

# Abstracta

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Artigos publicados - P268-2018 à P363-2018

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## Artigos publicados

[P268-2018] “A complete sample of LSP blazars fully described in gamma-rays New gamma-ray detections and associations with Fermi-LAT”

Arsioli, B.\*; Polenta, G.

Context. We study the gamma-ray and broadband spectral energy distribution (SED) properties of a complete sample of 104 bright, radio-selected low-synchrotron peaked (LSP) blazars, which have well-characterized SEDs from radio to X-rays. Most of the sources have already been detected in the gamma-ray band by Fermi-LAT, however almost 20% of these blazars have no counterpart in any of the Fermi catalogs published so far. Aims. Using the Fermi Science Tools, we look for gamma-ray emission for those objects not yet reported in any Fermi-LAT catalog, finding new detections and associations. We then study the multifrequency SED for all sources in our sample, fitting their synchrotron (Syn) and inverse Compton (IC) components. A complete sample of LSP blazars with a full description in gamma-ray is unique. We use this sample to derive the distribution of the Compton dominance (CD) along with population properties such as Syn and IC peak power, and frequency distributions. Methods. We performed a binned likelihood analysis in the 0.3-500 GeV energy band with Fermi-LAT Pass 8 data, integrating over 7.5 yr of observations. We studied gamma-ray light curves and test statistic (TS) maps to validate new detections and associations, thereby building a better picture of the high-energy activity in radio-selected LSP blazars. We fit the IC component for the new detections using all data at our disposal from X-rays to GeV gamma-rays, enhancing the amount of information available to study the Syn to IC peak-power correlations. Results. We deliver a unique characterization in gamma-rays for a complete sample of LSP blazars. We show that three previously unidentified 3FGL sources can be associated with blazars when using improved gamma-ray positions obtained from TS maps. Six previously unreported gamma-ray sources are detected at  $TS > 20$  level, while another three show TS values between 10-20. We evaluate two cases in which source confusion is likely present. In four cases there is no significant gamma-ray signature when integrating over 7.5 yr. Short-lived flares at similar to 1 month scale, however, have been detected in these sources. Finally, we measure the  $\log(CD)$  for the sample, which has a Gaussian-like distribution with median  $\log(CD)$  approximate to 0.1, implying that on average the peak-power for the Syn and IC components in LSP blazars is similar.

ASTRONOMY & ASTROPHYSICS 616, A20, 2018. DOI: 10.1051/0004-6361/201832786

[P269-2018] “A simple model for a minimal environment: the two-atom Tavis-Cummings model revisited”

Decordi, G. L.\*; Vidiella-Barranco, A.\*

Individual quantum systems may be interacting with surrounding environments having a small number of degrees of freedom. Here we discuss a simple toy model: a system constituted by a two-level atom (atom 1) interacting with a single mode cavity field which is (weakly) coupled to a small environment (atom 2). We investigate the influence of the minimal environment on the dynamics of the linear entropy and the atomic dipole squeezing of atom 1, as well as the entanglement between atom 1 and the field. We also obtain the full analytical solution of the two-atom Tavis-Cummings model for both arbitrary coupling strengths and frequency detunings, necessary to analyse the influence of the field-environment detuning on the evolution of the system's quantum properties. For complementarity, we discuss the role of the degree of mixedness of the environment by analysing the time-averaged linear entropy of atom 1.

JOURNAL OF MODERN OPTICS 65[16] 1879-1889, 2018. DOI: 10.1080/09500340.2018.1471172

[P270-2018] “Anisotropic flow of identified particles in Pb-Pb collisions at  $\sqrt{s(NN)}=5.02$  TeV”

Acharya, S.; Acosta, F. T.; Adamova, D.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al. ALICE Collaboration

The elliptic ( $v(2)$ ), triangular ( $v(3)$ ), and quadrangular ( $v(4)$ ) flow coefficients of  $\pi^{+/-}$ ,  $K^{+/-}$ ,  $p$  +  $(p)$  over bar,  $\Lambda$  +  $(\Lambda$ -bda) over bar,  $K_S(0)$ , and the phi-meson are measured in Pb-Pb collisions at  $\sqrt{s(NN)}=5.02$  TeV. Results obtained with the scalar product method are reported for the rapidity range  $|\eta| < 0.5$  as a function of transverse momentum,  $P_T$ , at different collision centrality intervals between 0-70%, including ultra-central (0-1%) collisions for  $\pi^{+/-}$ ,  $K^{+/-}$ , and  $p$  +  $(p)$  over bar. For  $P_T < 3$  GeV/c, the flow coefficients exhibit a particle mass dependence. At intermediate transverse momenta ( $3 < p(T) < 8-10$  GeV/c), particles show an approximate grouping according to their type (i.e., mesons and baryons). The phi-meson  $v(2)$ , which tests both particle mass dependence and type scaling, follows  $p$  +  $(p)$  over bar  $v(2)$  at low  $P_T$  and  $\pi^{+/-} v(2)$  at intermediate  $p(T)$ . The evolution of the shape of  $v(n)$  ( $p(T)$ ) as a function of centrality and harmonic number  $n$  is studied for the various particle species. Flow coefficients of  $\pi^{+/-}$ ,  $K^{+/-}$ , and  $p$  +  $(p)$  over bar for  $p(T) < 3$  GeV/c are compared to iEBE-VISHNU and MUSIC hydrodynamical calculations coupled to a hadronic cascade model (UrQMD). The iEBE-VISHNU calculations describe the results fairly well for  $P_T < 2.5$  GeV/c, while MUSIC calculations reproduce the measurements for  $p(T) < 1$  GeV/c. A comparison to  $v_n$  coefficients measured in Pb-Pb collisions at  $\sqrt{s(NN)}=2.76$  TeV is also provided.

JOURNAL OF HIGH ENERGY PHYSICS 9, 006, 2018. DOI: 10.1007/JHEP09(2018)006

[P271-2018] “Azimuthal correlations for inclusive 2-jet, 3-jet, and 4-jet events in pp collisions at  $\sqrt{s}=13$  TeV”

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

Azimuthal correlations between the two jets with the largest transverse momenta  $p(T)$  in inclusive 2-, 3-, and 4-jet events are presented for several regions of the leading jet  $p(T)$  up to 4 TeV. For 3- and 4-jet scenarios, measurements of the minimum azimuthal angles between any two of the three or four leading  $p(T)$  jets are also presented. The analysis is based on data from proton-proton collisions collected by the CMS Collaboration at a centre-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup>. Calculations based on leading-order matrix elements supplemented with parton showering and hadronization do not fully describe the data, so next-to-leading-order calculations matched with parton shower and hadronization models are needed to better describe the measured distributions. Furthermore, we show that azimuthal jet correlations are sensitive to details of the parton showering, hadronization, and multiparton interactions. A next-to-leading-order calculation matched with parton showers in the MC@NLO method, as implemented in HERWIG 7, gives a better overall description of the measurements than the powheg method.

EUROPEAN PHYSICAL JOURNAL C 78[7] 566, 2018. DOI: 10.1140/epjc/s10052-018-6033-4

[P272-2018] “Baryon content in a sample of 91 galaxy clusters selected by the South Pole Telescope at  $0.2 < z < 1.25$ ”

Chiu, I.; Mohr, J. J.; McDonald, M.; Sobreira, F.\*; et al.

We estimate total mass ( $M_{500}$ ), intracluster medium (ICM) mass ( $M_{\text{ICM}}$ ), and stellar mass ( $M_{\text{star}}$ ) in a Sunyaev-Zel'dovich effect (SZE) selected sample of 91 galaxy clusters with masses  $M_{500}$  greater than or similar to  $2.5 \times 10^{14} M_{\odot}$  and redshift  $0.2 < z < 1.25$  from the 2500 deg<sup>2</sup> South Pole Telescope SPT-SZ survey. The total masses  $M_{500}$  are estimated from the SZE observable, the ICM masses  $M_{\text{ICM}}$  are obtained from the analysis of Chandra X-ray observations, and the stellar masses  $M_{\text{star}}$  are derived by fitting spectral energy distribution templates to Dark Energy Survey griz optical photometry and WISE or Spitzer near-infrared photometry. We study trends in the stellar mass, the ICM mass, the total baryonic mass, and the cold baryonic fraction with cluster halo mass and redshift. We find significant departures from self-similarity in the mass scaling for all quantities, while the redshift trends are all statistically consistent with zero, indicating that the baryon content of clusters at fixed mass has changed remarkably little over the past approximate to 9 Gyr. We compare our results to the mean baryon fraction (and the stellar mass fraction) in the field, finding that these values lie above (below) those in cluster virial regions in all but the most massive clusters at low redshift. Using a simple model of the matter assembly of clusters from infalling groups with lower masses and from infalling material from the low-density environment or field surrounding the parent haloes, we show that the measured mass trends without strong redshift trends in the stellar mass scaling relation could be explained by a mass and redshift dependent fractional contribution from field material. Similar analyses of the ICM and baryon mass scaling relations provide evidence for the so-called 'missing baryons' outside cluster virial regions.

**MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 478[3] 3072-3099, 2018. DOI: 10.1093/mnras/sty1284**

**[P273-2018] "Caffeine and Placebo Improved Maximal Exercise Performance Despite Unchanged Motor Cortex Activation and Greater Prefrontal Cortex Deoxygenation"**

Pires, F. O.; dos Anjos, C. A. S.\*; Covolan, R. J. M.\*; Fontes, E. B.; Noakes, Timothy D.; Gibson, A. St C.; Magalhaes, F. H.; Ugrinowitsch, C.

Caffeine (CAF) is an ergogenic aid used to improve exercise performance. Independent studies have suggested that caffeine may have the ability to increase corticospinal excitability, thereby decreasing the motor cortex activation required to generate a similar motor output. However, CAF has also been suggested to induce a prefrontal cortex (PFC) deoxygenation. Others have suggested that placebo (PLA) may trigger comparable effects to CAF, as independent studies found PLA effects on motor performance, corticospinal excitability, and PFC oxygenation. Thus, we investigated if CAF and CAF-perceived PLA may improve motor performance, despite the likely unchanged MC activation and greater PFC deoxygenation. Nine participants ( $26.4 \pm 4.8$  years old,  $\text{VO}_{2\text{MAX}}$  of  $42.2 \pm 4.6 \text{ mL kg}^{-1} \text{ min}^{-1}$ ) performed three maximal incremental tests (MITs) in control (no supplementation) and similar to 60 min after CAF and PLA ingestion. PFC oxygenation (near-infrared spectroscopy at Fpl position), MC activation (EEG at Cz position) and vastus lateralis and rectus femoris muscle activity (EMG) were measured throughout the tests. Compared to control, CAF and PLA increased rectus femoris muscle EMG ( $P = 0.030$ ;  $F = 2.88$ ;  $d = 0.84$ ) at 100% of the MIT, and enhanced the peak power output ( $P = 0.006$ ;  $F = 12.97$ ;  $d = 1.8$ ) and time to exhaustion ( $P = 0.007$ ;  $F = 12.97$ ;  $d = 1.8$ ). In contrast, CAF and PLA did not change MC activation, but increased the PFC deoxygenation as indicated by the lower  $\text{O}(2)\text{Hb}$  ( $P = 0.001$ ;  $F = 4.68$ ;  $d = 1.08$ ) and THb concentrations ( $P = 0.01$ ;  $F = 1.96$ ;  $d = 0.7$ ) at 80 and 100% the MIT duration. These results showed that CAF and CAF-perceived PLA had the ability to improve motor performance, despite unchanged MC activation and greater PFC deoxygenation. The effectiveness of CAF as ergogenic aid to improve MIT performance was challenged.

**FRONTIERS IN PHYSIOLOGY 9, 1144, 2018. DOI: 10.3389/fphys.2018.01144**

**[P274-2018] "Can the cosmological dark sector be modeled by a single scalar field?"**

Carneiro, S.\*

In a previous paper it was shown that a minimally coupled scalar field of mass can describe both components of the dark sector in a unified way. In the solution found, the dark energy component decays linearly with the Hubble parameter, with a homogeneous creation of dark matter. In the present note we show that a  $\Lambda$ CDM dark sector can also be modeled by such a single field. More generally, we show that the system of Klein-Gordon and Einstein equations admits a uniparametric family of solutions that is equivalent to a non-adiabatic (with zero sound speed) generalised Chaplygin gas.

**GENERAL RELATIVITY AND GRAVITATION 50[9], 114, 2018. DOI: 10.1007/s10714-018-2439-4**

**[P275-2018] "Cognitive Reserve Relates to Functional Network Efficiency in Alzheimer's Disease"**

Weiler, M.\*; Casseb, R. F.\*; de Campos, B. M.; Teixeira, C. V. de L.; Carletti-Cassani, A. F. M.; Vicentini, J. E.; Magalhaes, T. N. C.; de Almeida, D. Q.; Talib, L. L.; Forlenza, O. V.; Balthazar, M. L. F.; Castellano, G.\*

Alzheimer's disease (AD) is the most common form of dementia, with no means of cure or prevention. The presence of abnormal disease-related proteins in the population is, in turn, much more common than the incidence of dementia. In this context, the cognitive reserve (CR) hypothesis has been proposed to explain the discontinuity between pathophysiological and clinical expression of AD, suggesting that CR mitigates the effects of pathology on clinical expression and cognition. fMRI studies of the human connectome have recently reported that AD patients present diminished functional efficiency in resting-state networks, leading to a loss in information flow and cognitive processing. No study has investigated, however, whether CR modifies the effects of the pathology in functional network efficiency in AD patients. We analyzed the relationship between CR, pathophysiology and network efficiency, and whether CR modifies the relationship between them. Fourteen mild AD, 28 amnesic mild cognitive impairment (aMCI) due to AD, and 28 controls were enrolled. We used education to measure CR, cerebrospinal fluid (CSF) biomarkers to evaluate pathophysiology, and graph metrics to measure network efficiency. We found no relationship between CR and CSF biomarkers; CR was related to higher network efficiency in all groups; and abnormal levels of CSF protein biomarkers were related to more efficient networks in the AD group. Education modified the effects of tau-related pathology in the aMCI and mild AD groups. Although higher CR might not protect individuals from developing AD pathophysiology, AD patients with higher CR are better able to cope with the effects of pathology-presenting more efficient networks despite pathology burden. The present study highlights that interventions focusing on cognitive stimulation might be useful to slow age-related cognitive decline or dementia and lengthen healthy aging.

**FRONTIERS IN AGING NEUROSCIENCE 10, 255, 2018. DOI: 10.3389/fnagi.2018.00255**

**[P276-2018] "Constraining Gluon Distributions in Nuclei Using Dijets in Proton-Proton and Proton-Lead Collisions at root s(NN)=5.02 TeV"**

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

The pseudorapidity distributions of dijets as functions of their average transverse momentum ( $p(T)_{ave}$ ) are measured in proton-lead (pPb) and proton-proton (pp) collisions. The data samples were collected by the CMS experiment at the CERN LHC, at a nucleon-nucleon center-of-mass energy of 5.02 TeV. A significant modification of the pPb spectra with respect to the pp spectra is observed in all  $p(T)_{ave}$  intervals investigated. The ratios of the pPb and pp distributions are compared to next-to-leading order perturbative quantum chromodynamics calculations with unbound nucleon and nuclear parton distribution functions (PDFs). These results give the first evidence that the gluon PDF at large Bjorken  $x$  in lead ions is strongly suppressed with respect to the PDF in unbound nucleons.

PHYSICAL REVIEW LETTERS 121[6] 062002, 2018. DOI: 10.1103/PhysRevLett.121.062002

[P277-2018] “Constraints on jet quenching in p-Pb collisions at  $\sqrt{s(NN)}=5.02$  TeV measured by the event-activity dependence of semi-inclusive hadron-jet distributions”

Acharya, S.; Adamova, D.; Adolfsson, J.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al. Collaboration, A. L. I. C. E.

The ALICE Collaboration reports the measurement of semi-inclusive distributions of charged-particle jets recoiling from a high-transverse momentum trigger hadron in p-Pb collisions at  $\sqrt{s(NN)} = 5.02$  TeV. Jets are reconstructed from charged-particle tracks using the anti- $k(T)$  algorithm with resolution parameter  $R = 0.2$  and  $0.4$ . A data-driven statistical approach is used to correct the uncorrelated background jet yield. Recoil jet distributions are reported for jet transverse momentum  $15 < p(T, jet)(ch) < 50$  GeV/c and are compared in various intervals of p-Pb event activity, based on charged-particle multiplicity and zero-degree neutral energy in the forward (Pb-going) direction. The semi-inclusive observable is self-normalized and such comparisons do not require the interpretation of p-Pb event activity in terms of collision geometry, in contrast to inclusive jet observables. These measurements provide new constraints on the magnitude of jet quenching in small systems at the LHC. In p-Pb collisions with high event activity, the average medium-induced out-of-cone energy transport for jets with  $R = 0.4$  and  $15 < p(T, jet)(ch) < 50$  GeV/c is measured to be less than  $0.4$  GeV/c at 90% confidence, which is over an order of magnitude smaller than a similar measurement for central Pb-Pb collisions at  $\sqrt{s(NN)} = 2.76$  TeV. Comparison is made to theoretical calculations of jet quenching in small systems, and to inclusive jet measurements in p-Pb collisions selected by event activity at the LHC and in d-Au collisions at RHIC.

PHYSICS LETTERS B 783, 95-113, 2018. DOI: 10.1016/j.physletb.2018.05.059

[P278-2018] “Constraints on models of scalar and vector leptoquarks decaying to a quark and a neutrino at  $\sqrt{s}=13$  TeV”

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

The results of a previous search by the CMS Collaboration for squarks and gluinos are reinterpreted to constrain models of leptoquark (LQ) production. The search considers jets in association with a transverse momentum imbalance, using the  $M_{T2}$  variable. The analysis uses proton-proton collision data at  $\sqrt{s} = 13$  TeV, recorded with the CMS detector at the LHC in 2016 and corresponding to an integrated luminosity of  $35.9 \text{ fb}^{-1}$ .

Leptoquark pair production is considered with LQ decays to a neutrino and a top, bottom, or light quark. This reinterpretation considers higher mass values than the original CMS search to constrain both scalar and vector LQs. Limits on the cross section for LQ pair production are derived at the 95% confidence level depending on the LQ decay mode. A vector LQ decaying with a 50% branching fraction to  $t \nu$ , and 50% to  $b \tau$ , has been proposed as part of an explanation of anomalous flavor physics results. In such a model, using only the decays to  $t \nu$ , LQ masses below 1530 GeV are excluded assuming the Yang-Mills case with coupling  $\kappa = 1$ , or 1115 GeV in the minimal coupling case  $\kappa = 0$ , placing the most stringent constraint to date from pair production of vector LQs.

PHYSICAL REVIEW D 98[3] 032005, 2018. DOI: 10.1103/PhysRevD.98.032005

[P279-2018] “Controlling the Self-Metalation Rate of Tetraphenylporphyrins on Cu(111) via Cyano Functionalization”

Lepper, M.; Koebl, J.; Zhang, L.; Meusel, M.; Hoelzel, H.; Lungerich, D.; Jux, N.; de Siervo, A.\*; Meyer, B.; Steinrueck, H.; Marbach, H.

The reaction rate of the self-metalation of free-base tetraphenylporphyrins (TPPs) on Cu(111) increases with the number of cyano groups ( $n=0, 1, 2, 4$ ) attached at the para positions of the phenyl rings. The findings are based on isothermal scanning tunneling microscopy (STM) measurements. At room temperature, all investigated free-base TPP derivatives adsorb as individual molecules and are aligned with respect to densely packed Cu substrate rows. Annealing at 400K leads to the formation of linear dimers and/or multimers via CN-Cu-CN bonds, accompanied by self-metalation of the free-base porphyrins following a first-order rate equation. When comparing the non-cyano-functionalized and the tetracyano-functionalized molecules, we find a decrease of the reaction rate by a factor of more than 20, corresponding to an increase of the activation energy from 1.48 to 1.59 eV. Density functional theory (DFT) calculations give insights into the influence of the peripheral electron-withdrawing cyano groups and explain the experimentally observed effects.

ANGEWANDTE CHEMIE-INTERNATIONAL EDITION 57[32] 10074-10079, 2018. DOI: 10.1002/anie.201803601

[P280-2018] “Dark Energy Survey Year 1 results: Cosmological constraints from cosmic shear”

Troxel, M. A.; MacCrann, N.; Zuntz, J.; Sobreira, F.\*; et al. DES Collaboration

We use  $26 \times 10^6$  galaxies from the Dark Energy Survey (DES) Year 1 shape catalogs over  $1321 \text{ deg}^2$  of the sky to produce the most significant measurement of cosmic shear in a galaxy survey to date. We constrain cosmological parameters in both the flat  $\Lambda$ CDM and the  $w$ CDM models, while also varying the neutrino mass density. These results are shown to be robust using two independent shape catalogs, two independent photo- $z$  calibration methods, and two independent analysis pipelines in a blind analysis. We find a 3.5% fractional uncertainty on  $\sigma_8$  ( $\Omega_m/0.3$ ) ( $0.5$ ) =  $0.782(-0.027)(+0.027)$  at 68% C. L., which is a factor of 2.5 improvement over the fractional constraining power of our DES Science Verification results. In  $w$ CDM, we find a 4.8% fractional uncertainty on  $\sigma_8$  ( $\Omega_m/0.3$ ) ( $0.5$ ) =  $0.777(-0.038)(+0.036)$  and a dark energy equation-of-state  $w = -0.95(-0.39)(+0.33)$ . We find results that are consistent with previous cosmic shear constraints in  $\sigma_8$ - $\Omega_m$ , and we see no evidence for disagreement of our weak lensing data with data from the cosmic microwave background.

Finally, we find no evidence preferring a  $\Lambda$ CDM model allowing  $w$  not equal  $-1$ . We expect further significant improvements with subsequent years of DES data, which will more than triple the sky coverage of our shape catalogs and double the effective integrated exposure time per galaxy.

PHYSICAL REVIEW D 98[4], 043528, 2018. DOI: 10.1103/PhysRevD.98.043528

**[P281-2018] “Dark Energy Survey year 1 results: Cosmological constraints from galaxy clustering and weak lensing”**

Abbott, T. M. C.; Abdalla, F. B.; Alarcon, A.; Sobreira, F.\*; et al.  
Dark Energy Survey Collaboration

We present cosmological results from a combined analysis of galaxy clustering and weak gravitational lensing, using 1321 deg<sup>2</sup> of griz imaging data from the first year of the Dark Energy Survey (DES Y1). We combine three two-point functions: (i) the cosmic shear correlation function of 26 million source galaxies in four redshift bins, (ii) the galaxy angular autocorrelation function of 650,000 luminous red galaxies in five redshift bins, and (iii) the galaxy-shear cross-correlation of luminous red galaxy positions and source galaxy shears. To demonstrate the robustness of these results, we use independent pairs of galaxy shape, photometric-redshift estimation and validation, and likelihood analysis pipelines. To prevent confirmation bias, the bulk of the analysis was carried out while “blind” to the true results; we describe an extensive suite of systematics checks performed and passed during this blinded phase. The data are modeled in flat  $\Lambda$ CDM and  $w$ CDM cosmologies, marginalizing over 20 nuisance parameters, varying 6 (for  $\Lambda$ CDM) or 7 (for  $w$ CDM) cosmological parameters including the neutrino mass density and including the 457 x 457 element analytic covariance matrix. We find consistent cosmological results from these three two-point functions and from their combination obtain  $S_8$  equivalent to  $\sigma_8(\Omega_m/0.3)^{0.5} = 0.773(-0.020)(+0.026)$  and  $\Omega_m = 0.267(-0.017)(+0.030)$  for  $\Lambda$ CDM; for  $w$ CDM, we find  $S_8 = 0.782(-0.024)(+0.036)$ ,  $\Omega_m = 0.284(-0.030)(+0.033)$ , and  $w = -0.82(-0.20)(+0.21)$  at 68% C.L. The precision of these DES Y1 constraints rivals that from the Planck cosmic microwave background measurements, allowing a comparison of structure in the very early and late Universe on equal terms. Although the DES Y1 best-fit values for  $S_8$  and  $\Omega_m$  are lower than the central values from Planck for both  $\Lambda$ CDM and  $w$ CDM, the Bayes factor indicates that the DES Y1 and Planck data sets are consistent with each other in the context of  $\Lambda$ CDM. Combining DES Y1 with Planck, baryonic acoustic oscillation measurements from SDSS, 6dF, and BOSS and type Ia supernovae from the Joint Lightcurve Analysis data set, we derive very tight constraints on cosmological parameters:  $S_8 = 0.802 \pm 0.012$  and  $\Omega_m = 0.298 \pm 0.007$  in  $\Lambda$ CDM and  $w = -1.00(-0.04)(+0.05)$  in  $w$ CDM. Upcoming Dark Energy Survey analyses will provide more stringent tests of the  $\Lambda$ CDM model and extensions such as a time-varying equation of state of dark energy or modified gravity.

PHYSICAL REVIEW D 98[4] 043526, 2018. DOI: 10.1103/PhysRevD.98.043526

**[P282-2018] “Dark Energy Survey year 1 results: Galaxy clustering for combined probes”**

Elvin-Poole, J.; Crocce, M.; Ross, A. J.; Sobreira, F.\*; et al.  
DES Collaboration

We measure the clustering of DES year 1 galaxies that are intended to be combined with weak lensing samples in order to produce precise cosmological constraints from the joint analysis of large-scale structure and lensing correlations.

Two-point correlation functions are measured for a sample of  $6.6 \times 10^5$  luminous red galaxies selected using the REDMAGIC algorithm over an area of 1321 square degrees, in the redshift range  $0.15 < z < 0.9$ , split into five tomographic redshift bins. The sample has a mean redshift uncertainty of  $\sigma(z)/(1+z) = 0.017$ . We quantify and correct spurious correlations induced by spatially variable survey properties, testing their impact on the clustering measurements and covariance. We demonstrate the sample’s robustness by testing for stellar contamination, for potential biases that could arise from the systematic correction, and for the consistency between the two-point auto- and cross-correlation functions. We show that the corrections we apply have a significant impact on the resultant measurement of cosmological parameters, but that the results are robust against arbitrary choices in the correction method. We find the linear galaxy bias in each redshift bin in a fiducial cosmology to be  $b(\sigma_8/0.81)_{\text{vertical}}(z=0.24) = 1.40 \pm 0.07$ ,  $b(\sigma_8/0.81)_{\text{vertical}}(z=0.38) = 1.60 \pm 0.05$ ,  $b(\sigma_8/0.81)_{\text{vertical}}(z=0.53) = 1.60 \pm 0.04$  for galaxies with luminosities  $L/L^* > 0.5$ ,  $b(\sigma_8/0.8)_{\text{vertical}}(z=0.68) = 1.93 \pm 0.04$  for  $L/L^* > 1$  and  $b(\sigma_8/0.81)_{\text{vertical}}(z=0.83) = 1.98 \pm 0.07$  for  $L/L^* > 1.5$ , broadly consistent with expectations for the redshift and luminosity dependence of the bias of red galaxies. We show these measurements to be consistent with the linear bias obtained from tangential shear measurements.

PHYSICAL REVIEW D 98[4], 042006, 2018. DOI: 10.1103/PhysRevD.98.042006

**[P283-2018] “Dark Energy Survey year 1 results: Galaxy-galaxy lensing”**

Prat, J.; Sanchez, C.; Fang, Y.; Sobreira, F.\*; et al.  
DES Collaboration

We present galaxy-galaxy lensing measurements from 1321 sq. deg. of the Dark Energy Survey (DES) Year 1 (Y1) data. The lens sample consists of a selection of 660,000 red galaxies with high-precision photometric redshifts, known as redMaGiC, split into five tomographic bins in the redshift range  $0.15 < z < 0.9$ . We use two different source samples, obtained from the METACALIBRATION (26 million galaxies) and IM3SHAPE (18 million galaxies) shear estimation codes, which are split into four photometric redshift bins in the range  $0.2 < z < 1.3$ . We perform extensive testing of potential systematic effects that can bias the galaxy-galaxy lensing signal, including those from shear estimation, photometric redshifts, and observational properties. Covariances are obtained from jackknife subsamples of the data and validated with a suite of log-normal simulations. We use the shear-ratio geometric test to obtain independent constraints on the mean of the source redshift distributions, providing validation of those obtained from other photo- $z$  studies with the same data. We find consistency between the galaxy bias estimates obtained from our galaxy-galaxy lensing measurements and from galaxy clustering, therefore showing the galaxy-matter cross-correlation coefficient  $r$  to be consistent with one, measured over the scales used for the cosmological analysis. The results in this work present one of the three two-point correlation functions, along with galaxy clustering and cosmic shear, used in the DES cosmological analysis of Y1 data, and hence the methodology and the systematics tests presented here provide a critical input for that study as well as for future cosmological analyses in DES and other photometric galaxy surveys.

PHYSICAL REVIEW D 98[4], 042005, 2018. DOI: 10.1103/PhysRevD.98.042005

**[P284-2018] “Dark Energy Survey Year 1 Results: redshift distributions of the weak-lensing source galaxies”**

Hoyle, B.; Gruen, D.; Bernstein, G. M.; Sobreira, F.\*; et al.  
DES Collaboration

We describe the derivation and validation of redshift distribution estimates and their uncertainties for the populations of galaxies used as weak-lensing sources in the Dark Energy Survey (DES) Year 1 cosmological analyses. The Bayesian Photometric Redshift (BPZ) code is used to assign galaxies to four redshift bins between  $z$  approximate to 0.2 and approximate to 1.3, and to produce initial estimates of the lensing-weighted redshift distributions  $n(\text{PZ})(i)(z)$  proportional to  $d(n)(i)/dz$  for members of bin  $i$ . Accurate determination of cosmological parameters depends critically on knowledge of  $n(i)$ , but is insensitive to bin assignments or redshift errors for individual galaxies. The cosmological analyses allow for shifts  $n(i)(z) = n(\text{PZ})(i)(z - \Delta z(i))$  to correct the mean redshift of  $n(i)(z)$  for biases in  $n(\text{PZ})(i)$ . The  $\Delta z(i)$  are constrained by comparison of independently estimated 30-band photometric redshifts of galaxies in the Cosmic Evolution Survey (COSMOS) field to BPZ estimates made from the DES griz fluxes, for a sample matched in fluxes, pre-seeing size, and lensing weight to the DES weak-lensing sources. In companion papers, the  $\Delta z(i)$  of the three lowest redshift bins are further constrained by the angular clustering of the source galaxies around red galaxies with secure photometric redshifts at  $0.15 < z < 0.9$ . This paper details the BPZ and COSMOS procedures, and demonstrates that the cosmological inference is insensitive to details of the  $n(i)(z)$  beyond the choice of  $\Delta z(i)$ . The clustering and COSMOS validation methods produce consistent estimates of  $\Delta z(i)$  in the bins where both can be applied, with combined uncertainties of  $\sigma(i)(\Delta z) = 0.015, 0.013, 0.011, \text{ and } 0.022$  in the four bins. Repeating the photo- $z$  procedure instead using the Directional Neighbourhood Fitting algorithm, or using the  $n(i)(z)$  estimated from the matched sample in COSMOS, yields no discernible difference in cosmological inferences.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY  
478[1], 592-610, 2018. DOI: 10.1093/mnras/sty957

[P285-2018] “Dark Energy Survey Year-1 results: galaxy mock catalogues for BAO”

Avila, S.; Crocce, M.; Ross, A. J.; Sobreira, F.\*; et al.  
Dark Energy Survey Collaboration

Mock catalogues are a crucial tool in the analysis of galaxy surveys data, both for the accurate computation of covariance matrices, and for the optimization of analysis methodology and validation of data sets. In this paper, we present a set of 1800 galaxy mock catalogues designed to match the Dark Energy Survey Year-1 BAO sample (Crocce et al. 2017) in abundance, observational volume, redshift distribution and uncertainty, and redshift-dependent clustering. The simulated samples were built upon HALOGEN (Avila et al. 2015) halo catalogues, based on a 2LPTdensity field with an empirical halo bias. For each of them, a light-cone is constructed by the superposition of snapshots in the redshift range  $0.45 < z < 1.4$ . Uncertainties introduced by so-called photometric redshifts estimators were modelled with a double-skewed-Gaussian curve fitted to the data. We populate haloes with galaxies by introducing a hybrid halo occupation distribution-halo abundance matching model with two free parameters. These are adjusted to achieve a galaxy bias evolution  $b(z(\text{ph}))$  that matches the data at the 1 sigma level in the range  $0.6 < z(\text{ph}) < 1.0$ . We further analyse the galaxy mock catalogues and compare their clustering to the data using the angular correlation function  $w(\theta)$ , the comoving transverse separation clustering  $\xi(\mu < 0.8)(S\text{-perpendicular to})$  and the angular power spectrum  $C_l$ , finding them in agreement. This is the first large set of three-dimensional  $\{RA, Dec., z\}$  galaxy mock catalogues able to simultaneously accurately reproduce the photometric redshift uncertainties and the galaxy clustering.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY  
479[1] 94-110, 2018. DOI: 10.1093/mnras/sty1389

[P286-2018] “Deep SOAR follow-up photometry of two Milky Way outer-halo companions discovered with Dark Energy Survey”

Luque, E.; Santiago, B.; Pieres, A.; Sobreira, F.\*; et al.

We report the discovery of a new star cluster, DES 3, in the constellation of Indus, and deeper observations of the previously identified satellite DES J0222.7-5217 (Eridanus III). DES 3 was detected as a stellar overdensity in first-year Dark Energy Survey data, and confirmed with deeper photometry from the 4.1-m Southern Astrophysical Research (SOAR) telescope. The new system was detected with a relatively high significance and appears in the DES images as a compact concentration of faint blue point sources. We determine that DES 3 is located at a heliocentric distance of similar or equal to 76.2 kpc and it is dominated by an old (similar or equal to 9.8Gyr) and metal-poor ( $[Fe/H]$  similar or equal to -1.84) population. While the age and metallicity values of DES 3 are comparable to typical globular clusters (objects with a high stellar density, stellar mass of similar to  $10(5)$  M-circle dot and luminosity M-V similar to -7.3), its half-light radius ( $r(h)$  similar to 6.87 pc) and luminosity (M-V similar to -1.7) are more indicative of faint star cluster. Based on the angular size, DES 3, with a value of  $r(h)$  similar to 0.'31, is among the smallest faint star clusters known to date. Furthermore, using deeper imaging of DES J0222.7-5217 taken with the SOAR telescope, we update structural parameters and perform the first isochrone modelling. Our analysis yields the first age (similar or equal to 12.6Gyr) and metallicity ( $[Fe/H]$  similar or equal to -2.01) estimates for this object. The half-light radius ( $r(h)$  similar or equal to 11.24 pc) and luminosity (M-V similar or equal to -2.4) of DES J0222.7-5217 suggest that it is likely a faint star cluster. The discovery of DES 3 indicates that the census of stellar systems in the Milky Way is still far from complete, and demonstrates the power of modern wide-field imaging surveys to improve our knowledge of the Galaxy's satellite population.

MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY  
478[2], 2006-2018, 2018. DOI: 10.1093/mnras/sty1039

[P287-2018] “Density split statistics: Cosmological constraints from counts and lensing in cells in DES Y1 and SDSS data”

Gruen, D.; Friedrich, O.; Krause, E.; Sobreira, F.\*; et al.  
DES Collaboration

We derive cosmological constraints from the probability distribution function (PDF) of evolved large-scale matter density fluctuations. We do this by splitting lines of sight by density based on their count of tracer galaxies, and by measuring both gravitational shear around and counts-in-cells in overdense and underdense lines of sight, in Dark Energy Survey (DES) First Year and Sloan Digital Sky Survey (SDSS) data. Our analysis uses a perturbation theory model [O. Friedrich et al., Phys. Rev. D 98, 023508 (2018)] and is validated using N-body simulation realizations and log-normal mocks. It allows us to constrain cosmology, bias and stochasticity of galaxies with respect to matter density and, in addition, the skewness of the matter density field. From a Bayesian model comparison, we find that the data weakly prefer a connection of galaxies and matter that is stochastic beyond Poisson fluctuations on  $\leq 20$  arcmin angular smoothing scale. The two stochasticity models we fit yield DES constraints on the matter density  $\Omega(m) = 0.26(-0.04)(+0.05)$  and  $\Omega(m) = 0.28(-0.03)(+0.04)$  that are consistent with each other. These values also agree with the DES analysis of galaxy and shear two-point functions (3x2pt, DES Collaboration et al.) that only uses second moments of the PDF. Constraints on  $s_8$  are model dependent ( $\sigma(8) = 0.97(-0.06)(+0.07)$  and  $0.80(-0.07)(+0.06)$  for the two stochasticity models), but consistent with each other and with the 3 x 2pt results if stochasticity is at the low end of the posterior range. As an additional test of gravity, counts and lensing in cells allow to compare the skewness S-3 of the matter density PDF to its Lambda CDM prediction.

We find no evidence of excess skewness in any model or data set, with better than 25 per cent relative precision in the skewness estimate from DES alone.

**PHYSICAL REVIEW D 98[2], 023507, 2018. DOI: 10.1103/PhysRevD.98.023507**

**[P288-2018] “Density split statistics: Joint model of counts and lensing in cells”**

Friedrich, O.; Gruen, D.; DeRose, J.; **Sobreira, F.\***; et al.  
DES Collaboration

We present density split statistics, a framework that studies lensing and counts-in-cells as a function of foreground galaxy density, thereby providing a large-scale measurement of both 2-point and 3-point statistics. Our method extends our earlier work on trough lensing and is summarized as follows: given a foreground (low redshift) population of galaxies, we divide the sky into subareas of equal size but distinct galaxy density. We then measure lensing around uniformly spaced points separately in each of these subareas, as well as counts-in-cells statistics (CiC). The lensing signals trace the matter density contrast around regions of fixed galaxy density. Through the CiC measurements this can be related to the density profile around regions of fixed matter density. Together, these measurements constitute a powerful probe of cosmology, the skewness of the density field and the connection of galaxies and matter. In this paper we show how to model both the density split lensing signal and CiC from basic ingredients: a non-linear power spectrum, clustering hierarchy coefficients from perturbation theory and a parametric model for galaxy bias and shot-noise. Using N-body simulations, we demonstrate that this model is sufficiently accurate for a cosmological analysis on year 1 data from the Dark Energy Survey.

**PHYSICAL REVIEW D 98[2], 023508, 2018. DOI: 10.1103/PhysRevD.98.023508**

**[P289-2018] “DES meets Gaia: discovery of strongly lensed quasars from a multiplet search”**

Agello, A.; Lin, H.; Kuropatkin, N.; **Sobreira, F.\***; et al.

We report the discovery, spectroscopic confirmation, and first lens models of the first, strongly lensed quasars from a combined search in WISE and Gaia-DR1 over the DES footprint. Their Einstein radii span a range between approximate to 2.0 arcsec and approximate to 0.4 arcsec. Two of these (WGD2038-4008, RA = 20: 38: 02.65, Dec. = -40: 08: 14.64; WGD2021-4115, RA = 20: 21: 39.45, Dec. = -41:15:57.11) also have confirmed deflector redshifts. The four-image lens WGD2038-4008, with source and deflector redshifts  $s = 0.777 \pm 0.001$  and  $z(l) = 0.230 \pm 0.002$ , respectively, has a deflector with radius  $R_{\text{eff}}$  approximate to 3.4 arcsec, stellar mass  $\log(M_{\text{star}}/M_{\odot}) = 11.64(-0.43)$  (+ 0.20), and extended isophotal shape variation. Simple lens models yield Einstein radii  $R_E = (1.30 \pm 0.04)$  arcsec, axis ratio  $q = 0.75 \pm 0.1$  (compatible with that of the starlight) and considerable shear-ellipticity degeneracies. The two-image lens WGD2021-4115 has  $z(s) = 1.390 \pm 0.001$  and  $z(l) = 0.335 \pm 0.002$ , and Einstein radius  $R_E = (1.1 \pm 0.1)$  arcsec, but higher-resolution imaging is needed to accurately separate the deflector and faint quasar image. Analogous lens model degeneracies hold for the other six lenses (J0146-1133, J0150-4041, J0235-2433, J0245-0556, J0259-2338, and J0508-2748) shown in this paper.

**MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 479[4], 4345-4354, 2018. DOI: 10.1093/mnras/sty1419**

**[P290-2018] “DES science portal: Creating science-ready catalogs”**

Fausti Neto, A.; da Costa, L. N.; Carnero, A.; **Sobreira, F.\***; et al.

We present a novel approach for creating science-ready catalogs through a software infrastructure developed for the Dark Energy Survey (DES). We integrate the data products released by the DES Data Management and additional products created by the DES collaboration in an environment known as DES Science Portal. Each step involved in the creation of a science-ready catalog is recorded in a relational database and can be recovered at any time. We describe how the DES Science Portal automates the creation and characterization of lightweight catalogs for DES Year 1 Annual Release, and show its flexibility in creating multiple catalogs with different inputs and configurations. Finally, we discuss the advantages of this infrastructure for large surveys such as DES and the Large Synoptic Survey Telescope. The capability of creating science-ready catalogs efficiently and with full control of the inputs and configurations used is an important asset for supporting science analysis using data from large astronomical surveys.

**ASTRONOMY AND COMPUTING 24, 52-69, 2018. DOI: 10.1016/j.ascom.2018.01.002**

**[P291-2018] “Direct measurement of the composite Goos-Hanchen shift of an optical beam”**

Santana, O. J. S.\*; de Araujo, L. E. E.\*

We experimentally study the Goos-Hanchen shift of a focused Gaussian optical beam in the critical region of incidence. We directly measure the beam's shift evaluated from the displacement of the location of the beam's intensity peak and its centroid by a novel image analysis method. We verify that the evaluation method has a dramatic impact on the physics of beam shift phenomena. The influence of wave-length, beam waist, and propagation distance on the beam shift is studied. Our experimental results confirm recent theoretical predictions about the composite Goos-Hanchen shift, including the observation of negative shifts of the beam's intensity peak.

**OPTICS LETTERS 43[16], 4037-4040, 2018. DOI: 10.1364/OL.43.004037**

**[P292-2018] “Discovery and Dynamical Analysis of an Extreme Trans-Neptunian Object with a High Orbital Inclination”**

Becker, J. C.; Khain, T.; Hamilton, S. J.; **Sobreira, F.\***; et al.

We report the discovery and dynamical analysis of 2015 BP519, an extreme trans-Neptunian object (TNO) detected by the Dark Energy Survey at a heliocentric distance of 55 au, perihelion of similar to 36 au, and absolute magnitude  $H-r = 4.3$ . The current orbit, determined from a 1110 day observational arc, has a semimajor axis  $a$  approximate to 450 au, eccentricity  $e$  approximate to 0.92, and inclination  $i$  54 degrees. With these orbital elements, 2015 BP519 is the most extreme TNO discovered to date, as quantified by the reduced Kozai action,  $\eta(0) = (1 - e(2))^{1/2} \cos i$ , which is a conserved quantity at fixed semimajor axis  $a$  for axisymmetric perturbations. We discuss the orbital stability and evolution of this object and find that, under the influence of the four known giant planets, 2015 BP519 displays rich dynamical behavior, including rapid diffusion in semimajor axis and more constrained variations in eccentricity and inclination. We also consider the long-term orbital stability and evolutionary behavior within the context of the Planet Nine hypothesis and find that 2015 BP519 adds to the circumstantial evidence for the existence of this proposed new member of the solar system, as it would represent the first member of the population of high- $i$ ,  $(\mu)$  over bar -shepherded TNOs.

**ASTRONOMICAL JOURNAL 156[2], 81, 2018. DOI: 10.3847/1538-3881/aad042**

**[P293-2018] “Dissecting the region around IceCube-170922A: the blazar TXS 0506+056 as the first cosmic neutrino source”**

Padovani, P.; Giommi, P.; Resconi, E.; Glauch, T.; Arsioli, B.\*; Sahakyan, N.; Huber, M.

We present the dissection in space, time, and energy of the region around the IceCube-170922A neutrino alert. This study is motivated by: (1) the first association between a neutrino alert and a blazar in a flaring state, TXS 0506+ 056; (2) the evidence of a neutrino flaring activity during 2014-2015 from the same direction; (3) the lack of an accompanying simultaneous gamma-ray enhancement from the same counterpart; (4) the contrasting flaring activity of a neighbouring bright gamma-ray source, the blazar PKS 0502+ 049, during 2014-2015. Our study makes use of multiwavelength archival data accessed through Open Universe tools and includes a new analysis of Fermi-LAT data. We find that PKS 0502+ 049 contaminates the gamma-ray emission region at low energies but TXS 0506+ 056 dominates the sky above a few GeV. TXS 0506+ 056, which is a very strong (top percent) radio and gamma-ray source, is in a high gamma-ray state during the neutrino alert but in a low though hard gamma-ray state in coincidence with the neutrino flare. Both states can be reconciled with the energy associated with the neutrino emission and, in particular during the low/hard state, there is evidence that TXS 0506+ 056 has undergone a hadronic flare with very important implications for blazar modelling. All multimessenger diagnostics reported here support a single coherent picture in which TXS 0506+ 056, a very high energy gamma-ray blazar, is the only counterpart of all the neutrino emissions in the region and therefore the most plausible first non-stellar neutrino and, hence, cosmic ray source.

**MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 480[1], 192-203, 2018. DOI: 10.1093/mnras/sty1852**

**[P294-2018] “DUNE sensitivities to the mixing between sterile and tau neutrinos”**

Coloma, P.; Forero, D. V.\*; Parke, S. J.

Light sterile neutrinos can be probed in a number of ways, including electroweak decays, cosmology and neutrino oscillation experiments. At long-baseline experiments, the neutral-current data is directly sensitive to the presence of light sterile neutrinos: once the active neutrinos have oscillated into a sterile state, a depletion in the neutral-current data sample is expected since they do not interact with the Z boson. This channel offers a direct avenue to probe the mixing between a sterile neutrino and the tau neutrino, which is currently only weakly constrained by current data from SuperK, IceCube and NOvA, however, these constraints will continue to improve as more data is collected by these experiments. In this work, we study the potential of the DUNE experiment to constrain the mixing angle which parametrizes this mixing,  $\theta_{13}$ , through the observation of neutral-current events at the far detector. We find that DUNE will be able to improve significantly over current constraints thanks to its large statistics and excellent discrimination between neutral- and charged-current events.

**JOURNAL OF HIGH ENERGY PHYSICS 7, 079, 2018. DOI: 10.1007/JHEP07(2018)079**

**[P295-2018] “Electroluminescence pulse shape and electron diffusion in liquid argon measured in a dual-phase TPC”**

Agnes, P.; Albuquerque, I. F. M.; Alexander, T.; Machado, A.\*; Segreto, E.\*; et al.

We report the measurement of the longitudinal diffusion constant in liquid argon with the DarkSide-50 dual-phase time projection chamber.

The measurement is performed at drift electric fields of 100 V/cm, 150 V/cm, and 200 V/cm using high statistics Ar-39 decays from atmospheric argon. We derive an expression to describe the pulse shape of the electroluminescence signal (S2) in dual-phase TPCs. The derived S2 pulse shape is fit to events from the uppermost portion of the TPC in order to characterize the radial dependence of the signal. The results are provided as inputs to the measurement of the longitudinal diffusion constant D-L, which we find to be  $(4.12 \pm 0.09)$  cm<sup>2</sup>/s for a selection of 140 keV electron recoil events in 200 V/cm drift field and 2.8 kV/cm extraction field. To study the systematics of our measurement we examine data sets of varying event energy, field strength, and detector volume yielding a weighted average value for the diffusion constant of  $(4.09 \pm 0.12)$  cm<sup>2</sup>/s. The measured longitudinal diffusion constant is observed to have an energy dependence, and within the studied energy range the result is systematically lower than other results in the literature.

**NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 904, 23-34, 2018. DOI:10.1016/j.nima.2018.06.077**

**[P296-2018] “Electromagnetic Propagation in a Relativistic Electron Gas at Finite Temperatures”**

Reis, D. M.; Reyes-Gomez, E.; Oliveira, L. E.\*; de Carvalho, C. A. A.

The electromagnetic propagation in a relativistic electron gas at finite temperatures and carrier densities is described. Using quantum electrodynamics at finite temperatures, electric and magnetic responses and general constitutive relations are obtained. Rewriting the propagator for the electromagnetic field in terms of the electric and magnetic responses, the modes that propagate in the gas are identified. As expected, the usual collective excitations are obtained, i.e., a longitudinal electric and two transverse magnetic plasmonic modes. In addition, a purely photonic mode is found, which satisfies the wave equation in vacuum, for which the electron gas is transparent. Dispersion relations for the plasmon modes at zero and finite temperatures are presented and the intervals of frequency and wavenumber where both electric and magnetic responses are simultaneously negative are identified, a behavior previously thought not to occur in natural systems. The investigation of the electromagnetic responses of a relativistic electron gas shows that, apart from the usual longitudinal electric plasmon mode and the two transverse magnetic plasmon modes, there is also a pure photonic mode that propagates with the speed of light, as if the medium were transparent. Furthermore, there is a region of frequencies and wavenumbers of the external fields where both the longitudinal electric permittivity and magnetic permeability are simultaneously negative, a property found in artificially constructed metamaterials.

**ANNALEN DER PHYSIK 530[7] 1700443, 2018. DOI: 10.1002/andp.201700443**

**[P297-2018] “Electroweak production of two jets in association with a Z boson in proton-proton collisions root s = 13 TeV”**

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

A measurement of the electroweak (EW) production of two jets in association with a Z boson in proton-proton collisions at root s = 13 TeV is presented, based on data recorded in 2016 by the CMS experiment at the LHC corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup>. The measurement is performed in the lljj final state with l including electrons and muons, and the jets j corresponding to the quarks produced in the hard interaction.



The measured cross section in a kinematic region defined by invariant masses  $m(\ell\ell) > 50$  GeV,  $m(jj) > 120$  GeV, and transverse momenta  $P_{Tj} > 25$  GeV is  $\sigma(\text{EW})(\ell jj) = 534 \pm 20$  (stat) fb (syst) fb, in agreement with leading-order standard model predictions. The final state is also used to perform a search for anomalous trilinear gauge couplings. No evidence is found and limits on anomalous trilinear gauge couplings associated with dimension-six operators are given in the framework of an effective field theory. The corresponding 95% confidence level intervals are  $-2.6 < c_{\text{www}}/\Lambda^2 < 2.6$  TeV<sup>-2</sup> and  $-8.4 < c_w/\Lambda^2 < 10.1$  TeV<sup>-2</sup>. The additional jet activity of events in a signal-enriched region is also studied, and the measurements are in agreement with predictions.

EUROPEAN PHYSICAL JOURNAL C 78[7], 589, 2018. DOI: 10.1140/epjc/s10052-018-6049-9

**[P298-2018] “Elliptic Flow of Charm and Strange Hadrons in High-Multiplicity p plus Pb Collisions at  $\sqrt{s(\text{NN})} = 8.16$  TeV”**

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

The elliptic azimuthal anisotropy coefficient ( $v_2$ ) is measured for charm ( $D^0$ ) and strange ( $K_S^0$ ,  $\Lambda$ ,  $\Xi^-$ , and  $\Omega^-$ ) hadrons, using a data sample of p + Pb collisions collected by the CMS experiment, at a nucleon-nucleon center-of-mass energy of  $\sqrt{s(\text{NN})} = 8.16$  TeV. A significant positive  $v_2$  signal from long-range azimuthal correlations is observed for all particle species in high-multiplicity p + Pb collisions. The measurement represents the first observation of possible long-range collectivity for open heavy flavor hadrons in small systems. The results suggest that charm quarks have a smaller  $v_2$  than the lighter quarks, probably reflecting a weaker collective behavior. This effect is not seen in the larger PbPb collision system at  $\sqrt{s(\text{NN})} = 5.02$  TeV, also presented.

PHYSICAL REVIEW LETTERS 121[8] 082301, 2018. DOI: 10.1103/PhysRevLett.121.082301

**[P299-2018] “Energy dependence and fluctuations of anisotropic flow in Pb-Pb collisions at  $\sqrt{s(\text{NN})} = 5.02$  and  $2.76$  TeV”**

Acharya, S.; Acosta, F. T.; Adamova, D.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

Measurements of anisotropic flow coefficients with two- and multi-particle cumulants for inclusive charged particles in Pb{Pb collisions at  $\sqrt{s(\text{NN})} = 5.02$  and  $2.76$  TeV are reported in the pseudorapidity range  $|\eta| < 0.8$  and transverse momentum  $0.2 < p_T < 50$  GeV/c. The full data sample collected by the ALICE detector in 2015 (2010), corresponding to an integrated luminosity of  $12.7$  ( $2.0$ )  $\mu\text{b}^{-1}$  in the centrality range  $0\%$ – $80\%$ , is analysed. Flow coefficients up to the sixth flow harmonic ( $v_6$ ) are reported and a detailed comparison among results at the two energies is carried out. The  $p_T$  dependence of anisotropic flow coefficients and its evolution with respect to centrality and harmonic number  $n$  are investigated. An approximate power-law scaling of the form  $v_n(p_T) \sim p_T/n$  is observed for all flow harmonics at low  $p_T$  ( $0.2 < p_T < 3$  GeV/c). At the same time, the ratios  $v_n(p_T)/v_n(m)$  are observed to be essentially independent of  $p_T$  for most centralities up to about  $p_T = 10$  GeV/c. Analysing the differences among higher-order cumulants of elliptic flow ( $v_2$ ), which have different sensitivities to flow fluctuations, a measurement of the standardised skewness of the event-by-event  $v_2$  distribution  $P(v_2)$  is reported and constraints on its higher moments are provided.

The Elliptic Power distribution is used to parametrise  $P(v_2)$ , extracting its parameters from fits to cumulants. The measurements are compared to different model predictions in order to discriminate among initial-state models and to constrain the temperature dependence of the shear viscosity to entropy-density ratio.

JOURNAL OF HIGH ENERGY PHYSICS 7, 103, 2018. DOI: 10.1007/JHEP07(2018)103

**[P300-2018] “eta’ production in nucleus-nucleus collisions as a probe of chiral dynamics”**

Torrieri, G.\*

I argue that, because of the peculiar properties of the eta’ meson, it is a promising probe of chiral dynamics. In particular, I show that a rotating gluon-dominated plasma might lead to an enhanced production of eta’ with respect to statistical model expectations. The presence of a strong topological susceptibility might give a similar effect. In both cases, unlike the statistical model, I expect a nontrivial dependence on event geometry, such as initial volume and impact parameter. Hence, an observation of eta’/pi ratio depending strongly on impact parameter might be a good indication of chiral effects, either from vorticity or topological phases of QCD.

PHYSICAL REVIEW C 98[1] 014901, 2018. DOI: 10.1103/PhysRevC.98.014901

**[P301-2018] “Evidence for associated production of a Higgs boson with a top quark pair in final states with electrons, muons, and hadronically decaying tau leptons at  $\sqrt{s} = 13$  TeV”**

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

Results of a search for the standard model Higgs boson produced in association with a top quark pair ( $t\bar{t}$ ) in final states with electrons, muons, and hadronically decaying tau leptons are presented. The analyzed data set corresponds to an integrated luminosity of  $35.9$  fb<sup>-1</sup> recorded in proton-proton collisions at  $\sqrt{s} = 13$  TeV by the CMS experiment in 2016. The sensitivity of the search is improved by using matrix element and machine learning methods to separate the signal from backgrounds. The measured signal rate amounts to  $1.23(-0.43)(+0.45)$  times the production rate expected in the standard model, with an observed (expected) significance of  $3.2$  ( $2.8$ )  $\sigma$ , which represents evidence for  $t\bar{t}$  production in those final states. An upper limit on the signal rate of  $2.1$  times the standard model production rate is set at 95% confidence level.

JOURNAL OF HIGH ENERGY PHYSICS 8, 066, 2018. DOI: 10.1007/JHEP08(2018)066

**[P302-2018] “Exfoliation of a non-van der Waals material from iron ore hematite”**

Balan, A. P.; Radhakrishnan, S.; Woellner, C. F.\*; Sinha, S. K.; Deng, L.; de los Reyes, C.; Rao, B. M.; Paulose, M.; Neupane, R.; Apte, A.; Kochat, V.; Vajtai, R.; Harutyunyan, A. R.; Chu, Ching-Wu; Costin, G.; Galvao, D. S.\*; Marti, A. A.; van Aken, P. A.; Varghese, O. K.; Tiwary, C. S.; Iyer, A. M. M. R.; Ajayan, P. M.

With the advent of graphene, the most studied of all two-dimensional materials, many inorganic analogues have been synthesized and are being exploited for novel applications.

Several approaches have been used to obtain large-grain, high-quality materials. Naturally occurring ores, for example, are the best precursors for obtaining highly ordered and large-grain atomic layers by exfoliation. Here, we demonstrate a new two-dimensional material 'hematene' obtained from natural iron ore hematite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>), which is isolated by means of liquid exfoliation. The two-dimensional morphology of hematene is confirmed by transmission electron microscopy. Magnetic measurements together with density functional theory calculations confirm the ferromagnetic order in hematene while its parent form exhibits antiferromagnetic order. When loaded on titania nanotube arrays, hematene exhibits enhanced visible light photocatalytic activity. Our study indicates that photogenerated electrons can be transferred from hematene to titania despite a band alignment unfavourable for charge transfer.

**NATURE NANOTECHNOLOGY 13[7] 602-609, 2018. DOI: 10.1038/s41565-018-0134-y**

**[P303-2018] "Exploring six modes of an optical parametric oscillator"**

Munoz-Martinez, L. F.; Barbosa, F. A. S.\*; Coelho, A. S.; Ortiz-Gutierrez, L.; Martinelli, M.; Nussenzveig, P.; Villar, A. S.

We measure the complete quantum state for six modes of the electromagnetic field produced by an optical parametric oscillator. The investigation involves the sidebands of the intense pump, signal, and idler fields generated by stimulated parametric down-conversion inside a triply resonant optical resonator. We develop a theoretical model to successfully interpret the experimental results. The model takes into account the coupling of the field modes to the phonon bath of the nonlinear crystal, clearly showing the roles of different physical effects in shaping the structure of the quantum correlations between the six optical modes.

**PHYSICAL REVIEW A 98[2] 023823, 2018. DOI: 10.1103/PhysRevA.98.023823**

**[P304-2018] "First-order structural transition and pressure-induced lattice/phonon anomalies in Sr<sub>2</sub>IrO<sub>4</sub>"**

Samanta, K.\*; Ardito, F. M.; Souza-Neto, N. M.; Granado, E.\*

Two intriguing unresolved issues of iridate physics are the avoided metallization under applied pressure of undoped Sr<sub>2</sub>IrO<sub>4</sub> and related materials, and the apparent absence of superconductivity under electron doping despite the similarity of the fermiology of these materials with respect to cuprates. Here, we investigate the crystal structure and lattice vibrations of Sr<sub>2</sub>IrO<sub>4</sub> by a combined phonon Raman scattering and x-ray powder diffraction experiment under pressures up to 66 GPa and room temperature. Density functional theory (DFT) and ab initio lattice dynamics calculations were also carried out. A first-order structural phase transition associated with an 8% collapse of the c-axis is observed at high pressures, with phase coexistence being observed between similar to 40 and 55 GPa. At lower pressures and still within the high-symmetry tetragonal phase, a number of lattice and phonon anomalies were observed, reflecting crossovers between isostructural competing states. A critical pressure of P-1 = 17 GPa is associated with the following anomalies: (i) a reduction of lattice volume compressibility and a change of behavior of the tetragonal c/a ratio take place above P-1; (ii) a fourfold symmetry-breaking lattice strain associated with lattice disorder is observed above P-1; (iii) two strong Raman-active modes at ambient conditions (at similar to 180 and similar to 260 cm<sup>-1</sup>) are washed out at P-1; and (iv) an asymmetric Fano line shape is observed for the similar to 390 cm<sup>-1</sup> mode above P-1, revealing a coupling of this phonon with electronic excitations.

DFT indicates that the Ir-4(+) in-plane canted magnetic moment is unstable against volumetric compression, indicating that the phase above P-1 is most likely nonmagnetic. Exploring the similarities between iridate and cuprate physics, we argue that these observations are consistent with the emergence of a rotational symmetry-breaking electronic instability at P-1, providing hints for the avoided metallization under pressure and supporting the hypothesis of possible competing orders that are detrimental to superconductivity in this family. Alternative scenarios for the transition at P-1 are also suggested and critically discussed. Additional phonon and lattice anomalies in the tetragonal phase are observed at P-2 = 30 and P-3 = 40 GPa, indicating that other competing phases are favored at high pressures.

**PHYSICAL REVIEW B 98[9] 094101, 2018. DOI: 10.1103/PhysRevB.98.094101**

**[P305-2018] "Geant4-DNA example applications for track structure simulations in liquid water: A report from the Geant4-DNA Project"**

Incerti, S.; Kyriakou, I.; Bernal, M. A.\*; Bordage, M. C.; Francis, Z.; Guatelli, S.; Ivanchenko, V.; Karamitros, M.; Lampe, N.; Lee, S. B.; Meylan, S.; Min, C. H.; Shin, W. G.; Nieminen, P.; Sakata, D.; Tang, N.; Villagrasa, C.; Tran, H. N.; Brown, J. M. C.

This Special Report presents a description of Geant4-DNA user applications dedicated to the simulation of track structures (TS) in liquid water and associated physical quantities (e.g., range, stopping power, mean free path...). These example applications are included in the Geant4 Monte Carlo toolkit and are available in open access. Each application is described and comparisons to recent international recommendations are shown (e.g., ICRU, MIRD), when available. The influence of physics models available in Geant4-DNA for the simulation of electron interactions in liquid water is discussed. Thanks to these applications, the authors show that the most recent sets of physics models available in Geant4-DNA (the so-called option4 and option 6 sets) enable more accurate simulation of stopping powers, dose point kernels, and W-values in liquid water, than the default set of models (option 2) initially provided in Geant4-DNA. They also serve as reference applications for Geant4-DNA users interested in TS simulations.

**MEDICAL PHYSICS 45[8], E722-E739, 2018. DOI: 10.1002/mp.13048**

**[P306-2018] "Hexapartite Entanglement in an above-Threshold Optical Parametric Oscillator"**

Barbosa, F. A. S.\*; Coelho, A. S.; Munoz-Martinez, L. F.; Ortiz-Gutierrez, L.; Villar, A. S.; Nussenzveig, P.; Martinelli, M.

We demonstrate, theoretically and experimentally, the generation of hexapartite modal entanglement by the optical parametric oscillator (OPO) operating above the oscillation threshold. We show that the OPO generates a rich structure of entanglement among sets of six optical sideband modes interacting through the nonlinear crystal. The class of quantum states thus produced can be controlled by a single parameter, the power of the external laser that pumps the system. Our platform allows for the generation of massive entanglement among many optical modes with well defined but vastly different frequencies, potentially bridging nodes of a multicolor quantum network.

**PHYSICAL REVIEW LETTERS 121[7], 073601, 2018. DOI: 10.1103/PhysRevLett.121.073601**

**[P307-2018] "High stiffness polymer composite with tunable transparency"**

Owuor, P. S.; Chaudhary, V.; Woellner, C. F.\*; Sharma, V.; Ramujan, R. V.; Stender, A. S.; Soto, M.; Ozden, S.; Barrera, E. V.; Vajtai, R.; Galvao, D. S.\*; Lou, J.; Tiwary, C. S.; Ajayan, P. M.

Biological materials are multifunctional performing more than one function in a perfect synergy. These materials are built from fairly simple and limited components at ambient conditions. Such judicious designs have proven elusive for synthetic materials. Here, we demonstrate a multifunctional phase change (pc) composite from simple building blocks, which exhibits high stiffness and optical transmittance control. We show an increase of more than one order of magnitude in stiffness when we embed paraffin wax spheres into an elastomer matrix, polydimethylsiloxane (PDMS) in a dynamic compression test. High stiffness is mainly influenced by presence of microcrystals within the wax. We further show fast temperature-controlled optical switching of the composite for an unlimited number of cycles without any noticeable mechanical degradation. Through experimental and finite element method, we show high energy absorption capability of pc-composite. Based on these properties, the pccomposite could be used as an effective coating on glasses for cars and windows. This simple approach to multi-functionality is exciting and could pave way for designs of other multifunctional materials at the macro-scale.

**MATERIALS TODAY 21[5] 475-482, 2018. DOI: 10.1016/j.mat-tod.2017.12.004**

**[P308-2018] “High-pressure studies on heavy-fermion anti-ferromagnet CeCuBi2”**

Piva, M. M.\*; Ajeesh, M. O.; Christovam, D. S.\*; dos Reis, R. D.; Jesus, C. B. R.\*; Rosa, P. F. S.\*; Adriano, C.\*; Urbano, R. R.\*; Nicklas, M.; Pagliuso, P. G.\*

We report in-plane electrical resistivity studies of CeCuBi2 and LaCuBi2 single crystals under applied pressure. At ambient pressure, CeCuBi2 is a c-axis Ising antiferromagnet with a transition temperature T-N approximate to 16 K. In a magnetic field applied along the c-axis at T approximate to 2 K a spin-flop transition takes place H-flip approximate to 5.7 T. Applying pressure on CeCuBi2 suppresses T-N at a slow rate. T-N(P) extrapolates to zero temperature at P-c approximate to 7 GPa. The critical field of the spin-flop transition H-flip(P) displays a maximum of 6.8 T at P approximate to 4 GPa. At low temperatures, a zero-resistance superconducting state emerges upon the application of external pressure having a maximum T-c of 7 K at 2.6 GPa in CeCuBi2. High-pressure electrical-resistivity experiments on the non-magnetic reference compound LaCuBi2 reveal also a zero resistance state with similar critical temperatures in the same pressure range as CeCuBi2. The great similarity between the superconducting properties of both materials and elemental Bi suggests a common origin of the superconductivity. We discuss that the appearance of this zero resistance state superconductivity may be related to the Bi layers present in the crystalline structure of both compounds and, therefore, could be intrinsic to CeCuBi2 and LaCuBi2, however further experiments under pressure are necessary to clarify this issue.

**JOURNAL OF PHYSICS-CONDENSED MATTER 30[37] 375601, 2018. DOI: 10.1088/1361-648X/aad7d8**

**[P309-2018] “Improving weak lensing mass map reconstructions using Gaussian and sparsity priors: application to DES SV”**

Jeffrey, N.; Abdalla, F. B.; Lahav, O.; Sobreira, F.\*; et al. DES Collaboration

Mapping the underlying density field, including non-visible dark matter, using weak gravitational lensing measurements is now a standard tool in cosmology. Due to its importance to the science results of current and upcoming surveys,

the quality of the convergence reconstruction methods should be well understood. We compare three methods: Kaiser-Squires (KS), Wiener filter, and GLIMPSE. Kaiser-Squires is a direct inversion, not accounting for survey masks or noise. The Wiener filter is well-motivated for Gaussian density fields in a Bayesian framework. GLIMPSE uses sparsity, aiming to reconstruct non-linearities in the density field. We compare these methods with several tests using public Dark Energy Survey (DES) Science Verification (SV) data and realistic DES simulations. The Wiener filter and GLIMPSE offer substantial improvements over smoothed Kaiser-Squires with a range of metrics. Both the Wiener filter and GLIMPSE convergence reconstructions show a 12 per cent improvement in Pearson correlation with the underlying truth from simulations. To compare the mapping methods' abilities to find mass peaks, we measure the difference between peak counts from simulated Lambda CDM shear catalogues and catalogues with no mass fluctuations (a standard data vector when inferring cosmology from peak statistics); the maximum signal-to-noise of these peak statistics is increased by a factor of 3.5 for the Wiener filter and 9 for GLIMPSE. With simulations, we measure the reconstruction of the harmonic phases; the phase residuals' concentration is improved 17 per cent by GLIMPSE and 18 per cent by the Wiener filter. The correlation between reconstructions from data and foreground redMaPPer clusters is increased 18 per cent by the Wiener filter and 32 per cent by GLIMPSE.

**MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 479[3] 2871-2888, 2018. DOI: 10.1093/mnras/sty1252**

**[P310-2018] “Inclusive J/psi production at forward and backward rapidity in p-Pb collisions at root s(NN)=8.16 TeV”**

Acharya, S.; Acosta, F. T.; Adamova, D.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; ALICE Collaboration

Inclusive J/psi production is studied in p-Pb interactions at a centre-of-mass energy per nucleon-nucleon collision root s(NN) = 8.16 TeV, using the ALICE detector at the CERN LHC. The J/psi meson is reconstructed, via its decay to a muon pair, in the centre-of-mass rapidity intervals  $2.03 < Y_{\text{cms}} < 3.53$  and  $-4.46 < Y_{\text{cms}} < -2.96$ , where positive and negative  $Y_{\text{cms}}$  refer to the p-going and Pb-going direction, respectively. The transverse momentum coverage is  $P_T < 20$  GeV/c. In this paper,  $Y_{\text{cms}}$ - and P-T-differential cross sections for inclusive J/psi production are presented, and the corresponding nuclear modification factors R-pPb are shown. Forward results show a suppression of the J/psi yield with respect to pp collisions, concentrated in the region P-T less than or similar to 5 GeV/c. At backward rapidity no significant suppression is observed. The results are compared to previous measurements by ALICE in p-Pb collisions at root s(NN) = 5.02 TeV and to theoretical calculations. Finally, the ratios R-FB between forward- and backward- $Y_{\text{cms}}$  R-pPb values are shown and discussed.

**JOURNAL OF HIGH ENERGY PHYSICS 7, 160, 2018. DOI: 10.1007/JHEP07(2018)160**

**[P311-2018] “Langmuir and Langmuir-Blodgett films of low-bandgap polymers”**

Braunger, M. L.\*; da Silva, E. A.; Awada, H.; de Oliveira, V. J. R.; Silva, H. S.; Begue, D.; Hiorns, R. C.; Lartigau-Dagron, C.; Olivati, C. de A.

Low-bandgap conjugated polymers have provided a considerable increase in organic photovoltaic efficiencies, however, an understanding of class-specific nanostructures, necessary to further improve device qualities, remains scarce. Their self-assembly and associated electronic behaviors in Langmuir-Blodgett (LB) films are used here to provide relationships specific to each polymer, clarifying their structure-property characteristics.

The behavior of two low-bandgap polymers based on cyclopentadithiophene (PCPDTBT) and dithienosilole (Si-PCPDTBT) units in the Langmuir trough were investigated and it is shown that it is possible to fabricate nanostructured films of low-bandgap polymers on solid substrates with the LB deposition technique. The polymers were mixed with amphiphilic molecules at well-defined concentrations to improve the formation of the LB films. The polymers were also deposited by drop-casting and LB techniques onto interdigitated electrodes to evaluate their electrical properties, and the LB films were characterized for their optical and morphological properties. It was found that both LB and drop-cast films of PCPDTBT showed higher electrical conductivities than those of Si-PCPDTBT. Importantly, LB films resulted in higher electrical conductivities - by an order of magnitude - compared to their equivalent mixtures with stearic acid in drop-cast films, although drop-cast films without stearic acid gave higher conductivities. This fine-tuning of the molecular architectures of the films is thus demonstrated to directly affect the physical properties and may lead to an improvement in device efficiencies in future applications.

**POLYMER INTERNATIONAL 67[8] 1028-1034, 2018. DOI: 10.1002/pi.5604**

**[P312-2018] "Liquid argon test of the ARAPUCA device"**

**Segreto, E.\*; Machado, A. A.; Paulucci, L.; Marinho, F.; Galante, D.; Guedes, S.\*; Fauth, A.\*; Teixeira, V.; Gelli, B.\*; Guzzo, M. R.\*; Araujo, W.; Ambrosio, C.; Bissiano, M.; Lixandrao Filho, A. L.\***

The ARAPUCA is a novel concept for liquid argon scintillation light detection which has been proposed for the photon detection system of the Deep Underground Neutrino Experiment. The test in liquid argon of one of the first ARAPUCA prototypes is presented in this work, where the working principle is experimentally demonstrated. The prototype has an acceptance window of 9 cm(2) and is read-out by a single SiPM with active area of 0.36 cm(2). Its global detection efficiency was estimated by exposing it to a natural Uranium source and to cosmic rays and was found to be 1.10% +/- 0.15%, which translates into an amplification of the effective detection area of the SiPM by a factor of about 3.7, in reasonable agreement with the prediction of a detailed Monte Carlo simulation of the device. Several other ARAPUCA prototypes of bigger dimensions and read-out by arrays of SiPMs have been built and are actually under test. In particular 32 ARAPUCA cells have been installed inside the protoDUNE detector, which is being assembled at CERN and will be operated in the second half of 2018.

**JOURNAL OF INSTRUMENTATION 13, P08021, 2018. DOI: 10.1088/1748-0221/13/08/P08021**

**[P313-2018] "Long-Baseline Oscillation Experiments as a Tool to Probe High Energy Flavor Symmetry Models"**

**Pasquini, P.\***

We review the current status of neutrino oscillation experiments, mainly focusing on T2(H) K, NO  $\nu_{\mu}$ , and DUNE. Their capability to probe high energy physics is found in the precision measurement of the CP phase and  $\theta_{23}$ . In general, neutrino mass models predict correlations among the mixing angles that can be used to scan and shrink their parameter space. We updated previous analysis and presented a list of models that contain such structure.

**ADVANCES IN HIGH ENERGY PHYSICS 1825874, 2018. DOI: 10.1155/2018/1825874**

**[P314-2018] "Low-Mass Dark Matter Search with the DarkSide-50 Experiment"**

**Agnes, P.; Albuquerque, I. F. M.; Alexander, T.; Machado, A. A.\*; Segreto, E.\*; et al.**  
DarkSide Collaboration

We present the results of a search for dark matter weakly interacting massive particles (WIMPs) in the mass range below 20 GeV/c(2) using a target of low-radioactivity argon with a 6786.0 kg d exposure. The data were obtained using the DarkSide-50 apparatus at Laboratori Nazionali del Gran Sasso. The analysis is based on the ionization signal, for which the DarkSide-50 time projection chamber is fully efficient at 0.1 keVee. The observed rate in the detector at 0.5 keVee is about 1.5 event/keVee/kg/d and is almost entirely accounted for by known background sources. We obtain a 90% C.L. exclusion limit above 1.8 GeV/c(2) for the spin-independent cross section of dark matter WIMPs on nucleons, extending the exclusion region for dark matter below previous limits in the range 1.8-6 GeV/c(2).

**PHYSICAL REVIEW LETTERS 121[8] 081307, 2018. DOI: 10.1103/PhysRevLett.121.081307**

**[P315-2018] "Magnetic frustration in low-dimensional substructures of hulsite Ni5.15Sn0.85(O2BO3)(2)"**

**Medrano, C. P. C.; Freitas, D. C.; Passamani, E. C.; Resende, J. A. L. C.; Alzamora, M.; Granado, E.\*; Galdino, C. W.\*; Baggio-Saitovitch, E.; Continentino, M. A.; Sanchez, D. R.**

This paper presents an extensive study of the structural, magnetic, and thermodynamic properties of the hulsite Ni<sub>5.15</sub>Sn<sub>0.85</sub>(O<sub>2</sub>BO<sub>3</sub>)(<sub>2</sub>). The crystal structure of the hulsite has two planar substructures formed by Ni and Sn atoms: one with rectangular configuration and the other with a triangular arrangement. These substructures are linked by the boron ions and by Ni in another site closer to the rectangular arrangement, resulting in a quasi-two-dimensional character. Thus, this system literally adds a new dimension to the study of oxyborates. Our results point to a complex magnetic behavior consistent with these substructures. The planes with rectangular arrangement form a complex magnetic ordering at 180 K (one of the highest magnetic transitions among the oxyborates). The other subsystem, formed by Ni atoms located in a two-dimensional triangular lattice, does not order down to temperatures as low as 3 K. The experimental results suggest a spin-liquid behavior for this subsystem. The magnetic moments of the ions between these planes also freeze at low temperatures. The two magnetic planes coexist as independent subsystems down to the lowest temperatures of our experiments.

**PHYSICAL REVIEW B 98[5] 054435, 2018. DOI: 10.1103/PhysRevB.98.054435**

**[P316-2018] "Measurement of charged particle spectra in minimum-bias events from proton-proton collisions at root s = 13 TeV"**

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

Pseudorapidity, transverse momentum, and multiplicity distributions are measured in the pseudorapidity range vertical bar eta vertical bar < 2.4 for charged particles with transverse momenta satisfying pT > 0.5 GeV in proton-proton collisions at a center-of-mass energy of root s = 13 TeV. Measurements are presented in three different event categories. The most inclusive of the categories corresponds to an inelastic pp data set, while the other two categories are exclusive subsets of the inelastic sample that are either enhanced or depleted in single diffractive dissociation events.

The measurements are compared to predictions from Monte Carlo event generators used to describe high-energy hadronic interactions in collider and cosmic-ray physics.

EUROPEAN PHYSICAL JOURNAL C 78[9], 697, 2018. DOI: 10.1140/epjc/s10052-018-6144-y

[P317-2018] “Measurement of the cross section for top quark pair production in association with a W or Z boson in proton-proton collisions at root s=13 TeV”

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

A measurement is performed of the cross section of top quark pair production in association with a W or Z boson using proton-proton collisions at a center-of-mass energy of 13TeV at the LHC. The data sample corresponds to an integrated luminosity of 35.9 fb(-1), collected by the CMS experiment in 2016. The measurement is performed in the same-sign dilepton, three- and four-lepton final states. The production cross sections are measured to be  $\sigma(t\bar{t})/\sigma(\bar{W}) = 0.77(-0.11)(+0.12)$  (stat)(-0.12)(+0.13) pb and  $\sigma(t\bar{t})/\sigma(\bar{Z}) = 0.99(-0.08)$  (+0.09) (stat)(-0.10)(+0.12) (syst) pb. The expected (observed) signal significance for the  $\sigma(t\bar{t})/\sigma(\bar{W})$  production in same-sign dilepton channel is found to be 4.5 (5.3) standard deviations, while for the  $\sigma(t\bar{t})/\sigma(\bar{Z})$  production in three- and four-lepton channels both the expected and the observed significance are found to be in excess of 5 standard deviations. The results are in agreement with the standard model predictions and are used to constrain the Wilson coefficients for eight dimension-six operators describing new interactions that would modify  $\sigma(t\bar{t})/\sigma(\bar{W})$  and  $\sigma(t\bar{t})/\sigma(\bar{Z})$  production.

JOURNAL OF HIGH ENERGY PHYSICS 8, 011, 2018 DOI: 10.1007/JHEP08(2018)011

[P318-2018] “Measurement of the inclusive J/psi polarization at forward rapidity in pp collisions at root s=8 TeV”

Acharya, S.; Acosta, F. T.; Adamova, D.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

We report on the measurement of the inclusive J/psi polarization parameters in pp collisions at a center of mass energy root s = 8 TeV with the ALICE detector at the LHC. The analysis is based on a data sample corresponding to an integrated luminosity of 1.23 pb(-1) J/psi resonances are reconstructed in their di-muon decay channel in the rapidity interval  $2.5 < y < 4.0$  and over the transverse-momentum interval  $2 < p_T < 15$  GeV/c. The three polarization parameters ( $\lambda(\theta)$ ,  $\lambda(\phi)$ ,  $\lambda(\theta, \phi)$ ) are measured as a function of pT both in the helicity and Collins-Soper reference frames. The measured J/psi polarization parameters are found to be compatible with zero within uncertainties, contrary to expectations from all available predictions. The results are compared with the measurement in pp collisions at root s = 7 TeV.

EUROPEAN PHYSICAL JOURNAL C 78[7], 562, 2018. DOI: 10.1140/epjc/s10052-018-6027-2

[P319-2018] “Measurement of the inelastic proton-proton cross section at root s=13 TeV”

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

A measurement of the inelastic proton-proton cross section with the CMS detector at a center-of-mass energy of root s = 13 TeV is presented. The analysis is based on events with energy deposits in the forward calorimeters, which cover pseudorapidities of  $-6.6 < \eta < -3.0$  and  $+3.0 < \eta < +5.2$ . An inelastic cross section of  $68.6 \pm 0.5(\text{syst}) \pm 1.6(\text{lumi})$  mb is obtained for events with  $M_X > 4.1$  GeV and/or  $M_Y > 13$  GeV, where  $M_X$  and  $M_Y$  are the masses of the diffractive dissociation systems at negative and positive pseudorapidities, respectively. The results are compared with those from other experiments as well as to predictions from high-energy hadron-hadron interaction models.

JOURNAL OF HIGH ENERGY PHYSICS 7, 161, 2018. DOI: 10.1007/JHEP07(2018)161

[P320-2018] “Measurement of the underlying event activity in inclusive Z boson production in proton-proton collisions at root s=13 TeV”

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

This paper presents a measurement of the underlying event activity in proton-proton collisions at a center-of-mass energy of 13TeV, performed using inclusive Z boson production events collected with the CMS experiment at the LHC. The analyzed data correspond to an integrated luminosity of 2.1 fb(-1). The underlying event activity is quantified in terms of the charged particle multiplicity, as well as of the scalar sum of the charged particles' transverse momenta in different topological regions defined with respect to the Z boson direction. The distributions are unfolded to the stable particle level and compared with predictions from various Monte Carlo event generators, as well as with similar CDF and CMS measurements at center-of-mass energies of 1.96 and 7TeV respectively.

JOURNAL OF HIGH ENERGY PHYSICS 7, 032, 2018. DOI: 10.1007/JHEP07(2018)032

[P321-2018] “Measurement of the weak mixing angle using the forward-backward asymmetry of Drell-Yan events in pp collisions at 8 TeV”

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

A measurement is presented of the effective leptonic weak mixing angle ( $\sin^2(\theta_{\text{eff}})$ ) using the forward-backward asymmetry of Drell-Yan lepton pairs ( $\mu\mu$  and  $ee$ ) produced in proton-proton collisions at  $\sqrt{s} = 8$  TeV at the CMS experiment of the LHC. The data correspond to integrated luminosities of 18.8 and 19.6 fb(-1) in the dimuon and dielectron channels, respectively, containing 8.2 million dimuon and 4.9 million dielectron events. With more events and new analysis techniques, including constraints obtained on the parton distribution functions from the measured forward-backward asymmetry, the statistical and systematic uncertainties are significantly reduced relative to previous CMS measurements. The extracted value of  $\sin^2(\theta_{\text{eff}})$  from the combined dilepton data is  $\sin^2(\theta_{\text{eff}}) = 0.23101 \pm 0.00036$  (stat)  $\pm 0.00018$  (syst)  $\pm 0.00016$  (theo)  $\pm 0.00031$  (parton distributions in proton) =  $0.23101 \pm 0.00053$ .

EUROPEAN PHYSICAL JOURNAL C 78[9] 701, 2018. DOI: 10.1140/epjc/s10052-018-6148-7

[P322-2018] “Measurement of the Z/gamma\* -> tau tau cross section in pp collisions at root s=13 TeV and validation of tau lepton analysis techniques”

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

A measurement is presented of the  $Z/\gamma^* \rightarrow \tau\tau$  cross section in pp collisions at  $\sqrt{s} = 13$  TeV, using data recorded by the CMS experiment at the LHC, corresponding to an integrated luminosity of 2.3 fb<sup>-1</sup>. The product of the inclusive cross section and branching fraction is measured to be  $\sigma(\text{pp} \rightarrow Z/\gamma^* X) B(Z/\gamma^* \rightarrow \tau\tau) = 1848 \pm 12$  (stat)  $\pm 67$  (syst + lumi) pb, in agreement with the standard model expectation, computed at next-to-next-to-leading order accuracy in perturbative quantum chromodynamics. The measurement is used to validate new analysis techniques relevant for future measurements of tau lepton production. The measurement also provides the reconstruction efficiency and energy scale for tau decays to hadrons +  $\nu(\tau)$  final states, determined with respective relative uncertainties of 2.2 and 0.9%.

EUROPEAN PHYSICAL JOURNAL C 78[9], 708, 2018. DOI: 10.1140/epjc/s10052-018-6146-9

[P323-2018] “Microphotonic needle for minimally invasive endoscopic imaging with sub-cellular resolution”

Tadayon, M. A.; Pavlova, I.; Martyniuk, K. M.; Mohanty, A.; Roberts, S. P.; Barbosa, F.\*; Denny, C. A.; Lipson, M.

Ultra-compact micro-optical elements for endoscopic instruments and miniaturized microscopes allow for non-invasive and non-destructive examination of microstructures and tissues. With sub-cellular level resolution such instruments could provide immediate diagnosis that is virtually consistent with a histologic diagnosis enabling for example to differentiate the boundaries between malignant and benign tissue. Such instruments are now being developed at a rapid rate; however, current manufacturing technologies limit the instruments to very large sizes, well beyond the sub-mm sizes required in order to ensure minimal tissue damage. We show here a platform based on planar microfabrication and soft lithography that overcomes the limitation of current optical elements enabling single cell resolution. We show the ability to resolve lithographic features that are as small as 2  $\mu\text{m}$  using probes with a cross section that is only 100 microns in size. We also show the ability to image individual activated neural cells in brain slices via our fabricated probe.

SCIENTIFIC REPORTS 8, 10756, 2018. DOI: 10.1038/s41598-018-29090-6

[P324-2018] “Molecular modeling of low bandgap diblock co-oligomers with pi-bridges for applications in photovoltaics”

Alves, G. G. B.; Oliveira, E. F.\*; Batagin-Neto, A.; Lavarda, F. C.

Recently, the diblock co-oligomers concept, a new design method to obtain conjugated organic compounds for varied applications in photovoltaics was proposed. These materials combines the interesting properties of extended systems and the versatility of small molecules, leading to low band-gap materials with improved properties, such as adjustable open circuit voltages and promising optical responses. Aiming to evaluate possible improved routes for the design of such materials, in this report we present a study on the effect of pi-bridges incorporation on the properties of diblock co-oligomers. Six different p-bridges were inserted between polythiophene (Th) and polypyrrol (Py) oligomers with five units, following the structure [Th]<sub>5</sub>-[pi-bridge]-[Py]<sub>5</sub>. The geometry optimization and optical absorption studies were carried out in the density functional theory (DFT) and time dependent-DFT (TD-DFT) frameworks, respectively, using the B3LYP correlation-exchange functional and 6-31G(d, p) basis set.

The results point out that compounds with improved opto-electronic properties can be obtained by an appropriated choice of the pi-bridges. The possible improvements are associated with the higher delocalization of the pi-systems on the molecules, reduction of the effective optical/electronic bandgaps, high optical transition probability between the new highest occupied and lowest unoccupied molecular levels (HOMO-LUMO), optimized charge transport properties and reduced exciton dissociation energies.

COMPUTATIONAL MATERIALS SCIENCE 152, 12-19, 2018. DOI: 10.1016/j.commatsci.2018.05.027

[P325-2018] “Mu-tau reflection symmetry with a high scale texture-zero”

Nishi, C. C.; Sanchez-Vega, B. L.\*; Souza Silva, G.

The mu tau-reflection symmetric neutrino mass matrix can accommodate all known neutrino mixing angles, with maximal atmospheric angle fixed, and predicts all the unknown CP phases of the lepton sector but is unable to predict the absolute neutrino mass scale. Here we present a highly predictive scenario where mu tau-reflection is combined with a discrete abelian symmetry to enforce a texture-zero in the mass matrix of the heavy right-handed neutrinos that generate the light neutrino masses. Such a restriction reduces the free parameters of the low energy theory to zero and the absolute neutrino mass scale is restricted to few discrete regions, three in the few meV range and one extending up to around 30 meV. The heavy neutrino sector is dependent only on two free parameters which are further restricted to small regions from the requirement of successful leptogenesis. Mass degenerate heavy neutrinos are possible in one case but there is no resonant enhancement of the CP asymmetry.

JOURNAL OF HIGH ENERGY PHYSICS 9, 042, 2018. DOI: 10.1007/JHEP09(2018)042

[P326-2018] “Nanoscope origin of the dissipative friction forces on a diamond tip sliding on magnetite surfaces”

Bogoni Jr, N.; Menezes, C. M.; Costi, F. B.; Perotti, B. L.; Echeverrigaray, F. G.; Perottoni, C. A.; Alvarez, F.\*; Figueroa, C. A.

Fundamental understanding of friction forces at the micro/nanoscale continues being a challenge in tribology. This work reports on the friction behavior of the outermost magnetite layers grown on a nitrided ferrous alloy studied by two different and independent experimental methods: nanoindentation followed by unidirectional sliding and friction force microscopy. Macroscopic mechanical properties involving hardness (H) and Young modulus (E), such as the plastic deformation parameter (H<sup>3</sup>/E<sup>2</sup>) and the elastic strain to failure (H/E), as well as surface roughness cannot explain the lack of influence of the friction coefficient on the outermost magnetite layer thickness. Moreover, the observed energy dissipation phenomenon is consistent with phononic non-conservative damping forces.

THIN SOLID FILMS 660, 258-262, 2018. DOI: 10.1016/j.tsf.2018.06.012

[P327-2018] “Nanowire Arrays as Force Sensors with Super-Resolved Localization Position Detection: Application to Optical Measurement of Bacterial Adhesion Forces”

da Silva, A. M.\*; Sahoo, P. K.\*; Cavalli, A.; de Souza, A. A.; Bakkers, E. P. A. M.; Cesar, C. L.\*; Janissen, R.; Cotta, M. A.\*

The design and application of indium phosphide (InP) nanowire arrays to acquire *Xylella fastidiosa* bacterial cell vector force maps are discussed. The nanowire deflections are measured with subdiffraction localization confocal laser scanning microscopy (CLSM). The nanowire mechanical stability in air and liquid media as well as methods to average out thermally induced oscillations are investigated. The accuracy of center determination of the CLSM reflected laser intensity profile at nanowire apex is studied using Gaussian fitting and localization microscopy techniques. These results show that the method is reliable for measuring nanowire displacements above approximate to 25 nm. Corresponding force ranges probed by this method can be customized depending on nanowire geometry and array configuration. The method is applied to explore *X. fastidiosa* cell adhesion forces on the InP nanowire surface, and in situ probes the effect of N-acetylcysteine on adhered cells. Future perspectives for application of this method in microbiology studies are also outlined.

**SMALL METHODS 2[7] UNSP 1700411, 2018. DOI: 10.1002/smt.201700411**

**[P328-2018] “Neutral pion and eta meson production in p-Pb collisions at root S-NN=5.02 TeV”**

Acharya, S.; Adamova, D.; Adolfsson, J.; **Albuquerque, D. S. D.\***; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al. ALICE Collaboration

Neutral pion and eta meson invariant differential yields were measured in non-single diffractive p-Pb collisions at root S-NN = 5.02 TeV with the ALICE experiment at the CERN LHC. The analysis combines results from three complementary photon measurements, utilizing the PHOS and EMCal calorimeters and the Photon Conversion Method. The invariant differential yields of pi(0) and eta meson inclusive production are measured near mid-rapidity in a broad transverse momentum range of  $0.3 < p(T) < 20$  GeV/c and  $0.7 < p(T) < 20$  GeV/c, respectively. The measured eta/pi(0) ratio increases with p(T) and saturates for  $p(T) > 4$  GeV/c at  $0.483 \pm 0.015(\text{stat}) \pm 0.015(\text{sys})$ . A deviation from m(T) scaling is observed for  $p(T) < 2$  GeV/c. The measured eta/pi(0) ratio is consistent with previous measurements from proton-nucleus and pp collisions over the full pi range. The measured eta/pi(0) ratio at high p(T) also agrees within uncertainties with measurements from nucleus nucleus collisions. The pi(0) and eta yields in p-Pb relative to the scaled pp interpolated reference, R-pPb, are presented for  $0.3 < p(T) < 20$  GeV/c and  $0.7 < p(T) < 20$  GeV/c, respectively. The results are compared with theoretical model calculations. The values of R-pPb are consistent with unity for transverse momenta above 2 GeV/c. These results support the interpretation that the suppressed yield of neutral mesons measured in Pb-Pb collisions at LHC energies is due to parton energy loss in the hot QCD medium.

**EUROPEAN PHYSICAL JOURNAL C 78[8] 624, 2018. DOI: 10.1140/epjc/s10052-018-6013-8**

**[P329-2018] “Neutrino emission from the direction of the blazar TXS 0506+056 prior to the IceCube-170922A alert”**

Aartsen, M. G.; Ackermann, M.; Adams, J.; **Arsioli, B.\***; et al. IceCube Collaboration

A high-energy neutrino event detected by IceCube on 22 September 2017 was coincident in direction and time with a gamma-ray flare from the blazar TXS 0506+056. Prompted by this association, we investigated 9.5 years of IceCube neutrino observations to search for excess emission at the position of the blazar. We found an excess of high-energy neutrino events, with respect to atmospheric backgrounds, at that position between September 2014 and March 2015.

Allowing for time-variable flux, this constitutes 3.5 sigma evidence for neutrino emission from the direction of TXS 0506+056, independent of and prior to the 2017 flaring episode. This suggests that blazars are identifiable sources of the high-energy astrophysical neutrino flux.

**SCIENCE 361[6398] 147-151, 2018. DOI: 10.1126/science.aat2890**

**[P330-2018] “Nuclear modification factor of D-0 mesons in PbPb collisions at root s(NN)=5.02 TeV”**

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

The transverse momentum (p(T)) spectrum of prompt D-0 mesons and their antiparticles has been measured via the hadronic decay channels  $D-0 \rightarrow K^- \pi^+$  and  $(D)$  over  $\bar{0} \rightarrow K^+ \pi^-$  in pp and PbPb collisions at a centre-of-mass energy of 5.02 TeV per nucleon pair with the CMS detector at the LHC. The measurement is performed in the D-0 meson p(T) range of 2-100 GeV/c and in the rapidity range of vertical bar y vertical bar < 1. The pp (PbPb) dataset used for this analysis corresponds to an integrated luminosity of 27.4 pb(-1) (530 mu b(-1)). The measured D-0 meson p(T) spectrum in pp collisions is well described by perturbative QCD calculations. The nuclear modification factor, comparing D-0 meson yields in PbPb and pp collisions, was extracted for both minimum-bias and the 10% most central PbPb interactions. For central events, the D-0 meson yield in the PbPb collisions is suppressed by a factor of 5-6 compared to the pp reference in the p(T) range of 6-10 GeV/c. For D-0 mesons in the high-p(T) range of 60-100 GeV/c, a significantly smaller suppression is observed. The results are also compared to theoretical calculations.

**PHYSICS LETTERS B 782, 474-496, 2018. DOI: 10.1016/j.physletb.2018.05.074**

**[P331-2018] “Observation of proton-tagged, central (semi) exclusive production of high-mass lepton pairs in pp collisions at 13 TeV with the CMS-TOTEM precision proton spectrometer”**

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

The process  $pp \rightarrow p(l^+)l^-p(l^*)l^-$ , with  $l^+(l^-)$  a muon or an electron pair produced at midrapidity with mass larger than 110 GeV, has been observed for the first time at the LHC in pp collisions at root s = 13 TeV. One of the two scattered protons is measured in the CMS-TOTEM precision proton spectrometer (CT-PPS), which operated for the first time in 2016. The second proton either remains intact or is excited and then dissociates into a low-mass state  $p^*$ , which is undetected. The measurement is based on an integrated luminosity of 9.4 fb(-1) collected during standard, high-luminosity LHC operation. A total of 12 mu(+)/mu(-) and 8 e(+)/e(-) pairs with  $m(l^+)l^- > 110$  GeV, and matching forward proton kinematics, are observed, with expected backgrounds of  $1.49 \pm 0.07$  (stat)  $\pm 0.53$  (syst) and  $2.36 \pm 0.09$  (stat)  $\pm 0.47$  (syst), respectively. This corresponds to an excess of more than five standard deviations over the expected background. The present result constitutes the first observation of proton-tagged gamma gamma collisions at the electroweak scale. This measurement also demonstrates that CT-PPS performs according to the design specifications.

**JOURNAL OF HIGH ENERGY PHYSICS 7, 153, 2018. DOI: 10.1007/JHEP07(2018)153**

**[P332-2018] “Observation of the  $\chi(b1)(3P)$  and  $\chi(b2)(3P)$  and Measurement of their Masses”**

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

The  $\chi(b1)(3P)$  and  $\chi(b2)(3P)$  states are observed through their  $\gamma(3S)(\gamma)$  decays, using an event sample of proton-proton collisions collected by the CMS experiment at the CERN LHC. The data were collected at a center-of-mass energy of 13 TeV and correspond to an integrated luminosity of 80.0 fb<sup>-1</sup>. The  $\gamma(3S)$  mesons are identified through their dimuon decay channel, while the low-energy photons are detected after converting to  $e^+e^-$  pairs in the silicon tracker, leading to a  $\chi(b)(3P)$  mass resolution of 2.2 MeV. This is the first time that the  $J = 1$  and 2 states are well resolved and their masses individually measured: 10513.42  $\pm$  0.41(stat)  $\pm$  0.18(syst) MeV and 10524.02  $\pm$  0.57(stat)  $\pm$  0.18(syst) MeV; they are determined with respect to the world-average value of  $\gamma(3S)$  mass, which has an uncertainty of 0.5 MeV. The mass splitting is measured to be 10.60  $\pm$  0.64(stat)  $\pm$  0.17(syst) MeV.

PHYSICAL REVIEW LETTERS 121[9] 092002, 2018. DOI: 10.1103/PhysRevLett.121.092002

**[P333-2018] “ $\phi$  meson production at forward rapidity in Pb-Pb collisions at  $\sqrt{s(NN)}=2.76$  TeV”**

Acharya, S.; Acosta, F. T.; Adamova, D.; Albuquerque, D. S. D.\*; Chinellato, D. D.\*; De Souza, R. D.\*; Takahashi, J.\*; et al.  
ALICE Collaboration

$\phi$  meson measurements provide insight into strangeness production, which is one of the key observables for the hot medium formed in high-energy heavy-ion collisions. ALICE measured  $\phi$  production through its decay in muon pairs in Pb-Pb collisions at  $\sqrt{s(NN)} = 2.76$  TeV in the intermediate transverse momentum range  $2 < p(T) < 5$  GeV/c and in the rapidity interval  $2.5 < y < 4$ . The  $f$  yield was measured as a function of the transverse momentum and collision centrality. The nuclear modification factor was obtained as a function of the average number of participating nucleons. Results were compared with the ones obtained via the kaon decay channel in the same  $pT$  range at midrapidity. The values of the nuclear modification factor in the two rapidity regions are in agreement within uncertainties.

EUROPEAN PHYSICAL JOURNAL C 78[7] 559, 2018. DOI: 10.1140/epjc/s10052-018-6034-3

**[P334-2018] “Properties of the superfluid in the disordered Bose-Hubbard model”**

de Abreu, B. R.\*; Ray, U.; Vitello, S. A.\*; Ceperley, D. M.

We investigate the properties of the superfluid phase in the three-dimensional disordered Bose-Hubbard model using quantum Monte Carlo simulations. The phase diagram is generated using Gaussian disorder on the onsite potential. Comparisons with box and speckle disorder show qualitative similarities leading to the reentrant behavior of the superfluid. Quantitative differences that arise are controlled by the specific shape of the disorder. Statistics pertaining to disorder distributions are studied for a range of interaction strengths and system sizes, where strong finite-size effects are observed. Despite this, both the superfluid fraction and compressibility remain self-averaging throughout the superfluid phase. Close to the superfluid-Bose-glass phase boundary, finite-size effects dominate but still suggest that self-averaging holds. Our results are pertinent to experiments with ultracold atomic gases where a systematic disorder averaging procedure is typically not possible.

PHYSICAL REVIEW A 98[2] 023628, 2018. DOI: 10.1103/PhysRevA.98.023628

**[P335-2018] “Quasar Accretion Disk Sizes from Continuum Reverberation Mapping from the Dark Energy Survey”**

Mudd, D.; Martini, P.; Zu, Y; Sobreira, F.\*; et al.  
DES Collaboration

We present accretion disk size measurements for 15 luminous quasars at  $0.7 \leq z \leq 1.9$  derived from griz light curves from the Dark Energy Survey. We measure the disk sizes with continuum reverberation mapping using two methods, both of which are derived from the expectation that accretion disks have a radial temperature gradient and the continuum emission at a given radius is well described by a single blackbody. In the first method we measure the relative lags between the multiband light curves, which provides the relative time lag between shorter and longer wavelength variations. From this, we are only able to constrain upper limits on disk sizes, as many are consistent with no lag the 2 sigma level. The second method fits the model parameters for the canonical thin disk directly rather than solving for the individual time lags between the light curves. Our measurements demonstrate good agreement with the sizes predicted by this model for accretion rates between 0.3 and 1 times the Eddington rate. Given our large uncertainties, our measurements are also consistent with disk size measurements from gravitational microlensing studies of strongly lensed quasars, as well as other photometric reverberation mapping results, that find disk sizes that are a factor of a few (similar to 3) larger than predictions.

ASTROPHYSICAL JOURNAL 862[2] 123, 2018. DOI: 10.3847/1538-4357/aac9bb

**[P336-2018] “Quasiparticle bands and optical properties of SnSe from an ab initio approach”**

Melendez, J. J.; Gonzalez-Romero, R. L.; Antonelli, A.\*

We present an ab initio study of the nature of the optical and quasiparticle gaps of SnSe. The density functional theory and the many-body perturbation theory under the GW approximation show that SnSe exhibits an indirect quasiparticle bandgap of 0.64 eV, which agrees with the experimental evidence. The optical gap, on the contrary, is direct and ranges between 0.9 and 1.1 eV for thin films. The optical absorption spectrum of SnSe evidences the formation of excitons, whose binding energies depend on the polarization of the incident electric field. Finally, we show evidences that the optical gap of single crystals arises from indirect transitions.

COMPUTATIONAL MATERIALS SCIENCE 152, 107-112, 2018. DOI: 10.1016/j.commatsci.2018.05.032

**[P337-2018] “Recent developments in surface science and engineering, thin films, nanoscience, biomaterials, plasma science, and vacuum technology”**

Mozetic, M.; Vesel, A.; Primc, G.; Hernandez-Montelongo, J.\*; et al.

Nanometer-sized structures, surfaces and sub-surface phenomena have played an enormous role in science and technological applications and represent a driving-force of current interdisciplinary science. Recent developments include the atomic-scale characterization of nanoparticles, molecular reactions at surfaces, magnetism at the atomic scale, photoelectric characterization of nanostructures as well as two-dimensional solids.



Research and development of smart nanostructured materials governed by their surface properties is a rapidly growing field. The main challenge is to develop an accurate and robust electronic structure description. The density of surface-related trap states is analyzed by transient UV photoconductivity and temperature-dependent admittance spectroscopy. An advanced application of thin films on shaped substrates is the deposition of catalytic layers on hollow glass microspheres for hydrogen storage controlled exothermal hydrolytic release. Surface properties of thin films including dissolution and corrosion, fouling resistance, and hydrophilicity/hydrophobicity are explored to improve materials response in biological environments and medicine. Trends in surface bio-functionalization routes based on vacuum techniques, together with advances in surface analysis of biomaterials, are discussed. Pioneering advances in the application of X-ray nanodiffraction of thin film cross-sections for characterizing nanostructure and local strain including in-situ experiments during nanoindentation are described. Precise measurements and control of plasma properties are important for fundamental investigations and the development of next generation plasma-based technologies. Critical control parameters are the flux and energy distribution of incident ions at reactive surfaces; it is also crucial to control the dynamics of electrons initiating non-equilibrium chemical reactions. The most promising approach involves the exploitation of complementary advantages in direct measurements combined with specifically designed numerical simulations. Exciting new developments in vacuum science and technology have focused on forward-looking and next generation standards and sensors that take advantage of photonics based measurements. These measurements are inherently fast, frequency based, easily transferrable to sensors based on photonics and hold promise of being disruptive and transformative. Realization of Pascal, the SI unit for pressure, a cold-atom trap based ultra-high and extreme high vacuum (UHV and XHV) standard, dynamic pressure measurements and a photonic based thermometer are three key examples that are presented.

**THIN SOLID FILMS 660, 120-160, 2018. DOI: 10.1016/j.tsf.2018.05.046**

**[P338-2018] “Registering the evolutionary history in individual-based models of speciation”**

Costa, C. L. N.; Marquitti, F. M. D.\*; Perez, S. I.\*; Schneider, D. M.\*; Ramos, M. F.\*; de Aguiar, M. A. M.\*

Understanding the emergence of biodiversity patterns in nature is a central problem in biology. Theoretical models of speciation have addressed this question in the macroecological scale, but little has been done to connect microevolutionary processes with macroevolutionary patterns. Knowledge of the evolutionary history allows the study of patterns underlying the processes being modeled, revealing their signatures and the role of speciation and extinction in shaping macroevolutionary patterns. In this paper we introduce two algorithms to record the evolutionary history of populations and species in individual-based models of speciation, from which genealogies and phylogenies can be constructed. The first algorithm relies on saving ancestor-descendant relationships, generating a matrix that contains the times to the most recent common ancestor between all pairs of individuals at every generation (the Most Recent Common Ancestor Time matrix, MRCAT). The second algorithm directly records all speciation and extinction events throughout the evolutionary process, generating a matrix with the true phylogeny of species (the Sequential Speciation and Extinction Events, SSEE). We illustrate the use of these algorithms in a spatially explicit individual-based model of speciation. We compare the trees generated via MRCAT and SSEE algorithms with trees inferred by methods that use only genetic distance between individuals of extant species, commonly used in empirical studies and applied here to simulated genetic data. Comparisons between trees are performed with metrics describing the overall topology, branch length distribution and imbalance degree.

We observe that both MRCAT and distance-based trees differ from the true phylogeny, with the first being closer to the true tree than the second.

**PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS 510, 1-14, 2018. DOI: 10.1016/j.physa.2018.05.150**

**[P339-2018] “Resonance suppression from color reconnection”**

Acconcia, R.\*; Chinellato, D. D.\*; Derradi de Souza, R.\*; Takahashi, J.\*; Torrieri, G.\*; Markert, C.

We present studies that show how multi-parton interaction and color reconnection affect the hadro-chemistry in proton-proton (pp) collisions with special focus on the production of resonances using the PYTHIA8 event generator. We find that color reconnection suppresses the relative production of meson resonances such as  $\rho(0)$  and  $K^*$ , providing an alternative explanation for the  $K^*/K$  decrease observed in proton-proton collisions as a function of multiplicity by the ALICE collaboration. Detailed studies of the underlying mechanism causing meson resonance suppression indicate that color reconnection leads to shorter, less energetic strings whose fragmentation is less likely to produce more massive hadrons for a given quark content, therefore reducing ratios such as  $K^*/K$  and  $\rho(0)/\pi$  in high-multiplicity pp collisions. In addition, we have also studied the effects of allowing string junctions to form and found that these may also contribute to resonance suppression.

**PHYSICAL REVIEW D 97[3] 036010, 2018. DOI: 10.1103/PhysRevD.97.036010**

**[P340-2018] “Scalar field black holes”**

Carneiro, S.\*; Fabris, J. C.

With a suitable decomposition of its energy-momentum tensor into pressureless matter and a vacuum type term, we investigate the spherical gravitational collapse of a minimally coupled, self-interacting scalar field, showing that it collapses to a singularity. The formed blackhole has a mass  $M$  similar to  $1/m$  (in Planck units), where  $m$  is the mass of the scalar field. If the latter has the axion mass,  $m$  similar to  $10^{-5}$  eV, the former has a mass  $M$  similar to  $10^{(-5)}M(\text{circle dot})$ .

**EUROPEAN PHYSICAL JOURNAL C 78[8]676, 2018. DOI: 10.1140/epjc/s10052-018-6161-x**

**[P341-2018] “Search for a heavy resonance decaying into a Z boson and a vector boson in the  $v(v)\overline{\text{bar}}q(q)\overline{\text{bar}}$  final state”**

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

A search is presented for a heavy resonance decaying into either a pair of Z bosons or a Z boson and a W boson (ZZ or WZ), with a Z boson decaying into a pair of neutrinos and the other boson decaying hadronically into two collimated quarks that are reconstructed as a highly energetic large-cone jet. The search is performed using the data collected with the CMS detector at the CERN LHC during 2016 in proton-proton collisions at a center-of-mass energy of 13 TeV, corresponding to a total integrated luminosity of 35.9 fb<sup>-1</sup>. No excess is observed in data with regard to background expectations. Results are interpreted in scenarios of physics beyond the standard model. Limits at 95% confidence level on production cross sections are set at 0.9 fb (63 fb) for spin-1  $W'$  bosons, included in the heavy vector triplet model, with mass 4.0 TeV (1.0 TeV),

and at 0.5 fb (40 fb) for spin-2 bulk gravitons with mass 4.0 TeV (1.0 TeV). Lower limits are set on the masses of  $W'$  bosons in the context of two versions of the heavy vector triplet model of 3.1 TeV and 3.4 TeV, respectively.

**JOURNAL OF HIGH ENERGY PHYSICS 7, 075, 2018. DOI: 10.1007/JHEP07(2018)075**

**[P342-2018] “Search for a singly produced third-generation scalar leptoquark decaying to a tau lepton and a bottom quark in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

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

A search is presented for a singly produced third-generation scalar leptoquark decaying to a tau lepton and a bottom quark. Associated production of a leptoquark and a tau lepton is considered, leading to a final state with a bottom quark and two tau leptons. The search uses proton-proton collision data at a center-of-mass energy of 13 TeV recorded with the CMS detector, corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup>. Upper limits are set at 95% confidence level on the production cross section of the third-generation scalar leptoquarks as a function of their mass. From a comparison of the results with the theoretical predictions, a third-generation scalar leptoquark decaying to a tau lepton and a bottom quark, assuming unit Yukawa coupling ( $\lambda$ ), is excluded for masses below 740 GeV. Limits are also set on  $\lambda$  of the hypothesized leptoquark as a function of its mass. Above  $\lambda = 1.4$ , this result provides the best upper limit on the mass of a third-generation scalar leptoquark decaying to a tau lepton and a bottom quark.

**JOURNAL OF HIGH ENERGY PHYSICS 7, 115, 2018. DOI: 10.1007/JHEP07(2018)115**

**[P343-2018] “Search for additional neutral MSSM Higgs bosons in the tau tau final state in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

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

A search is presented for additional neutral Higgs bosons in the tau tau final state in proton-proton collisions at the LHC. The search is performed in the context of the minimal supersymmetric extension of the standard model (MSSM), using the data collected with the CMS detector in 2016 at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup>. To enhance the sensitivity to neutral MSSM Higgs bosons, the search includes production of the Higgs boson in association with b quarks. No significant deviation above the expected background is observed. Model-independent limits at 95% confidence level (CL) are set on the product of the branching fraction for the decay into tau leptons and the cross section for the production via gluon fusion or in association with b quarks. These limits range from 18 pb at 90 GeV to 3.5 fb at 3.2 TeV for gluon fusion and from 15 pb (at 90 GeV) to 2.5 fb (at 3.2 TeV) for production in association with b quarks, assuming a narrow width resonance. In the  $m(h)$  (mod+) scenario these limits translate into a 95% CL exclusion of  $\tan\beta > 6$  for neutral Higgs boson masses below 250 GeV, where  $\tan\beta$  is the ratio of the vacuum expectation values of the neutral components of the two Higgs doublets. The 95% CL exclusion contour reaches 1.6 TeV for  $\tan\beta = 60$ .

**JOURNAL OF HIGH ENERGY PHYSICS 9, 007, 2018. DOI: 10.1007/JHEP09(2018)007**

**[P344-2018] “Search for beyond the standard model Higgs bosons decaying into a  $b(b)\overline{b}$  pair in pp collisions at  $\sqrt{s}=13$  TeV”**

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

A search for Higgs bosons that decay into a bottom quark-antiquark pair and are accompanied by at least one additional bottom quark is performed with the CMS detector. The data analyzed were recorded in proton-proton collisions at a center-of-mass energy of  $\sqrt{s} = 13$  TeV at the LHC, corresponding to an integrated luminosity of 35.7 fb<sup>-1</sup>. The final state considered in this analysis is particularly sensitive to signatures of a Higgs sector beyond the standard model, as predicted in the generic class of two Higgs doublet models (2HDMs). No signal above the standard model background expectation is observed. Stringent upper limits on the cross section times branching fraction are set for Higgs bosons with masses up to 1300 GeV. The results are interpreted within several MSSM and 2HDM scenarios.

**JOURNAL OF HIGH ENERGY PHYSICS 8, 113, 2018. DOI: 10.1007/JHEP08(2018)113**

**[P345-2018] “Search for disappearing tracks as a signature of new long-lived particles in proton-proton collisions at  $\sqrt{s}=13$  TeV”**

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

A search is presented for long-lived charged particles that decay within the CMS detector and produce the signature of a disappearing track. A disappearing track is an isolated track with missing hits in the outer layers of the silicon tracker, little or no energy in associated calorimeter deposits, and no associated hits in the muon detectors. This search uses data collected with the CMS detector in 2015 and 2016 from proton-proton collisions at a center-of-mass energy of 13 TeV at the LHC, corresponding to an integrated luminosity of 38.4 fb<sup>-1</sup>. The results of the search are interpreted in the context of the anomaly-mediated supersymmetry breaking model. The data are consistent with the background-only hypothesis. Limits are set on the product of the cross section for direct production of charginos and their branching fraction to a neutralino and a pion, as a function of the chargino mass and lifetime. At 95% confidence level, charginos with masses below 715 (695) GeV are excluded for a lifetime of 3 (7) ns, as are charginos with lifetimes from 0.5 to 60 ns for a mass of 505 GeV. These are the most stringent limits using a disappearing track signature on this signal model for chargino lifetimes above approximate to 0.7 ns.

**JOURNAL OF HIGH ENERGY PHYSICS 8, 016, 2018. DOI: 10.1007/JHEP08(2018)016**

**[P346-2018] “Search for narrow and broad dijet resonances in proton-proton collisions at  $\sqrt{s}=13$  TeV and constraints on dark matter mediators and other new particles”**

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

Searches for resonances decaying into pairs of jets are performed using proton-proton collision data collected at  $\sqrt{s} = 13$  TeV corresponding to an integrated luminosity of up to 36 fb<sup>-1</sup>. A low-mass search, for resonances with masses between 0.6 and 1.6 TeV, is performed based on events with dijets reconstructed at the trigger level from calorimeter information.

A high-mass search, for resonances with masses above 1.6 TeV, is performed using dijets reconstructed offline with a particle-flow algorithm. The dijet mass spectrum is well described by a smooth parameterization and no evidence for the production of new particles is observed. Upper limits at 95% confidence level are reported on the production cross section for narrow resonances with masses above 0.6 TeV. In the context of specific models, the limits exclude string resonances with masses below 7.7 TeV, scalar diquarks below 7.2 TeV, axigluons and colorons below 6.1 TeV, excited quarks below 6.0 TeV, color-octet scalars below 3.4 TeV,  $W'$  bosons below 3.3 TeV,  $Z'$  bosons below 2.7 TeV, Randall-Sundrum gravitons below 1.8 TeV and in the range 1.9 to 2.5 TeV, and dark matter mediators below 2.6 TeV. The limits on both vector and axial-vector mediators, in a simplified model of interactions between quarks and dark matter particles, are presented as functions of dark matter particle mass and coupling to quarks. Searches are also presented for broad resonances, including for the first time spin-1 resonances with intrinsic widths as large as 30% of the resonance mass. The broad resonance search improves and extends the exclusions of a dark matter mediator to larger values of its mass and coupling to quarks.

**JOURNAL OF HIGH ENERGY PHYSICS 8, 130, 2018.** DOI: 10.1007/JHEP08(2018)130

**[P347-2018] “Search for new physics in events with two soft oppositely charged leptons and missing transverse momentum in proton-proton collisions at root s=13 TeV”**

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

A search is presented for new physics in events with two low-momentum, oppositely charged leptons (electrons or muons) and missing transverse momentum in proton-proton collisions at a centre-of-mass energy of 13 TeV. The data collected using the CMS detector at the LHC correspond to an integrated luminosity of 35.9 fb<sup>-1</sup>. The observed event yields are consistent with the expectations from the standard model. The results are interpreted in terms of pair production of charginos and neutralinos ( $\tilde{\chi}$  over tilde (+/-)(1) and  $\tilde{\chi}$  over tilde (0)(2)) with nearly degenerate masses, as expected in natural supersymmetry models with light higgsinos, as well as in terms of the pair production of top squarks ( $\tilde{t}$  over tilde), when the lightest neutralino and the top squark have similar masses. At 95% confidence level, wino-like  $\tilde{\chi}$  over tilde (+/-)(1)/ $\tilde{\chi}$  over tilde (0)(2) masses are excluded up to 230 GeV for a mass difference of 20 GeV relative to the lightest neutralino. In the higgsino-like model, masses are excluded up to 168 GeV for the same mass difference. For  $\tilde{t}$  over tilde pair production, top squark masses up to 450 GeV are excluded for a mass difference of 40 GeV relative to the lightest neutralino.

**PHYSICS LETTERS B 782, 440-467, 2018.** DOI: 10.1016/j.physletb.2018.05.062

**[P348-2018] “Search for R-parity violating supersymmetry in pp collisions at root s=13 TeV using bjets in a final state with a single lepton, many jets, and high sum of large-radius jet masses”**

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

Results are reported from a search for physics beyond the standard model in proton-proton collisions at a center-of-mass energy of root s=13 TeV. The search uses a signature of a single lepton, large jet and bottom quark jet multiplicities, and high sum of large-radius jet masses, without any requirement on the missing transverse momentum in an event.

The data sample corresponds to an integrated luminosity of 35.9 fb<sup>-1</sup> recorded by the CMS experiment at the LHC. No significant excess beyond the prediction from standard model processes is observed. The results are interpreted in terms of upper limits on the production cross section for R-parity violating supersymmetric extensions of the standard model using a benchmark model of gluino pair production, in which each gluino decays promptly via  $\tilde{g}$  over tilde -> tbs. Gluinos with a mass below 1610 GeV are excluded at 95% confidence level.

**PHYSICS LETTERS B 783, 114-139, 2018.** DOI: 10.1016/j.physletb.2018.06.028

**[P349-2018] “Search for resonant pair production of Higgs bosons decaying to bottom quark-antiquark pairs in proton-proton collisions at 13 TeV”**

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

A search for a narrow-width resonance decaying into two Higgs bosons, each decaying into a bottom quark-antiquark pair, is presented. The search is performed using proton-proton collision data corresponding to an integrated luminosity of 35.9 fb<sup>-1</sup> at root s = 13 TeV recorded by the CMS detector at the LHC. No evidence for such a signal is observed. Upper limits are set on the product of the production cross section for the resonance and the branching fraction for the selected decay mode in the resonance mass range from 260 to 1200 GeV.

**JOURNAL OF HIGH ENERGY PHYSICS 8, 152, 2018.** DOI: 10.1007/JHEP08(2018)152

**[P350-2018] “Search for the flavor-changing neutral current interactions of the top quark and the Higgs boson which decays into a pair of b quarks at root s=13 TeV”**

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

A search for flavor-changing neutral currents (FCNC) in events with the top quark and the Higgs boson is presented. The Higgs boson decay to a pair of b quarks is considered. The data sample corresponds to an integrated luminosity of 35.9 fb<sup>-1</sup> recorded by the CMS experiment at the LHC in proton-proton collisions at root s = 13 TeV. Two channels are considered: single top quark FCNC production in association with the Higgs boson (pp -> tH), and top quark pair production with FCNC decay of the top quark (t -> qH). Final states with one isolated lepton and at least three reconstructed jets, among which at least two are associated with b quarks, are studied. No significant deviation is observed from the predicted background. Observed (expected) upper limits at 95% confidence level are set on the branching fractions of top quark decays, B(t -> uH) < 0.47% (0.34%) and B(t -> cH) < 0.47% (0.44%), assuming a single nonzero FCNC coupling.

**JOURNAL OF HIGH ENERGY PHYSICS 6, 102, 2018.** DOI: 10.1007/JHEP06(2018)102

**[P351-2018] “Search for third-generation scalar leptoquarks decaying to a top quark and a tau lepton at root s=13 TeV”**

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

Search for pair production of heavy scalar leptoquarks (LQs), each decaying into a top quark and a tau lepton, is presented. The search considers final states with an electron or a muon, one or two tau leptons that decayed to hadrons, and additional jets. The data were collected in 2016 in proton-proton collisions at  $\sqrt{s} = 13$  TeV with the CMS detector at the LHC, and correspond to an integrated luminosity of 35.9 fb<sup>-1</sup>. No evidence for pair production of LQs is found. Assuming a branching fraction of unity for the decay  $LQ \rightarrow t \tau$ , upper limits on the production cross section are set as a function of LQ mass, excluding masses below 900 GeV at 95% confidence level. These results provide the most stringent limits to date on the production of scalar LQs that decay to a top quark and a tau lepton.

EUROPEAN PHYSICAL JOURNAL C 78[9] 707, 2018. DOI: 10.1140/epjc/s10052-018-6143-z

[P352-2018] “Search for vector-like T and B quark pairs in final states with leptons at  $\sqrt{s}=13$  TeV”

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

A search is presented for pair production of heavy vector-like T and B quarks in proton-proton collisions at  $\sqrt{s} = 13$  TeV. The data sample corresponds to an integrated luminosity of 35.9 fb<sup>-1</sup>, collected with the CMS detector at the CERN LHC in 2016. Pair production of T quarks would result in a wide range of final states, since vector-like T quarks of charge  $2e/3$  are predicted to decay to  $bW$ ,  $tZ$ , and  $tH$ . Likewise, vector-like B quarks are predicted to decay to  $tW$ ,  $bZ$ , and  $bH$ . Three channels are considered, corresponding to final states with a single lepton, two leptons with the same sign of the electric charge, or at least three leptons. The results exclude T quarks with masses below 1140-1300 GeV and B quarks with masses below 910-1240 GeV for various branching fraction combinations, extending the reach of previous CMS searches by 200-600 GeV.

JOURNAL OF HIGH ENERGY PHYSICS 8, 177, 2018. DOI: 10.1007/JHEP08(2018)177

[P353-2018] “Status of neutrino oscillations 2018: 3 sigma hint for normal mass ordering and improved CP sensitivity”

de Salas, P. F.; Forero, D. V.\*; Ternes, C. A.; Tortola, M.; Valle, J. W. F.

We present a new global fit of neutrino oscillation parameters within the simplest three-neutrino picture, including new data which appeared since our previous analysis[1]. In this update we include new long-baseline neutrino data involving the antineutrino channel in T2K, as well as new data in the neutrino channel, data from NO  $\nu$  A, as well as new reactor data, such as the Daya Bay 1230 days electron antineutrino disappearance spectrum data and the 1500 live days prompt spectrum from RENO, as well as new Double Chooz data. We also include atmospheric neutrino data from the IceCube DeepCore and ANTARES neutrino telescopes and from Super-Kamiokande. Finally, we also update our solar oscillation analysis by including the 2055-day day/night spectrum from the fourth phase of the Super-Kamiokande experiment. With the new data we find a preference for the atmospheric angle in the upper octant for both neutrino mass orderings, with maximal mixing allowed at  $\Delta\chi^2 = 1.6$  (3.2) for normal (inverted) ordering. We also obtain a strong preference for values of the CP phase  $\delta$  in the range  $[\pi, 2\pi]$ , excluding values close to  $\pi/2$  at more than 4 sigma. More remarkably, our global analysis shows a hint in favor of the normal mass ordering over the inverted one at more than 3 sigma. We discuss in detail the status of the mass ordering, CP violation and octant sensitivities, analyzing the interplay among the different neutrino data samples.

PHYSICS LETTERS B 782, 633-640, 2018. DOI: 10.1016/j.physletb.2018.06.019

[P354-2018] “Stellar Streams Discovered in the Dark Energy Survey”

Shipp, N.; Drlica-Wagner, A.; Balbinot, E.; Sobreira, F.\*; et al.  
DES Collaboration

We perform a search for stellar streams around the Milky Way using the first 3 yr of multiband optical imaging data from the Dark Energy Survey (DES). We use DES data covering similar to 5000 deg<sup>2</sup> to a depth of  $g > 23.5$  with a relative photometric calibration uncertainty of  $< 1\%$ . This data set yields unprecedented sensitivity to the stellar density field in the southern celestial hemisphere, enabling the detection of faint stellar streams to a heliocentric distance of similar to 50 kpc. We search for stellar streams using a matched filter in color-magnitude space derived from a synthetic isochrone of an old, metal-poor stellar population. Our detection technique recovers four previously known thin stellar streams: Phoenix, ATLAS, Tucana III, and a possible extension of Molonglo. In addition, we report the discovery of 11 new stellar streams. In general, the new streams detected by DES are fainter, more distant, and lower surface brightness than streams detected by similar techniques in previous photometric surveys. As a by-product of our stellar stream search, we find evidence for extratidal stellar structure associated with four globular clusters: NGC 288, NGC 1261, NGC 1851, and NGC 1904. The ever-growing sample of stellar streams will provide insight into the formation of the Galactic stellar halo, the Milky Way gravitational potential, and the large- and small-scale distribution of dark matter around the Milky Way.

ASTROPHYSICAL JOURNAL 862[2] 114, 2018. DOI: 10.3847/1538-4357/aacdad

[P355-2018] “Stochastic sampling of the isothermal-isobaric ensemble: Phase diagram of crystalline solids from molecular dynamics simulation”

Cajahuaranga, S.\*; Antonelli, A.\*

A methodology to sample the isothermal-isobaric ensemble using Langevin dynamics is proposed, which combines novel features of geometric integrators for the equations of motion. By employing the Trotter expansion, the methodology generates a robust, symmetric, and accurate numerical algorithm. In order to show that the proposed method correctly samples the phase-space, simulations in the isotropic NPT ensemble were carried out for two analytical examples. Also this method lets us study a solid-solid phase transition by conducting a fully flexible-cell molecular dynamics simulation. Additionally, we present an efficient method to determine the Gibbs free energy in a wide interval of pressure along an isothermal path, which allows us to determine the transition pressure in a driven by pressure solid-solid phase transition. Our calculations show that the methodology is highly suitable for the study of the phase diagram of crystalline solids.

JOURNAL OF CHEMICAL PHYSICS 149[6] 064114, 2018. DOI: 10.1063/1.5029842

[P356-2018] “Survey geometry and the internal consistency of recent cosmic shear measurements”

Troxel, M. A.; Krause, E.; Chang, C.; Sobreira, F.\*; et al.

We explore the impact of an update to the typical approximation for the shape noise term in the analytic covariance matrix for cosmic shear experiments that assumes the absence of survey boundary and mask effects.

We present an exact expression for the number of galaxy pairs in this term based on the survey mask, which leads to more than a factor of three increase in the shape noise on the largest measured scales for the Kilo-Degree Survey (KiDS-450) real-space cosmic shear data. We compare the result of this analytic expression to several alternative methods for measuring the shape noise from the data and find excellent agreement. This update to the covariance resolves any internal model tension evidenced by the previously large cosmological best-fitting  $\chi^2$  for the KiDS-450 cosmic shear data. The best-fitting  $\chi^2$  is reduced from 161 to 121 for 118 degrees of freedom. We also apply a correction to how the multiplicative shear calibration uncertainty is included in the covariance. This change shifts the inferred amplitude of the correlation function to higher values. We find that this improves agreement of the KiDS-450 cosmic shear results with Dark Energy Survey Year 1 and Planck results.

**MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 479[4] 4998-5004, 2018. DOI: 10.1093/mnras/sty1889**

**[P357-2018] “The gamma-ray emitting region in low synchrotron peak blazars Testing self-synchrotron Compton and external Compton scenarios”**

Arsioli, B.\*; Chang, Y-L.

**Aims.** From the early days in gamma-ray astronomy, locating the origin of GeV emission within the core of an active galactic nucleus (AGN) persisted as an open question; the problem is to discern between near-and far-site scenarios with respect to the distance from the super massive central engine. We investigate this question under the light of a complete sample of low synchrotron peak (LSP) blazars which is fully characterized along many decades in the electromagnetic spectrum, from radio up to tens of GeV. We consider the high-energy emission from bright radio blazars and test for synchrotron self-Compton (SSC) and external Compton (EC) scenarios in the framework of localizing the gamma-ray emission sites. Given that the inverse Compton (IC) process under the EC regime is driven by the abundance of external seed photons, these photons could be mainly ultraviolet (UV) to X-rays coming from the accretion disk region and the broad-line region (BLR), therefore close to the jet launch base; or infrared (IR) seed photons from the dust torus and molecular cloud spine-sheath, therefore far from jet launch base. We investigate both scenarios, and try to reveal the physics behind the production of gamma-ray radiation in AGNs which is crucial in order to locate the production site. **Methods.** Based on a complete sample of 104 radio-selected LSP blazars, with 37 GHz flux density higher than 1 Jy, we study broadband population properties associated with the nonthermal jet emission process, and test the capability of SSC and EC scenarios to explain the overall spectral energy distribution (SED) features. We use SEDs well characterized from radio to gamma rays, considering all currently available data. The enhanced available information from recent works allows us to refine the study of Syn to IC peak correlations, which points to a particular gamma-ray emission site. **Results.** We show that SSC alone is not enough to account for the observed SEDs. Our analysis favors an EC scenario under the Thomson scattering regime, with a dominant IR external photon field. Therefore, the far-site (i.e., far from the jet launch) is probably the most reasonable scenario to account for the population properties of bright LSP blazars in cases modeled with a pure leptonic component. We calculate the photon energy density associated with the external field at the jet comoving frame to be  $U'(\text{ext}) = 1.69 \times 10^{-2}$  erg  $\text{cm}^{-3}$ , finding good agreement to other correlated works.

**ASTRONOMY & ASTROPHYSICS 616, A63, 2018. DOI: 10.1051/0004-6361/201833005**

**[P358-2018] “The Role of Cu Length on the Magnetic Behaviour of Fe/Cu Multi-Segmented Nanowires”**

Moraes, S.; Navas, D.; Beron, F.\*; Proenca, M. P.; Pirola, K. R.\*; Sousa, C. T.; Araujo, J. P.

A set of multi-segmented Fe/Cu nanowires were synthesized by a two-step anodization process of aluminum substrates and a pulsed electrodeposition technique using a single bath. While both Fe segment length and diameter were kept constant to (30 +/- 7) and (45 +/- 5) nm, respectively, Cu length was varied between (15 +/- 5) and (120 +/- 10) nm. The influence of the non-magnetic layer thickness variation on the nanowire magnetic properties was investigated through first-order reversal curve (FORC) measurements and micromagnetic simulations. Our analysis confirmed that, in the multi-segmented Fe/Cu nanowires with shorter Cu segments, the dipolar coupling between Fe segments controls the nanowire magnetic behavior, and its performance is like that of a homogenous Fe nanowire array of similar dimensions. On the other hand, multi-segmented Fe/Cu nanowires with larger Cu segments act like a collection of non-interacting magnetic entities (along the nanowire axis), and their global behavior is mainly controlled by the neighbor-to-neighbor nanodisc dipolar interactions.

**NANOMATERIALS 8[7] 490, 2018. DOI: 10.3390/nano8070490**

**[P359-2018] “The Splashback Feature around DES Galaxy Clusters: Galaxy Density and Weak Lensing Profiles”**

Chang, C.; Baxter, E.; Jain, B.; Sobreira, F.\*; et al. DES Collaboration

Splashback refers to the process of matter that is accreting onto a dark matter halo reaching its first orbital apocenter and turning around in its orbit. The clustercentric radius at which this process occurs,  $r(\text{sp})$ , defines a halo boundary that is connected to the dynamics of the cluster. A rapid decline in the halo profile is expected near  $r(\text{sp})$ . We measure the galaxy number density and weak lensing mass profiles around REDMAPPER galaxy clusters in the first-year Dark Energy Survey (DES) data. For a cluster sample with mean  $M-200\text{m}$  mass approximate to  $2.5 \times 10^{14} M(\text{circle dot})$ , we find strong evidence of a splashback-like steepening of the galaxy density profile and measure  $r(\text{sp}) = 1.13 \pm 0.07 h^{-1} \text{ Mpc}$ , consistent with the earlier Sloan Digital Sky Survey measurements of More et al. and Baxter et al. Moreover, our weak lensing measurement demonstrates for the first time the existence of a splashback-like steepening of the matter profile of galaxy clusters. We measure  $r(\text{sp}) = 1.34 \pm 0.21 h^{-1} \text{ Mpc}$  from the weak lensing data, in good agreement with our galaxy density measurements. For different cluster and galaxy samples, we find that, consistent with  $\Lambda\text{CDM}$  simulations,  $r(\text{sp})$  scales with  $R-200\text{m}$  and does not evolve with redshift over the redshift range of 0.3-0.6. We also find that potential systematic effects associated with the REDMAPPER algorithm may impact the location of  $r(\text{sp})$ . We discuss the progress needed to understand the systematic uncertainties and fully exploit forthcoming data from DES and future surveys, emphasizing the importance of more realistic mock catalogs and independent cluster samples.

**ASTROPHYSICAL JOURNAL 864[1] 83, 2018. DOI: 10.3847/1538-4357/aad5e7**

**[P360-2018] “Thermoplasmonic enhancement of upconversion in small-size doped NaGd(Y)F-4 nanoparticles coupled to gold nanostars”**

Martinez, E. D.\*; Urbano, R. R.\*; Rettori, C.\*

Plasmon enhancement of luminescence is a common strategy to boost the efficiency of both fluorescence and upconversion via the augmented local electromagnetic field. However, the local heating produced when exciting the plasmon resonance of metallic nanoparticles is often overlooked.

As higher temperatures are usually detrimental for radiative processes, only the electromagnetic contribution is exploited for enhancement. We show here that for small size (<20 nm) rare-earth doped -NaGd(Y)F<sub>4</sub> upconversion nanoparticles (UCNPs), the photothermal properties of gold nanostars (AuNSs) can be used to enhance the total emission intensity. On the contrary, for UCNPs of larger size, the thermoplasmonic effect is adverse for the emissivity. Therefore, we developed a novel strategy to enhance the emission intensity by combining the thermoplasmonic effect on AuNSs with the size-dependent thermal properties of UCNPs. Furthermore, by following the integrated intensity ratio between the emission lines of Er<sup>3+</sup>, H-2(11/2) I-4(15/2) and S-4(3/2) I-4(15/2), a direct correlation between the local temperature and the emission intensity could be established. Optical thermometry measurements show that the thermoplasmonic effect in AuNSs, with a plasmon absorption band close to the excitation wavelength, can produce an increment of the local temperature of more than 100 degrees C when exposed to 976 nm continuous-wave laser light at 50 W cm<sup>-2</sup> of power density. The results provided here are relevant for the design and implementation of plasmon-enhanced luminescent devices, up-conversion solar-cells, bioprobes and also for hyperthermia.

**NANOSCALE 10[30] 14687-14696, 2018. DOI: 10.1039/c8nr01639a**

**[P361-2018] “Tuning magnetic coercivity with external pressure in iron-rhenium based ferrimagnetic double perovskites”**

Escanhoela Jr, C. A.; Fabbris, G.; Sun, F.; Park, C.; Gopalakrishnan, J.; Ramesha, K.; **Granado, E.\***; Souza-Neto, N. M.; van Veenendaal, M.; Haskel, D.

We studied the effect of physical pressure on the electronic and magnetic properties of ferrimagnetic double perovskites A(2)FeReO(6) (A = Ca, Ba) using Re L<sub>2,3</sub> edge x-ray absorption spectroscopy and powder diffraction measurements. Volume compression is shown to dramatically increase the magnetic coercivity (H<sub>c</sub>) in polycrystalline samples of both compounds with Delta H<sub>c</sub>/Delta V similar to 150-200 Oe/angstrom(3). A nearly eight-fold increase in H<sub>c</sub>, from 0.2 to 1.55 T, is obtained in Ba<sub>2</sub>FeReO<sub>6</sub> at P = 29 GPa. While no signs of structural phase transitions are seen in either sample to similar to 30 GPa, the structural data points to a pressure-driven increase in tetragonal distortion of ReO<sub>6</sub> octahedra. A sizable but pressure-independent Re orbital-to-spin magnetic moment ratio is observed, pointing to the critical role of spin-orbit interactions at Re sites. We present a J(eff) description of the electronic structure that combines effects of crystal field and spin-orbit coupling on the Re 5d(2) orbitals and use this description to provide insight into the pressure-induced enhancement of magnetic anisotropy.

**PHYSICAL REVIEW B 98[5] 054402, 2018. DOI: 10.1103/PhysRevB.98.054402**

**[P362-2018] “Understanding the degeneracies in NOvA data”**

Bharti, S.; **Prakash, S.\***; Rahaman, U.; Sankar, S. U.

The combined analysis of  $\nu(\mu)$  disappearance and  $\nu(e)$  appearance data of NOvA experiment leads to three nearly degenerate solutions. This degeneracy can be understood in terms of deviations in  $\nu$  appearance signal, caused by unknown effects, with respect to the signal expected for a reference set of oscillation parameters. We define the reference set to be vacuum oscillations in the limit of maximal  $\theta_{23}$  and no CP-violation. We then calculate the deviations induced in the  $\nu$  appearance signal event rate by three unknown effects: (a) matter effects, due to normal or inverted hierarchy (b) octant effects, due to  $\theta_{23}$  being in higher or lower octant and (c)

CP-violation, whether  $\delta(\text{CP}) \approx 77/2$  or  $\delta(\text{CP})$  similar to  $\pi/2$ . We find that the deviation caused by each of these effects is the same for NOvA. The observed number of  $\nu$  events in NOvA is equivalent to the increase caused by one of the effects. Therefore, the observed number of  $\nu$  appearance events of NOvA is the net result of the increase caused by two of the unknown effects and the decrease caused by the third. Thus we get the three degenerate solutions. We also find that further data by NOvA can not distinguish between these degenerate solutions but addition of one year of neutrino run of DUNE can make a distinction between all three solutions. The distinction between the two NH solutions and the IH solution becomes possible because of the larger matter effect in DUNE. The distinction between the two NH solutions with different octants is a result of the synergy between the anti-neutrino data of NOvA and the neutrino data of DUNE.

**JOURNAL OF HIGH ENERGY PHYSICS 9, 036, 2018. DOI: 10.1007/JHEP09(2018)036**

**[P363-2018] “Underwater adhesive using solid-liquid polymer mixes”**

Chipara, A. C.; Tsafack, T.; Owuor, P. S.; Yeon, J.; Junkermeier, C. E.; van Duin, A. C. T.; Bhowmick, S.; Asif, S. A. S.; Radhakrishnan, S.; Park, J. H.; **Brunetto, G.\***; Kaipparattu, B. A.; Galvao, D. S.\*; Chipara, M.; Lou, J.; Tsang, H. H.; Dubey, M.; Vajtai, R.; Tiwary, C. S. Ajayan, P. M.

Instantaneous adhesion between different materials is a requirement for several applications ranging from electronics to biomedicine. Approaches such as surface patterning, chemical cross-linking, surface modification, and chemical synthesis have been adopted to generate temporary adhesion between various materials and surfaces. Because of the lack of curing times, temporary adhesives are instantaneous, a useful property for specific applications that need quick bonding. However, to this day, temporary adhesives have been mainly demonstrated under dry conditions and do not work well in submerged or humid environments. Furthermore, most rely on chemical bonds resulting from strong interactions with the substrate such as acrylate based. This work demonstrates the synthesis of a universal amphibious adhesive solely by combining solid polytetrafluoroethylene (PTFE) and liquid polydimethylsiloxane (PDMS) polymers. While the dipole-dipole interactions are induced by a large electronegativity difference between fluorine atoms in PTFE and hydrogen atoms in PDMS, strong surface wetting allows the proposed adhesive to fully coat both substrates and PTFE particles, thereby maximizing the interfacial chemistry. The two-phase solid-liquid polymer system displays adhesive characteristics applicable both in air and water, and enables joining of a wide range of similar and dissimilar materials (glasses, metals, ceramics, papers, and biomaterials). The adhesive exhibits excellent mechanical properties for the joints between various surfaces as observed in lap shear testing, T-peel testing, and tensile testing. The proposed biocompatible adhesive can also be reused multiple times in different dry and wet environments. Additionally, we have developed a new reactive force field parameterization and used it in our molecular dynamics simulations to validate the adhesive nature of the mixed polymer system with different surfaces. This simple amphibious adhesive could meet the need for a universal glue that performs well with a number of materials for a wide range of conditions.

**MATERIALS TODAY CHEMISTRY 9, 149-157, 2018. DOI: 10.1016/j.mtchem.2018.07.002**

## Correções

**[Co005-2018] “Measurement of b hadron lifetimes in pp collisions at root s = 8TeV (vol 78, 2018)”**

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

CMS Collaboration

EUROPEAN PHYSICAL JOURNAL C 78[7] 561, 2018. DOI: 10.1140/epjc/s10052-018-6014-7

\*Autores da comunidade IFGW  
Fonte: Web of Science on-line (WOS)

## Defesas de Dissertações do IFGW

[D014-2018] “Teoremas No-Hair em modelos análogos à gravitação”

Aluno: Guilherme Andretta Faustino  
Orientador: Prof. Dr. Alberto V. Saa  
Data: 09/10/2018

[D015-2018] “Uso de fotomultiplicadora pequena para entender o alcance dinâmico do detector de superfície do Observatório Pierre Auger”

Aluno: Allan Machado Payeras  
Orientador: Prof. Dr. Anderson Campos Fauth  
Data: 19/10/2018

[D016-2018] “Comportamento eletrônico, magnético e estrutural da ludwigita  $\text{Co}_3\text{O}_2\text{BO}_3$ ”

Aluno: Carlos William Galdino  
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[T015-2018] “Investigação de sinais de múons, rádio e fluorescência provenientes de chuviscos atmosféricos extensos de altas energias para análises de composição química”

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Orientador: Prof. Dr. Anderson Campos Fauth  
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[T016-2018] “Filmes de Óxido de Alumínio dopados com Érbio para Fotônica Integrada”

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Orientador: Prof. Dr. Newton Cesario Frateschi  
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Aluno: Sílvia Azevedo dos Santos Cucatti  
Orientador: Prof. Dr. Fernando Alvarez  
Data: 17/10/2018

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Aluno: Denis Eduardo Peixoto  
Orientador: Prof. Dr. Maurício Urban Kleinke  
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