimensional (2D) metallic kagome lattices provide an ideal platform for exploring geometric frustration and lattice stability in elemental systems. Motivated by recent realizations of goldene and kagome goldene, we investigate free-standing kagome monolayers of Cu, Ag, and Au using first-principles calculations and ab initio molecular dynamics. All systems satisfy the 2D Born stability criteria. Phonon calculations show that the unstrained kagome phase is dynamically unstable, while moderate biaxial tensile strain stabilizes Ag and Au. Finite-temperature simulations reveal rapid reconstruction in Cu, metastability in Ag, and competing kagome and trigonal motifs in Au.

CHEMICAL PHYSICS LETTERS 887, 142676, 2026. DOI: 10.1016/j.cplett.2026.142676. Acesso em: **https://doi.org/10.1016/j.cplett.2026.142676**

[P030-2026] "Layered zinc hydroxide-dipeptide hybrid integrated into silk-based 3D scaffolds aiming for biomedical applications"

Eulálio, D.; Figueiredo, M. P.; Silva, S. S.; Rodrigues, L. C.; Fernandes, E. M.; Martins, A.; Franco, A.; Costa, D. S. da; **Landers, R.*; Leroux, F.*; Taviot-Gueho, C.***; Faria, D. L. A. de; Reis, R. L.; Constantino, V. R. L.

Zinc ions and N-acetylcysteine (NAC) are bioactive agents with key physiological roles. When associated with biomacromolecules such as silk fibroin (SF), they offer a promising pathway for advanced biomedical applications. This study reports the synthesis of layered zinc hydroxide (LZH) intercalated with NAC as well as the development of LZH-NAC/SF scaffolds. The synthesis of LZH-NAC was conducted using a constant-pH method, and experimental parameters were controlled to obtain a monophasic LZH. Comprehensive structural, spectroscopic, textural, and thermal characterisation confirmed the successful intercalation of NAC into the LZH. The employed methodology enabled the production of an LZH--NAC nanomaterial with an encapsulation efficiency of approximately 80 % by mass and a loading capacity of around 30 %. To evaluate its biomedical potential, LZH-NAC/SF 3D composite scaffolds were prepared by dispersing LZH-NAC in SF solution, followed by freezing and freeze-drying. The average pore sizes observed in the scaffolds ranged from 75 to 87 mu m, and the swelling capacity was approximately 1700 % after incubation in phosphate-buffered saline (pH 7.4). Cytocompatibility assays revealed that LZH-NAC/SF scaffolds supported cell viability at a zinc concentration of 0.189 mg/mL, similar to that of the SF and NAC/SF scaffolds. These results underscore the potential of LZH-NAC/SF scaffolds as multifunctional biomaterials for the controlled delivery of therapeutic agents, with significant implications for tissue engineering and drug delivery systems.

APPLIED CLAY SCIENCE 281, 108087, 2026. DOI: 10.1016/j.clay.2025.108087. Acesso em: **https://doi.org/10.1016/j.clay.2025.108087**

[P031-2026] "Low-Density InGaAs/AlGaAs Quantum Dots in Droplet-Etched Nanoholes"

Silva, S. F. C. da*; Garcia Jr., A. J.; Aigner, M.; Weidinger, C.; Krieger, T. M.; Undeutsch, G.; **Deneke, C.*;** Bashir, I.; Manna, S.; Peter, M.; Brytavskyi, I.; Aberl, J.; Rastelli, A.

Over the past two decades, epitaxial semiconductor quantum dots (QDs) have demonstrated very promising properties as sources of single and entangled photons on-demand. Among different growth methods, droplet etching epitaxy has allowed the growth of almost strain-free QDs, with low and controllable surface densities, small excitonic fine structure splitting (FSS), and fast radiative decays. Here, we extend the technique to In(Ga)As QDs in AlGaAs, thereby increasing the achievable emission wavelength range beyond that accessible to GaAs/AlGaAs QDs while preserving some of the key advantages of this growth method. We observe QD densities of similar to 0.25 mu m-2, FSS values as small as 3 mu eV, and short radiative lifetimes of similar to 300 ps, while extending the achievable emission wavelength to similar to 900 nm at cryogenic temperatures. We envision these QDs to be particularly suitable for integrated quantum photonics applications.

NANO LETTERS 26[3], p. 953-960, 2026. DOI: 10.1021/acs.nanolett.5c04426. Acesso em: **https://doi.org/10.1021/acs.nanolett.5c04426**

[P032-2026] "Low-noise optomechanical single phonon-photon conversion for quantum networks"

Chen, L.; Korsch, A. R.; **Kersul, C. M.*; Benevides, R.***; Yu, Y.; **Alegre, T. P M.***; Groblacher, S.

Nano-structured optomechanical crystals (OMC) form an interface between mechanical modes with long coherence times and telecom optical photons, ideal for long-distance distribution of quantum information. However, the implementation of scalable quantum networks based on OMCs has been inhibited by thermal mechanical noise. Here, we overcome this limitation using a quasi-two-dimensional OMC and generate single photons via single phonon-photon conversion. In this work, we verify the low thermal noise and high purity of the generated single photons through a Hanbury Brown-Twiss experiment with g (2) (0) = 0.3 5 - 0.08 + 0.10 . We perform Hong-Ou-Mandel interference of the emitted photons showcasing the indistinguishability and coherence with visibility V=0.52±0.15 after 1.43 km fiber delay. Lastly, we use two-photon interference to measure the temporal wavepackets of optomechanically generated single photons demonstrating narrow bandwidths as low as 10 MHz. Our results pave the way for multinode quantum networks of mechanical oscillators and hybrid entanglement generation between mechanical oscillators and telecom quantum emitters.

NATURE COMMUNICATIONS 17[1], 1187, 2026. DOI: 10.1038/s41467-025-67956-2. Acesso em: **https://doi.org/10.1038/s41467-025-67956-2**

[P033-2026] "Magnetism Induced by Azanide and Ammonia Adsorption in Defective Molybdenum Disulfide and Diselenide: A First-Principles Study"

Fabris, G. S. L.*; Ipaves, B.*; Oliveira, R. B.; Gutierrez, H. R.; Pereira Jr., M. L.; **Galvao, D. S.***

Two-dimensional (2D) transition metal dichalcogenides (TMDs) have attracted considerable attention due to their tunable structural, electronic, and spin-related properties, particularly in the presence of point defects and molecular adsorbates. Motivated by these aspects, we have investigated using first-principles methods, the magnetic properties induced by azanide (NH2) and ammonia (NH3) adsorption on defective monolayers of molybdenum disulfide (MoS2) and molybdenum diselenide (MoSe2). Spin-polarized density functional theory (DFT) at the generalized gradient approximation (GGA) level, using the Perdew-Burke-Ernzerhof (PBE) functional, was employed to investigate the impact of mono- and divacancies on the local spin environment and the role of molecular adsorption in modifying magnetic behavior. The results show that pristine chalcogen vacancies do not generate magnetism, whereas the adsorption of NH2 and NH3 creates localized magnetic moments in Mo-based dichalcogenides. A notable case occurs for MoSe2, where NH3 dissociation into NH2 and H fragments on the same side of the surface produces a net magnetic moment of 2.0 mu B. Tests performed on W-based dichalcogenides under equivalent conditions showed no magnetic response and are reported here only for comparison. These findings demonstrate that molecular adsorption combined with defect engineering can be a practical approach to tune magnetism in 2D materials, with potential relevance for spintronic and sensing applications.

ACS OMEGA, 2026. DOI: 10.1021/acsomega.5c10979 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1021/acsomega.5c10979**

[P034-2026] "Magnus force induced magnetic diode effect in skyrmion systems"

Souza, J. C. B.*; Reichhardt, C. J. O.; Reichhardt, C.; Saxena, A.

We show that skyrmions can exhibit a "magnetic diode effect," where there is a nonreciprocal response in the transport when the magnetic field is reversed. This effect can be achieved for skyrmions moving in channels with a sawtooth potential on one side and a reversed sawtooth potential on the other side. We consider the cases of both spin-transfer torque (STT) and spin--orbit torque (SOT). When the magnetic field is held fixed, the velocity response of the skyrmion is the same for current applied in either direction for both torques, so there is no current diode effect. When the magnetic field is reversed, under STT driving the velocity of the skyrmion reverses and its absolute value changes. Under SOT driving, the velocity remains in the same direction but drops to a much lower value, resulting in negative differential conductivity. For a fixed current, we find a nonreciprocal skyrmion velocity as a function of the applied field's sign, in analogy to the velocity-current curves observed in the usual diode effect. The nonreciprocity is generated by the Magnus force, which causes skyrmions to interact preferentially with one side of the channel. Since the channel sides have opposite asymmetry, a positive magnetic field can cause the skyrmion to interact with the "hard" asymmetry side of the channel, while a negative magnetic field causes the skyrmion to interact with the "easy" asymmetry side. This geometry could be used to create new kinds of magnetic-field-induced diode effects that can be harnessed in new types of skyrmion-based devices.

JOURNAL OF APPLIED PHYSICS 139[2], 023902, 2026. DOI: 10.1063/5.0308055. Acesso em: **https://doi.org/10.1063/5.0308055**

[P035-2026] "Measurement of the branching fraction of the Λb0 -- J/ψΛ decay and isospin asymmetry of B -- J/ψK decays"

Aaij, R.; Abdelmotteleb, A. S. W.; **Magalhaes, P. C.*; Lopes, F. C. L.***; et al.
The LHCb collaboration

This paper describes a measurement of the Lambda(0)(b) -> J/psi Lambda branching fraction using data collected with the LHCb experiment in proton-proton collisions from 2016 to 2018. The dataset corresponds to an integrated luminosity of 5.4 fb(-1). The branching fraction is determined relative to that of B-0 -> J/psi K-S(0) decays, B(Lambda(0)(b) -> J/psi Lambda)/(B-0 -> J/psi K-S(0)) = 0.750 +/- 0.005 +/- 0.022 +/- 0.005 +/- 0.062, yielding B(Lambda(0)(b) -> J/psi Lambda) = (3.34 +/- 0.02 +/- 0.10 +/- 0.08 +/- 0.28) x 10(-4), where the first uncertainty is statistical, the second systematic, the third due to external inputs on branching fractions and the fourth due to the ratio of Lambda(0)(b) baryon and B-0 meson hadronisation fractions. In addition, the isospin asymmetry between the rates of B-0 -> J/psi K-S(0) and B+ -> J/psi K+ decays is measured to be A(I) = -0.0135 +/- 0.0004 +/- 0.0133, where the first uncertainty is statistical and the second systematic.

JOURNAL OF HIGH ENERGY PHYSICS [1], 159, 2026. DOI: 10.1007/JHEP01(2026)159. Acesso em: **https://doi.org/10.1007/JHEP01(2026)159**

[P036-2026] "Metabolic reprogramming enhances oxidative stress resistance in differentiating cardiomyocytes"

Novais, L. B.; Rodrigues, B. R. I.; Pereira, F. O. B.; Amaral, A. G.; Lapa, S. C.; **Maldonado, L. L.***; Víctor-Carvalho, P.; Moretto, I. A.; Zamora-Obando, H. R.; Silva, M. C. da; Samogim, A. P.; Brito, I. R. de; Carvalho, M. das G. S.; Campos, A. T. P.; Antunes, M. B. de M. P.; **Cesar, C. L.*;** Carvalho, H. F.; Simionato, A. V. C.; Thomaz, A. A. de; Santos, A. M. dos

Cardiomyocyte differentiation is a complex process involving significant metabolic remodeling, but its impact on cellular redox state and cell damage remains poorly understood. Using metabolomics, biophysical, and biochemical approaches, we characterized, in vitro, the metabolic shift of differentiating cardiomyocytes and its implications for oxidative damage. We found that differentiating cardiomyocytes undergo a broad metabolic reprogramming from a glycolytic to an oxidative state, marked by increased activity in key pathways, including malate--aspartate shuttle, glutathione metabolism, and tricarboxylic acid cycle. This metabolic transition was associated with mitochondrial enlargement and increased reactive oxygen species (ROS) production. Intriguingly, despite ROS increase, differentiated cells maintained similar levels of DNA damage as cardiomyoblasts and were more resistant to a H2O2 challenge. Our findings suggest that metabolic adaptations during cardiomyocyte differentiation enhance their capacity to mitigate oxidative stress damage, providing an adaptive avenue that enables cardiomyocyte survival upon exposure to an oxygen-rich environment.

SCIENTIFIC REPORTS 16[1], 5534, 2026. DOI: 10.1038/s41598-026-35263-5. Acesso em: **https://doi.org/10.1038/s41598-026-35263-5**

[P037-2026] "Modeling the light response of an optically readout GEM based TPC for the CYGNO experiment"

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

The use of gaseous Time Projection Chambers enables the detection and the detailed study of rare events due to particles interactions with the atoms of the gas with energy releases as low as a few keV. Due to this capability, these instruments are being developed for applications in the field of astroparticle physics, such as the study of dark matter and neutrinos. To acquire events occurring in the sensitive volume with a high granularity, the Cygno collaboration is developing a solution where the light generated during the avalanche processes occurring in a multiplication stage based on Gas Electron Multiplier (GEM) is read out by optical sensors with very high sensitivity and spatial resolution. To achieve a high light output, gas gain values of the order of 105-106 are needed. In this working condition, a dependence of the detector response on the spatial density of the charge collected in the GEM holes has been observed, indicating a gain-reduction effect likely caused by space--charge buildup within the multiplication channels. This paper presents data collected with a prototype featuring a sensitive volume of about two liters, together with a model developed by the collaboration to describe and predict the gain dependence on charge density. A comparison with experimental data shows that the model reproduces, with a percent-level precision, the gain behaviour over nearly one order of magnitude.

EUROPEAN PHYSICAL JOURNAL C 86[2], 123, 2026. DOI: 10.1140/epjc/s10052-026-15318-7. Acesso em: **https://doi.org/10.1140/epjc/s10052-026-15318-7**

[P038-2026] "Plasmonic Properties of Icosahedral-Seeded Gold Nanostars"

Prioli, O. L. de C.; Ferrari, D.; Fabris, L.; **Ugarte, D.***; Santos, D. P. dos

Gold nanostars (AuNSs) exhibit rich plasmonic responses that are highly sensitive to the number, orientation, and relative length of their legs. Here, we use the boundary element method to investigate the optical properties of experimentally realistic AuNSs grown from icosahedral seeds. The simulated extinction spectra reveal three main plasmonic resonances: a high-energy, radial-like mode with charge oscillations from the core to the leg tips (mode #1, 700-900 nm), an intermediate mode (mode #2, similar to 1000-1200 nm) that emerges when a shorter leg is present, and a low-energy dipolar mode (mode #3, similar to 1300 nm) dominated by coupling between oppositely oriented legs relative to the core. Charge-density maps show that modes #1 and #2 arise from hybridization between the single-short-leg plasmon and the collective resonance of the legs originated from the same plane of the icosahedral core. Electron energy-loss spectroscopy simulations confirmed the radial-like nature of this collective mode. Near-field calculations show tip-localized SERS enhancement factors up to similar to 108, with modes #2 and #3 producing the strongest hot spots. These results establish structure-property relationships for applications such as ultrasensitive detection of a given analyte.

JOURNAL OF PHYSICAL CHEMISTRY C 130[4], p. 1609-1618, 2026. DOI: 10.1021/acs.jpcc.5c07756. Acesso em: **https://doi.org/10.1021/acs.jpcc.5c07756**

[P039-2026] "Positive unidirectional anisotropy in Y3Fe5O12/Ir20Mn80 bilayers"

Souza, E. C.; **Ribeiro, P. R. T.***; D'azevedo, C. N.; Abrao, J. E.; Machado, F. L. A.; Rezende, S. M.

We report an experimental study of the unidirectional anisotropy in bilayers made of the important ferrimagnetic insulator yttrium iron garnet (YIG) and the room temperature antiferromagnet Ir20Mn80 (IrMn). Measurements of the magnetization hysteresis loop in a wide temperature range and ferromagnetic resonance at room temperature revealed an unconventional positive exchange bias (EB). For comparison, we also made FMR measurements in a Py/IrMn bilayer that led to a negative EB with amplitude nearly two orders of magnitude larger than in YIG/IrMn. The presence of the positive EB, in which the hysteresis loop shift occurs in the direction of the field applied during deposition of the films, is attributed to an antiferromagnetic coupling between the spins of the two layers at the interface. We attribute the small value of the exchange bias field in YIG/IrMn to a competition between different spin couplings at the interface IrMn/YIG produced by the interface roughness.

JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS 638, 173725, 2026. DOI: 10.1016/j.jmmm.2025.173725. Acesso em: **https://doi.org/10.1016/j.jmmm.2025.173725**

[P040-2026] "Quadrene: A novel quasi-2D carbon allotrope with high carrier mobility"

Lima, K. A. L.*; Laranjeira, J. A. dos S.; Cavalcante, N. J. N.; Martins, N. F.; Sambrano, J. R.; **Galvao, D. S.*;** Ribeiro Jr., L. A.

We present a comprehensive first-principles investigation of a novel carbon allotrope characterized by quasi-tetragonal atomic motifs and quasi-two-dimensional structural behavior. Structural analysis reveals an open framework composed of alternating diamond-like and square units, while thermodynamic assessments indicate a negative formation energy, suggesting high intrinsic stability. Phonon spectra confirm dynamical robustness, and ab initio molecular dynamics simulations at 1000 K validate its thermal resilience. Furthermore, the system exhibits an indirect bandgap of 1.58 eV at the HSE06 level, anisotropic mechanical behavior, and a broadband optical response, reinforcing its potential for nanoelectronic and optoelectronic applications. The highly anisotropic mechanical behavior is characterized by an in-plane Young's modulus ranging from 80 to 550 GPa depending on crystallographic direction. Additionally, the electronic transport properties exhibit pronounced anisotropy, with hole mobilities reaching up to 2.1 x 102 cm2/V s and electron mobilities up to 6.40 x 102 cm2/V s along different crystallographic directions, highlighting the material's promise for directionally selective nanoelectronic device applications.

COMPUTATIONAL CONDENSED MATTER 46, e01239, 2026. DOI: 10.1016/j.cocom.2026.e01239. Acesso em: **https://doi.org/10.1016/j.cocom.2026.e01239**

[P041-2026] "Quantum Biochemistry Insights into Ligand Recognition at the a1A-Adrenoceptor"

Gomes, L. T. da C.; **Bezerra, K. S.***; Gavioli, E. C.; Oliveira, J. I. N.; **Galvao, D. S.***; Fulco, U. L.; Dantas Jr., E. da S.

Understanding the molecular basis of ligand recognition at alpha(1A)-adrenoceptor (alpha(1A)-AR) is essential for developing highly selective therapeutic agents. In this study, we applied a quantum biochemistry approach combining density functional theory (DFT) with the molecular fractionation with conjugate caps (MFCC) method to perform a detailed energetic characterization of the interactions between alpha(1A)-AR and three ligands with distinct pharmacological profiles: the endogenous nonselective agonist noradrenaline, the partial and selective alpha(1A)-AR agonist oxymetazoline, and the selective alpha(1A)-AR antagonist tamsulosin. Our calculations of total binding energy accurately reproduced the experimental relative affinity ranking (tamsulosin > oxymetazoline > noradrenaline), supporting the reliability of the MFCC-DFT protocol in modeling receptor-ligand interactions at quantum resolution.A total of 81, 88, and 93 amino acid residues of alpha(1A)-AR interacted with noradrenaline, oxymetazoline, and tamsulosin, respectively. The most energetically relevant residues were located within 4 & Aring;. A comprehensive residue-level analysis revealed that ASP106, VAL107, PHE288,

and PHE312 are key contributors to the total binding energy of all ligands, corroborating evidence from structural and mutagenesis studies. Specifically for oxymetazoline, this ligand contains a tert-butyl group that establishes nonpolar interactions with residues such as VAL185 and ALA189, which are not observed in the noradrenaline-alpha(1A)-AR complex. Additionally, unlike noradrenaline, oxymetazoline exhibits an attractive interaction with MET292 and does not engage in polar interactions with SER188. These differential interaction patterns may contribute to the distinct pharmacological profile of oxymetazoline relative to noradrenaline. Tamsulosin also exhibited a distinct interaction profile compared to agonists noradrenaline and oxymetazoline, interacting with residues located in the extracellular vestibule, including SER83, PHE86, GLU87, TRP102, CYS176, and LYS309. These additional interactions play a pivotal role in stabilizing tamsulosin within the binding pocket, contributing to its high selectivity and antagonistic behavior at the alpha(1A)--AR. Altogether, these findings provide a robust theoretical framework for understanding the molecular determinants of functional selectivity and subtype specificity at alpha(1A)--AR, offering valuable insights for the rational design of new ligands with improved selectivity, efficacy, and safety profiles.

ACS OMEGA, 2026. DOI: 10.1021/acsomega.5c08861 Early Access Date: FEB 2026. Acesso em: **https://doi.org/10.1021/acsomega.5c08861**

[P042-2026] "Radio frequency-induced catalysis using multi--component two-dimensional quasicrystals for effective sulfamethoxazole removal from water"

Manzoor, Z.; Karthik, R.; Ferreira, M. A.; **Galvao, D. S.***; Mukhopadhyay, N. K.; Yadav, T. P.; Dadhwal, P.; Saka, P. C.; Woellner, C. F.; Chowdhury, S.; Tiwary, C. S.

This study presents a novel strategy for removing pharmaceutical pollutants from aqueous media using radio frequency (RF)-assisted catalysis with two-dimensional (2D) AlFeCoNiCu quasicrystals (QCs). The QCs were synthesized via liquid-phase exfoliation of the corresponding bulk alloy and exposed to 35 MHz RF irradiation to assess their catalytic performance. Under these conditions, the 2D QCs achieved 55 % removal of sulfamethoxazole (SMX) within 10 min, nearly double the efficiency of control systems. This performance is attributed to enhanced electrical conductivity, improved RF penetration, and localized surface heating, as confirmed by thermal imaging. In situ transmission electron microscopy and combined density functional theory/molecular dynamics simulations revealed progressive SMX degradation, facilitated by charge transfer from Ni-rich active sites, confirming the catalytic role of the QCs. These findings demonstrate that RF-activated 2D QCs provide a magnetically recoverable, energy-efficient, and scalable platform for pharmaceutical pollutant removal, offering a sustainable solution for next-generation water treatment technologies.

APPLIED CATALYSIS B-ENVIRONMENT AND ENERGY 383, 126062, 2026. DOI: 10.1016/j.apcatb.2025.126062. Acesso em: **https://doi.org/10.1016/j.apcatb.2025.126062**

[P043-2026] "Refractometry with filled antiresonant capillary fibers"

Goncalves Junior, S. F.; **Rosa, L. O.***; Marques, F. A. M.; Cotta, A. A. C.; Tsuchida, J. E.; Fujiwara, E.; **Cordeiro, C. M. B.***; Osorio, J. H.

We demonstrate the realization of refractometric measurements relying on the study of the transmission spectrum of filled capillary fibers. In the method reported herein, the fiber is filled with a material with a lower refractive index than that of the capillary and, due to antiresonant guidance mechanism, a characteristic transmission spectrum alternating high and low attenuation regions is obtained. The refractive index data is hence extracted by analyzing the spectral positions of the fiber transmission bands. While this method holds broad applicability for diverse materials, we specifically applied this technique to characterize the refractive index of agarose gels, due to their interest as a promising optical material. By analyzing the transmission spectra across the 600-900 nm wavelength range, we determined the dispersion trend for agar gels prepared with varying water and glycerol concentrations and estimated their first-order Sellmeier coefficients. The reported refractometric method provides a simple and promising means for characterizing the dispersion properties of a wide range of materials, including gels, solids, and liquids, also opening new possibilities for the development of new refractive index sensing platforms.

MEASUREMENT SCIENCE AND TECHNOLOGY 37[1], 015203, 2026. DOI: 10.1088/1361-6501/ae2981. Acesso em: **https://iopscience.iop.org/article/10.1088/1361-6501/ae2981**

[P044-2026] "Roadmap on quantum thermodynamics"

Campbell, S.; D'Amico, I.; Ciampini, M. A.; **Bonanca, M. V. S.*; Cavalcante, M. F.*;** et al.

The last two decades have seen quantum thermodynamics become a well established field of research in its own right. In that time, it has demonstrated a remarkably broad applicability, ranging from providing foundational advances in the understanding of how thermodynamic principles apply at the nano-scale and in the presence of quantum coherence, to providing a guiding framework for the development of efficient quantum devices. Exquisite levels of control have allowed state-of-the-art experimental platforms to explore energetics and thermodynamics at the smallest scales which has in turn helped to drive theoretical advances. This Roadmap provides an overview of the recent developments across many of the field's sub-disciplines, assessing the key challenges and future prospects, providing a guide for its near term progress.

QUANTUM SCIENCE AND TECHNOLOGY 11[1], 012501, 2026. DOI: 10.1088/2058-9565/ae1e27. Acesso em: **https://iopscience.iop.org/article/10.1088/2058-9565/ae1e27**

[P045-2026] "Skyrmion behavior in attractive-repulsive square array of pinning centers"

Basseto, L.; **Vizarim, N. P.*; Souza, J. C. B.*;** Venegas, P. A.

We investigate the driven dynamics of a single skyrmion in a square lattice of mixed pinning sites, where attractive and repulsive defects coexist using a particle-based model. The mixed landscape yields directional locking at theta sk=-45 degrees and flow at locked angles near the intrinsic skyrmion Hall angle. By mapping defect strengths, we show that weaker attraction lowers the depinning threshold, whereas stronger repulsion stabilizes and broadens the -45 degrees locking plateau. Moreover, combinations of attractive and repulsive defect strengths allows control of directional lockings and their force ranges. Defect size further tunes the response, selecting among -45 degrees, -50 degrees, -55 degrees, and approximate to-59 degrees. These results establish mixed pinning as a practical knob to steer skyrmion trajectories and the effective Hall response, providing design guidelines for skyrmion-based memory and logic devices.

JOURNAL OF PHYSICS-CONDENSED MATTER 38[2], 025803, 2026. DOI: 10.1088/1361-648X/ae35f9. Acesso em: **https://iopscience.iop.org/article/10.1088/1361-648X/ae35f9**

[P046-2026] "Square Fe-TPyP metal-organic framework on Ag(100) showing high/low junction variants and dose-dependent growth"

Barreto, R. R.*; Prior, I. A. S.*; Ferreira, E. B. da C.*; Carreño--Diaz, V.*; Weiler, I. S.*; Thill, A. S.; Bernardi, F.; **Siervo, A. de***

In this study, we report a surface-confined metal-organic networks (SMON) obtained by post-depositing Fe onto a sub-monolayer of 5,10,15,20-tetra(4-pyridyl)porphyrin on Ag(100) and activating at 350 K. Scanning tunneling microscopy (STM) reveals a rectangular/square lattice built from pyridyl-Fe-pyridyl nodes, coexisting with close-packed TPyP domains. Two reproducible junction motifs emerge at identical lattice positions: high-contrast nodes and lower-contrast nodes, consistent with, respectively, an on-top Fe bridge above and below the pyridyl plane, which is stabilized closer to Ag(100). Raising the activation temperature by heat treatment to 400 K, the island density decreases, and the median island size increases. Increasing the Fe dose at 350 K, the islands grow up to similar to 90 molecules per island before a plateau, indicating a crossover from diffusion--limited to site/supply-limited growth. At 450 K, intramolecular metalation proceeds without long-range coordination, resulting in a metalated, but unlinked, monolayer. These observations establish a temperature and dose window for assembling Fe--TPyP SMON on Ag(100) and highlight how substrate registry and coordination chemistry produce distinct junction heights within an otherwise rigid square metric. We report a new motif that appears at 350 K, characterized by an ordered phase resembling a double-lobed linker node that forms extended domains.

SURFACE SCIENCE 766, 122897, 2026. DOI: 10.1016/j.susc.2025.122897. Acesso em: **https://doi.org/10.1016/j.susc.2025.122897**

[P047-2026] "Structural Stability of Sulfur-Depleted MoS2"

Jaques, Y. M.*; Woellner, C. F.; Sassi, L. M.; Pereira Jr., M. L.; Ribeiro Jr., L. A.; Ajayan, P. M.; **Galvao, D. S.***

Transition metal dichalcogenides (TMDs), particularly monolayer MoS2, have received increased attention in materials science and have been exploited in diverse applications, from photonics to catalysis. Defects in TMDs play a crucial role in modulating their properties, and understanding defect-induced dynamics is of great importance. This study investigates the dynamics of sulfur depletion in defective monolayer MoS2, which yields stable MoS monolayers. Various defect sizes, temperature regimes (300-1000 K), and substrate effects were investigated. Through comprehensive classical molecular dynamics (CMD) and ab initio molecular dynamics (AIMD) simulations, we elucidate the dynamics of sulfur vacancy formation in MoS2 lattices. After removal of all sulfur atoms from the top layer, several sulfur atoms from the bottom layer spontaneously migrate to the top layer as a response to increase structural stability, thus creating a MoSx alloy. These findings deepen our understanding of defect dynamics in TMDs, offering valuable insights into the controlled engineering of their properties for nanotechnology applications.

ACS NANOSCIENCE AU, 2026. DOI: 10.1021/acsnanoscienceau.5c00172 Early Access Date: FEB 2026. Acesso em: **https://doi.org/10.1021/acsnanoscienceau.5c00172**

[P048-2026] "Studying metal halide perovskites with synchrotron x-ray techniques"

Silva, A. A. M. C.*; Araujo, B. S.; Ayala, A. P.; Marcal, L. A. B.

Metal halide perovskites generally present functional properties such as ferroelectricity and ferroelasticity, forming nano domains which dictate most of their physical properties. Crystalline changes in the nanoscale, including heat-induced domain rearrangements, are generally responsible for the appearance of structural defects. This is valid for bulk and surface but is especially relevant in nanomaterials, where charge traps lead to degradation in perovskites, reducing the lifetime and compromising their use in solar cells. The growth of oriented nano domains, on the other hand, does not only improve perovskite-based solar cells efficiency and lifetime, but can be potentially used to tailor conductivity and optical emission, opening new possibilities for applications in optoelectronic devices. Studying phase transitions, defect formation and nano domain dynamics in perovskites is challenging, requiring techniques capable of probing crystals with high strain sensitivity and good spatial resolution. In situ and operando experiments, for instance, are difficult to perform using traditional techniques which require severe sample preparation. Recent developments in synchrotron x-ray sources, with the emergence of instruments able to offer small x-ray beams with improved photon flux and coherence, can bring new insights into the field. This review focuses on x-ray methods for the study of perovskite basic properties, enlightening possible multi-technique experiments which are currently available in large scale facilities.

NANOTECHNOLOGY 37[3], 032002, 2026. DOI: 10.1088/1361-6528/ae2d5c. Acesso em: **https://iopscience.iop.org/article/10.1088/1361-6528/ae2d5c**

[P049-2026] "The need for a nonlocal expansion in general relativity"

Galoppo, M.; **Torrieri, G.***

Motivated by known facts about effective field theory and non-Abelian gauge theory, we argue that the post-Newtonian approximation might fail even in the limit of weak fields and small velocities for wide-extended rotating bodies, where angular momentum spans significant spacetime curvature. We construct a novel dimensionless quantity that samples this breakdown, and we evaluate it by means of existing analytical solutions of rotating extended bodies and observational data. We give estimates for galaxies and binary systems, as well as our home in the Cosmos, Laniakea. We thus propose that a novel effective field theory of general relativity might be needed to account for the onset of nonlocal angular momentum effects.

ANNALS OF PHYSICS 484, 170293, 2026. DOI: 10.1016/j.aop.2025.170293. Acesso em: **https://doi.org/10.1016/j.aop.2025.170293**

[P050-2026] "Therapeutic Perspectives of SIRT6 Regulation: Computational Analysis of Activation and Inhibition by Bioactive Molecules"

Matias, É. G. de; **Bezerra, K. S.*;** Clemente Jr., W. S.; Oliveira, J. I. N.; **Galvao, D. S.***; Fulco, U. L.

Sirtuin 6 (SIRT6) is an enzyme belonging to the class of nicotinamide adenine dinucleotide (NAD+) dependent histone deacetylases. It has been of interest due to its multivariate biological role and association with aging-related diseases and metabolic dysfunctions. SIRT6 activation protects against metabolic diseases and aging, and its inhibition is considered a therapy against cancer and inflammation. Here, we explore the modulation of SIRT6 by bioactive molecules, providing a detailed view of the molecular interactions that lead to the activation or inhibition of this protein. Therefore, we investigated the interactions between the ligands quercetin (QUE), isoquercetin (ISO), catechin gallate (CG), and trichostatin A (TSA) with SIRT6, using computational methods from the perspective of molecular modeling through the Molecular Fractionation with Caps Conjugates (MFCC) technique and according to the calculation parameters of Density Functional Theory (DFT). The results revealed the energetic values of each amino acid residue constituting the interaction pocket with the analyzed ligands within a radius of up to 10.0 & Aring;.The analysis of the interaction energies showed an order of priority among the ligands, highlighting CG as the most promising. The observation of the interactions between amino acid residues and ligands identified significant contributions from residues VAL70, PHE64, PHE82, and PHE86.

In addition, residues such as PRO62, MET136, MET157, and VAL115 stand out as key components of the protein active site. These findings offer strategic insights into the molecular mechanisms underlying the binding of the studied ligands to SIRT6, providing a deep understanding of their affinity and pharmacological potential.

JOURNAL OF MOLECULAR RECOGNITION 39[1], e70016, 2026. DOI: 10.1002/jmr.70016. Acesso em: **https://doi.org/10.1002/jmr.70016**

[P051-2026] "Tuning Structure and Performance of 2D/3D Perovskites by Alkyl Chain Length Engineering"

Rodrigues, M. H. de M.; Sobrinho, J. A.; Machado, A. P.; **Brandao, Z. C.*;** Barcelos, I. D.; Labre, C.; Szostak, R.; Nogueira, A. F.

Bulky 2D alkylammonium cations in metal halide perovskites offer a route to improve both structural stability and optoelectronic performance. This study systematically explores the incorporation of alkylammonium iodides with different chain lengths-dodecylammonium (C12), hexadecylammonium (C16), and octadecylammonium (C18)-into perovskite films for solar cells. Using spectroscopic and nanoscale characterization techniques, we show that C12 provides the best results: enhanced [111] orientation, reduced nonradiative recombination, uniform cation distribution, and improved vertical conductivity. Nanoscale X-ray diffraction and AFM-based infrared spectroscopy revealed that intermediate chain lengths enable favorable lattice expansion and interfacial passivation without hindering crystal growth. Solar cells based on C12-modified films reached power conversion efficiencies over 20%, surpassing both pristine and longer-chain formulations. These findings demonstrate that tuning alkyl chain length is an effective molecular design strategy to guide perovskite crystallization and improve device performance and stability.

ACS ENERGY LETTERS, 2026. DOI: 10.1021/acsenergylett.5c02838 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1021/acsenergylett.5c02838**

[P052-2026] "Ultrasensitive MicroRNA Detection Combining Reduced Graphene Oxide Electrolyte-Gated Transistors and Machine Learning"

Deleigo, A. V. F.; Lelis, G. C.; Braunger, M. L.; Casalini, S.; Watanabe, Y.; Schleder, G. R.; Fonseca, W. T.; **Oliveira, R. F. de***

MicroRNAs (miRNAs) are promising biomarkers for disease diagnosis, but conventional detection methods such as reverse transcription polymerase chain reaction (RT-PCR) require complex instrumentation and reagents, limiting their suitability for portable diagnostics. Here, we report an ultrasensitive and selective biosensor that integrates DNA-functionalized reduced graphene oxide (rGO), electrolyte-gated transistors (EGTs), and machine learning (ML) for miRNA detection. The platform targets the miR-34 family (miR-34a, miR-34b, and miR-34c), which is associated with cancer and neurological disorders. The biosensor discriminates perfectly matched from mismatched sequences over a wide dynamic range (0.1-1000 amol L-1) with an ultralow limit of detection of 0.098 amol L-1. ML enables multidimensional analysis of EGT transfer curves and extraction of physically meaningful features from high-dimensional data. This approach advances point-of-care technologies for highly sensitive and selective miRNA detection, with strong potential for portable molecular diagnostics.

SMALL, 2026. DOI: 10.1002/smll.202512199 Early Access Date: JAN 2026. Acesso em: **https://doi.org/10.1002/smll.202512199**

[P053-2026] "Unraveling Mn intercalation and diffusion in NbSe2 bilayers through DFTB simulations"

Ipaves, B.*; Oliveira, R. B. de; **Fabris, G. da S. L.***; Batzill, M.; **Galvao, D. S.***

Understanding transition metal atoms' intercalation and diffusion behavior in two-dimensional (2D) materials is essential for optimizing their performance in emerging applications. In this study, we used density functional tight binding (DFTB) simulations to investigate the atomic-scale mechanisms of manganese (Mn) intercalation into NbSe2 bilayers. Our results show that Mn prefers intercalated and embedded positions rather than surface adsorption, as cohesive energy calculations indicate enhanced stability in these configurations. Nudged elastic band (NEB) calculations revealed an energy barrier of 0.68 eV for the migration of Mn into the interlayer, comparable to other substrates, suggesting accessible diffusion pathways. Molecular dynamics (MD) simulations further demonstrated an intercalation concentration-dependent behavior. Mn atoms initially adsorb on the surface and gradually diffuse inward, resulting in an effective intercalation at higher Mn densities before clustering effects emerge. These results provide helpful insights into the diffusion pathways and stability of Mn atoms within NbSe2 bilayers, consistent with experimental observations and offering a deeper understanding of heteroatom intercalation mechanisms in transition metal dichalcogenides.

PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES 175, 116355, 2026. DOI: 10.1016/j.physe.2025.116355. Acesso em: **https://doi.org/10.1016/j.physe.2025.116355**

[P054-2026] "Unraveling the (1 x 1) and (1 x 2) reconstructed surface structures of SrTiO3(110) single crystal"

Pancotti, A.; Silva, J. J.; Castro, M. S.; **Siervo, A. de*; Landers, R.***; Nascente, P. A. P.

The surface composition and structure of a strontium titanate (1 1 0) single crystal were evaluated by x-ray photoelectron spectroscopy (XPS), low-energy electron diffraction (LEED), and x-ray photoelectron diffraction (XPD). The (1 x 1) and (1 x 2) reconstructions of the SrTiO3 (1 1 0) surface were characterized by XPD. The comparison between the experimental and theoretical XPD results that used multiple-scattering calculation of diffractions (MSCD) simulation combined with the genetic algorithm suggests that (1 x 2) reconstruction comprises a coexistence of 60.0 % TiO4+ and 40.0 % O24- terminations on the (1 x 1) reconstructed SrTiO3 (1 1 0) surface.

APPLIED SURFACE SCIENCE 721, 165401, 2026. DOI: 10.1016/j.apsusc.2025.165401. Acesso em: **https://doi.org/10.1016/j.apsusc.2025.165401**

[P055-2026] "Unveiling single-ion magnetism in lanthanide--coumarin carboxylate coordination polymers"

Hollauer, H. V. P.; Guedes, G. P.; Mariano, D. L.; Ghivelder, L.; **Mendonça, A. A.***; Soriano, S.; Farias, R. L.; Escobar, L. B. L.

Three new coordination polymers, [Ln(3-CCA)3(H2O)2<middle dot>2H2O]n (Ln = Gd (1), Tb (2), Dy (3)), were synthesized through reaction between the above-mentioned lanthanide ions and coumarin-3-carboxylic acid (3-CCA). Single-crystal and powder X-ray diffraction analyses revealed that complex 1 exhibits a nona-coordination, whereas complexes 2 and 3 adopt an octa--coordinated geometry. The chemical composition of the complexes was confirmed by FTIR and CHN analyses, while their phase purity was verified by powder X-ray diffraction. DC magnetic measurements revealed the presence of weak ferromagnetic interactions between the Ln ions in 1. Moreover, the magnetocaloric properties of this compound were investigated and its performance was evaluated using the Temperature-Averaged Entropy Change (TEC) parameter. Additionally, AC magnetic susceptibility measurements revealed field-induced single-ion magnet (SIM) behavior at low temperatures for complexes 2 and 3.

DALTON TRANSACTIONS, 2026. DOI: 10.1039/d5dt02478a. Acesso em: **https://doi.org/10.1039/D5DT02478A**

[P056-2026] "ß-Irida-graphene: A new 2D carbon allotrope for sodium-ion battery anodes"

Laranjeira, J. A. S.; **Lima, K. A. L.***; Martins, N. F.; Ribeiro Junior, L. A.; **Galvao, D. S.***; Cabral, L. A.; Sambrano, J. R.

The quest for sustainable and efficient energy storage has driven the exploration of sodium-ion batteries (SIBs) as promising alternatives to lithium-ion systems. However, the larger ionic radius of sodium poses intrinsic challenges such as slow diffusion and structural strain in conventional electrode materials. As a contribution to addressing these limitations, the beta-Irida-graphene (beta-IG) is herein introduced, a novel two-dimensional (2D) carbon allotrope derived from Irida-graphene, featuring a diverse polygonal lattice of 3-, 4-, 6-, 8-, and 9membered carbon rings. Through density functional theory and ab initio molecular dynamics simulations, beta-IG demonstrated remarkable thermal, dynamical, and mechanical stability, coupled with intrinsic conductive character and efficient sodium-ion mobility (energy barriers < 0.30 eV). Furthermore, the adsorption of sodium ions was energetically favorable, delivering an impressive predicted specific capacity of 554.5 mAh/g. The reported findings highlight beta-IG as a good potential anode candidate for next-generation SIBs, offering high-rate performance and structural robustness, and expanding the functional design space for advanced carbon-based electrode materials.

PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES 177, 116442, 2026. DOI: 10.1016/j.physe.2025.116442. Acesso em: **https://doi.org/10.1016/j.physe.2025.116442**

Material editorial 2026

[E001-2026] "Exploring Light Polarization Using Smartphone Screens and Dielectric Interface Reflectance"

Hammer, D. N.*; Batistel, T. M.*; Cordeiro, C. M. B.*

PHYSICS TEACHER 64[1], p. 40-44, 2026. DOI: 10.1119/5.0204107. Acesso em: **https://doi.org/10.1119/5.0204107**

Livro publicado 2026

[L001-20] "Archimedes, the Center of Gravity and the Law of the Lever"

Assis, A. K. T.*

Apeiron: Montreal, 3ª edição, 2026, 339 páginas, ISBN: 9781987980455. Acesso em: **https://www.ifi.unicamp.br/~assis/Archimedes-3rd-edition.pdf**

Defesas de dissertações do IFGW

[D001-2026] "Heteroestruturas de Nitreto de Boro Hexagonal/Grafite estudadas por Espectroscopia de Catodoluminescência de baixa energia"
Aluno: Victor Feitosa Marques de Oliveira
Orientador: Prof. Dr. Luiz Fernando Zagonel
Data: 03/02/2026

[D002-2026] "Modelos seesaw para massa de neutrinos: uma revisão"
Aluno: Eduardo Walter da Silva
Orientador: Prof. Dr. Pedro Cunha de Holanda
Data: 09/02/2026

[D003-2026] "O mistério da fase de campo magnético alto do CeRnIn5"
Aluno: Nicoly Hembeck Palmeira
Orientador: Prof. Dr. Eduardo Miranda
Data: 23/02/2026

[D004-2026] "Efeitos quânticos em um sistema constituído por uma molécula simples acoplada a uma cavidade toroidal"
Aluno: José Lucas Tagliaférro Bertassoli
Orientador: Prof. Dr. Antonio Vidiella Barranco
Data: 25/02/2026

[D005-2026] "Investigando as origens de raios cósmicos ultraenergéticos com o Observatório Pierre Auger: buscas por anisotropias em grande escala e por correlações com galáxias starburst"
Aluno: Mateus Zeferino Rennó
Orientador: Profa. Dra. Carola Dobrigkeit Chinellato
Data: 26/02/2026

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[T001-2026] "Interações de léptons de GeV à EeV"
Aluno: Reinaldo Francener
Orientador: Prof. Dr. Diego Rossi Gratieri
Data: 04/03/2026

[T002-2026] "Correlações pós-quânticas e suas consequências: De grafos de exclusividade a cenários Prepara-e-Mede"
Aluno: José Nogueira de Castro Neto
Orientador: Prof. Dr. Rafael Luiz da Silva Rabelo
Data: 19/03/2026

***Fonte:** Portal IFGW/Eventos
Acesso em: https://portal.ifi.unicamp.br/a-instituicao/eventos/month.calendar/2025/12/16/-

Abstracta

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