



**2025 SBFoton International Optics and Photonics Conference (SBFoton IOPC)
São Pedro, São Paulo, Brazil / September 21th - 24th 2025**

ABSTRACT

#	Paper ID	Abstract
1	1571152849	This study explores traditional colorants used by the Xetá people, focusing on genipap and a presumed iron oxide. Using UV-Vis spectroscopy, Raman, and EDS, key spectral features and unexpected results emerged. Genipap showed water-related peaks and strong fluorescence in solid and gelatinous forms. The supposed iron oxide also fluoresced strongly and, unexpectedly, contained no iron but high levels of carbon, oxygen, and potassium-indicating a different compound. These findings highlight the need for further investigation and support efforts to preserve the Xetá's cultural heritage through documentation and understanding of their traditional materials.
2	1571155856	This work presents the design and experimental validation of a high-resolution interrogation system for fiber Bragg grating (FBG) sensor arrays, developed using a microcontroller-based architecture. The system implements a twin-grating scheme with a tunable FBG or a Fabry-Perot filter for interrogating multiple FBGs in a single fiber. It integrates optoelectronics and embedded system for real-time processing. To improve resolution, a peak identification algorithm based on polynomial interpolation was implemented. Hysteresis compensation algorithm and a temperature stabilization module are integrated. Experimental results demonstrate a 1.5 pm resolution with the FBG filter, and a 500 Hz scan frequency with the Fabry-Perot filter.
3	1571156210	This paper presents the development of a Spectral-Domain Optical Coherence Tomography (SD-OCT) system designed for high-resolution biomedical and industrial applications, developed using a fiber-coupled Michelson interferometer architecture and GPU-accelerated image reconstruction software. Experimental validation using a human tooth specimen demonstrated the system's ability to resolve sub-millimetric surface features and subsurface structures up to 1.5 mm depth, outperforming photon-counting X-Ray CT imaging in near-surface defect detection. The results achieved acquisition rates of up to 56,000 A-scans/second with 13 μm lateral resolution, highlighting the utility in medical diagnostics and industrial inspections.
4	1571158333	We report a neuromorphic device based on thin films of sodium-doped zinc oxide and activated by light. The surface present reactive mechanisms that allow the changing in electrical conductivity due to the adsorbed molecules from atmosphere. Neuromorphic behavior is induced by light illumination and memory retention is associated to persistent photoconductivity. The retention is enhanced at non-oxidant environment such as vacuum and carbon dioxide, presenting a long-term memory character higher than one hour. At synthetic and free air, the retention is lower, presenting short-term memory character. The role of oxygen is decisive to the memory retention understanding.

- 5 1571158559 Chalcogenide glasses exhibit unique properties that make them promising candidates for advanced photonic applications, including nonlinear optics, optical storage, fibers, and optoelectronic devices. However, producing glasses with tailored properties through a "trial and error" approach is time-consuming and costly. In this study, a Random Forest model accurately predicted the nonlinear refractive index of chalcogenide glasses based on their matrix composition, achieving a mean absolute percentage error below 10% on unseen samples. These results highlight the potential of machine learning to accelerate materials development by drastically reducing the dependence on experimental measurements.

- 6 1571161155 The population lens (PL) effect in the thermal lens (TL) signal is measured in Nd³⁺-doped optical materials. The time-dependent thermal lens signal is obtained from the divergence/convergence of the probe beam after the pulsed or continuous laser excitation. Thermal lens transients are measured for Nd³⁺-doped samples in different glass matrices, such as phosphate, fluoride, and low silica calcium aluminosilicate. Experimental results show different electronic and thermal effects depending on the glass matrices. The intensity ratio of PL and TL is relatively large at the probe beam wavelength and can be clearly differentiated when pulsed excitation is used.

- 7 1571161158 This study evaluated the use of double-pulse laser-induced breakdown spectroscopy (DP-LIBS) combined with machine learning to detect *Escherichia coli* in grape tomatoes. A total of 216 samples were analyzed, with spectral data from elements like Mg, Zn, and P used as input features for classification. The Multilayer Perceptron (MLP) neural network achieved 92.4% accuracy in the test set, outperforming the Random Forest model. The results demonstrate the potential of DP-LIBS as a rapid, non-destructive, and accurate method for food safety monitoring, paving the way for broader applications in the detection of other pathogens in agricultural products.

- 8 1571161365 This paper presents an analysis of data obtained from two arrays of Fiber Bragg Grating (FBG) sensors installed in an underground power distribution network of an urban condominium. Sensors were placed along underground ducts (or conduits) and temperature variations were monitored optically in real time. The results show a correlation between the measured temperature and the ambient temperature, without events exceeding the limits established by current standards. However, the thermal stability observed in the measurements reinforces the feasibility of using FBGs for continuous monitoring in underground networks, contributing to predictive maintenance strategies and increased operational reliability.

- 9 1571162948 Fingerprint biometrics are trusted globally for their precision, but what happens when skin undergoes abrupt changes? This study explores how occupational exposure alters fingerprint structures, affecting biometric reliability. Using Optical Coherence Tomography (OCT), the finger skin of 21 adults from three occupations: educators, mechanics, and cleaning staff, was scanned. Results show visible deformation of fingerprint minutiae, thinning of the stratum corneum, and increased epidermal thickness in those exposed to physical stressors. These changes highlight the impact of occupation on biometric identity. OCT proves a promising, non-invasive tool for detecting skin alterations, advancing dermatological research and secure identification.

- 10 1571165051 Perylene is an organic compound with potential for different optical applications. One important factor that influences the linear responses of organic molecules is the solvent used in the solution. The nonlinear solvatochromism, however, is not as well explored. Thus, we investigate the nonlinear properties alongside photophysical parameters for perylene in toluene, dichloromethane, and chloroform. The two-photon absorption (2PA) spectra (550-800 nm) were obtained by the femtosecond Z-scan technique. A single 2PA band (~25 GM) was observed for all molecules, around 600 nm. Such results indicate minimal variations in the 2PA with different solvents for pure perylene.

- 11 1571165320 This paper presents results about the design of Oxide/Metal/Hydride structures for D-shaped optical fibers with the aim of proposing hydrogen-sensitive devices. A Finite Element model is developed to investigate the effect of each layer thickness on the sensitivity and an optimization routine is suggested. The obtained structure is

- computationally investigated under hydrogen load for concentrations between 0%-4%.
- 12 1571165432 With the growing demand for food, rapid detection methods like LIBS (Laser Induced Breakdown Spectroscopy) are essential to identify chemical compounds. This study utilizes LIBS to characterize 23 Brazilian coffee samples (Arabica and Robusta field-sourced and commercial) to detect nutrients and adulterants. Machine learning was applied to distinguish Arabica from Robusta coffee, using the PCA (Principal Component Analysis) algorithm. Spectra revealed Fe, Mg, Na, Ca, and K as main nutrients, with Al peaks in one Arabica and one commercial sample. LIBS combined with multivariate analysis showed promising results for coffee authentication.
 - 13 1571165647 We present a fiber-based transverse displacement sensor relying on a 3D-printed structure and specklegram analysis. The 3D-printed platform embeds a multimode optical fiber to convert transverse displacements into axial deformation on the optical fiber. By analyzing the measured specklegrams, the sensor demonstrated the capability to quantify transverse displacement increments, showing a sensitivity of $-2.5 \pm 0.1 \text{ mm}^{-1}$, representing the slope of the zero-mean normalized cross-correlation coefficient response to transverse displacements. We believe that this work presents a promising approach for developing fiber sensors for mechanical parameter measurement, broadening their applicability in areas such as structural health monitoring and precision positioning.
 - 14 1571165709 This work presents the electrical and optical characterization of the 3AWA16 device, evaluated under dark conditions and illumination at wavelengths of 455 nm, 470 nm, 505 nm, and green laser ($\sim 520 \text{ nm}$). Current-voltage (I-V) measurements reveal a marked increase in photocurrent in the presence of light, particularly under green laser illumination, where the current reaches values around $100 \mu\text{A}$. Pulsed responses observed in the visible range suggest a functional photodetector behavior with sensitivity dependent on both the wavelength and light intensity. The results highlight the device's potential for applications in visible-range optoelectronics, especially for green light detection.
 - 15 1571166295 Delayed results required to determine the five-day biological oxygen demand - BOD5 hinder the ability of wastewater treatment plants - WWTP reacting to different situations and meet treatment goals. Reducing BOD turnaround time from days to a few hours was our quest. Such solution is based on a system of two batch bioreactor end-devices associated to a cloud internet-of-things platform. Such approach aims to monitor and control a WWTP to support decision-making.
 - 16 1571166542 This study presents a green synthesis of Ag nanoparticles using waste açai seeds and xenon lamp photoreduction, controlled by current (10-15 A or 0.4-8 W) and time (0-8 min). Optimal conditions prevented aggregation, as confirmed by both UV-Vis and SPR bands (at 425 nm for Ag). Three kinetic regimes were identified: diffusion-limited ($<10 \text{ \AA}$), cooperative reduction (10-15 \AA), and saturation ($>15 \text{ \AA}$). The method efficiently upcycles organic waste into well-defined bimetallic nanoparticles, emphasizing precise current and short irradiation times.
 - 17 1571166739 This study contrasts the Speckle intensity curves of soil samples with clay and sand. The technique used was Speckle interferometry and the analysis was the computational method based on the Time History Speckle Pattern, THSP, and Error Theory.
 - 18 1571167190 This study investigates polarization-dependent photoinduced effects in As_2S_3 and As_2Se_3 thin films excited by fs-laser pulses operating in the telecommunications range. The findings demonstrated the localized formation of structural defects, including crystallization, and revealed anisotropy-induced birefringence that varied with laser parameters.
 - 19 1571168008 Antibiotic quality has always been a concern in the pharmaceutical industry and the World Health Organization (WHO), especially in the growing and emerging antimicrobial resistance crisis. FTIR spectroscopy can contribute to the monitoring of antimicrobials, especially when coupled with chemometric techniques. The present work aims to investigate spectral differences of Ampicillin samples through FTIR

- qualitatively and quantitatively, highlighting the spectral differences associated with different degradation conditions (acidic and thermal).
- 20 1571168607 This study presents a Raman spectroscopy protocol for the analysis of dental tissues, focusing on the ratio between mineral peaks of phosphate (960cm^{-1}) and carbonate (1070cm^{-1}). We investigated samples from distinct conditions: femtosecond laser-treated teeth; teeth with Hypomineralization; and after ionizing radiation. Our results consistently demonstrate the technique's ability to detect significant modifications in the mineral content of dental tissues. Raman spectra revealed changes in peak area, especially in the carbonate/phosphate ratio, allowing the identification of mineral loss or modification. The technique enabled the detection of early alterations related to demineralization, reinforcing its role in dental diagnostics and treatment evaluation.
- 21 1571169018 In this study, laser-induced breakdown spectroscopy (LIBS) proved to be a promising alternative for direct and rapid multi-element analysis of 54 samples from three different areas, requiring minimal sample preparation. A calibration model was developed and validated for the carbon (C) line at $247,86\text{ nm}$. Furthermore, machine learning techniques were applied to distinguish soils fertilized with solid and liquid fertilizers, as well as non-fertilized soils, achieving an accuracy above 98.3%. Principal Component Analysis (PCA) was used to cluster these soils, confirming the separation of the groups.
- 22 1571169042 Non-invasive oximetry is essential for continuous blood oxygen monitoring in routine and critical care. Evidence suggests pulse oximeters may be biased by melanin absorption, affecting accuracy in individuals with darker skin. In this prospective study of 100 ICU patients, simultaneous SpO_2 and SaO_2 were recorded, and skin tone was objectively measured using ITA[®] at dorsal hand site. LED emission spectra were also analyzed. Within the 85%-100% SaO_2 range, two of the three devices exceeded the 3% ARMS threshold. The most accurate oximeter had a longer-wavelength, narrower-band infrared LED, underscoring the need for optimized optics and objective pigment evaluation.
- 23 1571169048 A hybrid optical frequency comb generator is demonstrated using two CW lasers modulated by a single-drive Mach-Zehnder Modulator (SD-MZM) and spectrally broadened through four-wave mixing in a highly nonlinear fiber (HNLFF). The initial 150 GHz carrier spacing is converted into multiple equidistant tones across the C-band. By adjusting the MZM bias from 4.9 V to 5.25 V, the comb spacing is tuned from 50 GHz to 25 GHz, enabling flexible DWDM grid adaptation. The proposed architecture combines electro-optic and Kerr effects using standard components, making it suitable for 5G/6G photonic systems and reconfigurable optical networks.
- 24 1571169061 Accessing skin tone has gained significant relevance in recent decades, mainly due to the increased use of images for diagnostics and cosmetology. Color categorization methods like the Individual Typology Angle and the Monk scale have been used to mitigate this bias. In this study, we present a comprehensive evaluation of the correlation between these two scales through Monte Carlo computational simulation. Results indicate the Monk palette provides better segmentation for darker skin tones, but does not represent real human skin tones at the lighter end of the spectrum.
- 25 1571169364 We investigate the suitability of the algorithm based on the auto-correlation of the signal power waveform (ACSPW) to estimate accumulated chromatic dispersion (CD) in intensity modulation with direct detection (IMDD) systems with transmitter CD precompensation. Simulation and experimental results validate the accuracy of the ACSPW method in IMDD systems, while also highlighting its limitations in estimating low accumulated CD values. To circumvent this issue, we propose to intentionally include additional dispersion at the transmitter during system startup, driving the algorithm towards appropriate estimation conditions.

- 26 1571169635 Distributed Acoustic Sensing (DAS) systems have emerged as a high-potential solution for a wide range of applications, including vehicular monitoring. A key challenge in DAS signal processing is the reliable detection of anomalies within high-dimensional data streams, particularly under scarce anomalous training samples. In this work, we propose an autoencoder-based approach for anomaly detection in DAS systems. The method employs a fully connected neural architecture trained on normal traces to model typical system behavior. Reconstruction errors are then used to identify anomalous traces. The approach is validated on an open-access DAS dataset, demonstrating the model's ability to identify anomalous traces.
- 27 1571169711 Carboxyl-functionalized graphene oxide (GO-COOH) is a well-known 2D material with outstanding nonlinear saturable absorption characteristics. When deposited on D-shaped optical fibers, it provides strong evanescent-field coupling, enabling efficient mode-locking in fiber lasers. This work demonstrates, for the first time, the use of blade coating to integrate graphene oxide onto D-shaped fibers, offering a simple, material-efficient, and controlled method for thin film deposition. Using this approach in an erbium-doped fiber laser (EDFL) achieved 240 fs pulses, confirming the potential of blade-coated graphene oxide for ultrafast photonics and advancing practical femtosecond laser technologies.
- 28 1571169724 This work aims to address and review concepts related to the propagation of optical radiation in turbid media. The radiative transfer equation (RTE) is essential to understand how radiation propagates and interacts with matter. To this end, concepts from electromagnetism and statistical physics will be used to derive the general RTE, which describes multiple scatterings of light by a turbid medium composed of arbitrary particles. Comparisons will also be made with the Boltzmann equation. Additionally, Monte Carlo simulation is commonly used to approximate solutions to both the RTE and the Boltzmann equation.
- 29 1571169734 This paper presents an experimental implementation of a Beyond 5G (B5G) communication system for smart farming, integrating Radio-over-Fiber (RoF) and Power-over-Fiber (PoF) technologies. A 2.3 GHz B5G signal is transmitted over a 10-km Single-Mode Fiber (SMF) RoF link, while 5 W of optical power is delivered through a 1-km Multi-Mode Fiber (MMF) PoF link. At the Remote Antenna Unit (RAU), power is converted and regulated to supply the RoF receiver and enable short-range wireless coverage via antenna. RoF and PoF subsystems are validated in terms of EVM and power stability, confirming R-PoF's viability for rural B5G smart farming deployments.
- 30 1571169843 Water scarcity is a major limiting factor for agricultural productivity, often causing physiological damage before visual symptoms are noticeable. Early detection of water stress is essential for sustainable crop management. This study integrates photonic techniques-infrared thermography and chlorophyll fluorescence imaging-with artificial intelligence (AI) to detect early physiological responses to water deficit in plants. These non-invasive tools capture subtle changes in temperature and photosynthetic activity, generating complex datasets. Machine learning algorithms were applied to classify stressed and non-stressed plants accurately, based on these signals. The combined approach demonstrates strong potential for enhancing early diagnosis of plant stress and sustainable agricultural practices.
- 31 1571169856 The early detection of plant diseases is essential for sustainable cotton production, particularly in response to emerging threats such as *Aphelenchoides besseyi* recently identified in cotton crops. This study investigates the use of photonic techniques-infrared thermography, fluorescence imaging, and laser-induced fluorescence spectroscopy (LIFS) to detect physiological changes in cotton plants under nematode stress. These non-invasive methods capture temperature variations and fluorescence signals related to plant metabolism. Combined with classification algorithms, photonic data enabled early identification of infected plants before visual symptoms appeared. Results demonstrate the potential of integrated photonics and AI for early, accurate disease diagnosis.

- 32 1571170003 This paper investigates Bidirectional Long Short-Term Memory (Bi-LSTM) recurrent neural networks for nonlinear compensation in digital coherent optical systems. Simulations were conducted for a 112 Gbps DP-16QAM system over a 140 km link, exploring various Bi-LSTM configurations with different memory cell and tap counts. Within the tested parameter range, results show that increasing the number of taps improves bit error ratio (BER) performance by mitigating nonlinear intersymbol interference, but also raises computational complexity. The findings emphasize the need for multi-objective optimization during the hyperparameter selection to achieve a trade-off between computational cost and nonlinear compensation effectiveness in practical optical systems.
- 33 1571170013 This paper compares the gain and loss coefficients of erbium-ytterbium-co-doped calcium-zinc and sodium-zinc phosphate glasses. The results show that sodium-zinc phosphate glasses exhibit a 1.2 dB/mm transmission loss coefficient and an on-off gain of 2.3 dB/mm for a 5 mm thick sample. As for the calcium-zinc phosphates, they present a slightly higher loss coefficient of 1.3 dB/mm and an on-off gain of 2.1 dB/mm for the same sample thickness. This experimental characterization reveals that both glasses present similar performance, so other factors related to synthesis and hydrophility will be determinant in the matrix selection.
- 34 1571170036 We investigate the application of the best match search technique for chromatic dispersion (CD) estimation in single sideband pulse amplitude modulation 4-level (SSB-PAM-4) systems using a Kramers-Kronig receiver. We propose employing a cost function previously derived for ML-based PAM-4 signal equalization and compare it with the one based on the constant modulus algorithm (CMA), originally derived for M-QAM coherent systems. The results demonstrate that the PAM-4-based cost function (CF) offers higher accuracy and robustness in CD estimation compared to the CMA-based one, including the implementation of smaller NFFT sizes, for which the CMA-based one fails.
- 35 1571170599 This work shows a ReLU-like activation function generated by the emission of a Nd:YVO random laser. The emission response was fitted and implemented as a custom activation function in a neural network trained on the MNIST dataset, achieving an accuracy of 96%. This indicates the potential of random lasers as optical activations for future optical neural network architectures.
- 36 1571170663 This work presents a comparative study between single-clad (SCF) and double-clad (DCF) fiber designs, focusing on modal propagation and tolerance to the transverse mode instability (TMI). Analytical solutions for LP_{mn} modes and numerical simulations are used to analyze the transverse intensity distributions and the influence of structural parameters on the TMI onset threshold in high-power fiber lasers. Results show that DCFs exhibit greater tolerance to TMI, attributed to the broader transverse mode distribution in lower-index regions, which enhances optical confinement and thermal dissipation.
- 37 1571170735 This paper presents the implementation of a Lagrange-based processor extension for woofer-tweeter adaptive optics control. The approach leverages the complementary response of two deformable mirrors to compensate for a broad range of wavefront aberrations. Applications include high-energy laser propagation through the atmosphere, where adaptive optics mitigate distortions caused by turbulence, enabling improved beam focus and reduced scintillation in scenarios such as free-space optical communication and energy transmission.
- 38 1571170773 Lens-free holographic microscopy (LHM) is a compact and cost-effective imaging technique with growing applications in biomedical analysis. This work presents the development and characterization of two key components for a multispectral LHM system: a compact, current-controlled RGB light source and a graphical control interface developed in Python. The light module delivers precise and efficient current regulation, with low ripple and thermal stability, while the software interface enables automated multiframe acquisition and time-lapse imaging requiring reduced user intervention. Together, these modules contribute to making LHM setups more accessible and reproducible.

- 39 1571170927 This study evaluates the classification of oral squamous cell carcinoma (OSCC) using micro-FTIR hyperspectral imaging and two tree-based models: Random Forest and XGBoost. After preprocessing and PCA, class imbalance was addressed with AIKNN and Tomek Links. Both models achieved high accuracy, and key spectral bands-Amide I, II, and III-were consistently highlighted, supporting their relevance in oral cancer detection.
- 40 1571171107 Barium titanate (BaTiO_3) perovskites exhibit notable optical properties, which are further enhanced by Er/Yb ions doping, making them promising for advanced photonic applications. Embedding BaTiO_3 : Er/Yb (BTEY) in polymeric resins can boost optical nonlinearities and enable the creation of functional 3D microstructures. This study presents the fabrication and characterization of BTEY-embedded microstructures via two-photon polymerization (2PP), including analysis of powder and resin properties. The resulting structures exhibit a smooth surface (RMS ~ 27 nm) and uniform nanoparticle incorporation, with morphological and structural characteristics that are suitable for integrated photonic device applications.
- 41 1571171198 The hybrid routing and spectrum assignment (HRSA) algorithm for the RSA problem in elastic optical networks (EONs) outperforms the classical RSA algorithms. However, the decision-making process remains largely unexplained. Here, we propose a methodology to study how topological features steer HRSA's adaptive choices between RSA ordering for source-destination node pairs in EONs. Using machine learning models, we aim to identify key topological metrics that govern HRSA's choices. The methodology provides a roadmap for deriving insights into the most relevant metrics to explain HRSA algorithm. Results show that it is possible to identify the minimum set of features that explain HRSA.
- 42 1571171211 Zinc sulfide (ZnS) is a wide band gap semiconductor with numerous technological applications in optical devices. In this study, nanostructured Ag-doped ZnS samples were prepared by solvothermal method. Pure-ZnS sample exhibits cubic symmetry of sphalerite structure whereas samples with higher values of Ag content exhibits coexistence of sphalerite structure and wurtzite structure with hexagonal symmetry. Photoluminescence spectra present typical four emissions ascribed to Zn and S vacancies, Zn and S interstitials for ZnS host matrix. As the Ag content increases, the relative intensity increases for red-orange emissions and an additional emission is observed, allowing a tunable photoluminescence emission with Ag-doping.
- 43 1571171214 This paper investigates the impact of fiber optic length, and, in consequence, the propagation latency between Distributed Units (O-DU) and Radio Units (O-RU) in Open Radio Access Networks (OpenRAN). The analysis is based on the following key performance metrics: Reference Signal Received Power (RSRP), bitrate between O-RU and User Equipment (UE), and average transmission delay from Core Network (CN) to UE. The goal is to correlate fiber physical distance with signal quality, network throughput, and latency, providing essential insights for planning and optimizing OpenRAN networks, especially in challenging scenarios.
- 44 1571171222 This paper presents the analysis of a fully optical Finite Impulse Response filter, designed via direct realization, which enhances data transmission rates in optical communication systems. As optical fibers present issues like chromatic dispersion (CD), our method reduces reliance on complex Digital Signal Processing (DSP) techniques, thereby lowering system costs. The photonic chip aims to lessen overall system costs by using phase shifters, delay lines, and attenuators to compensate for the CD. The promise of optical filters as an effective way to improve performance in optical networks is highlighted by this study.
- 45 1571171231 We demonstrate a new method to deposit carbon nanotubes (CNT) on optical fibers based on a syringe-loaded CNT solution axially aligned to the fiber tip. A laser generates an optical tweezer in a water-based CNT solution, depositing nanotubes over the fiber cross-section. The parameters are adjusted, resulting in two deposited CNT layers with distinct thicknesses. This setup employs smaller solution volumes than those commonly used in beakers, providing high confinement, protection, and interaction of nanotubes, laser, and fiber, offering a promising alternative for real-time monitoring, which are significant to the development of industrial fiber lasers and biomedical optoacoustic devices.

- 46 1571171240 This work compares clustering techniques for self-phase modulation (SPM) mitigation, evaluating k-means, Gaussian mixture models (GMM), density-based spatial clustering for applications with noise (DBSCAN), and ordering points to identify the clustering structure (OPTICS) on experimental 32 GBd dual polarization 16-ary quadrature amplitude modulation (DP-16QAM) signals. Results show all clustering methods surpass maximum likelihood detection, with GMM and DBSCAN achieving the best performance. GMM outperforms at higher powers, while DBSCAN excels at lower powers but demands careful tuning.
- 47 1571171249 In this study, nanostructured ZnO-Mg samples were prepared by polymeric precursor method. Pure ZnO sample exhibits hexagonal symmetry of wurtzite structure. Samples with Mg content equal to 30 and 40 at. % exhibit the presence of secondary phase indexed as MgO. Photoluminescence spectra present typical emissions for ZnO. As the Mg content is incorporated exceeding the solubility limit, the relative intensity decreases for green emissions, which has been attributed to the formation of defects like Mg_i, inhibiting the formation of Zn_i and V_{Zn}. Thus, red shift tunable photoluminescence emission is observed with Mg incorporation, as depicted by CIE coordinates.
- 48 1571171264 This work presents an experimental characterization of a high-concentration L-band EDFA prototype's performance. The analysis focused on gain and noise figure across a wide range of pump and input signal powers. Various pumping configurations were investigated, including forward, backward, and diverse bidirectional power distributions. Results indicate a potential signal gain exceeding 22 dB with a noise figure below 4.5 dB, considering equalized output power. Notably, a significant increase in signal gain, exceeding 10 dB at some operating points, was observed, achievable by simply varying the pumping configuration with the same available pump power.
- 49 1571171268 This work presents a comparative study of pseudo-random (PRNG) and quantum-random (QRNG) number generators based on a combination of random-walk-based variance analysis and uniformity assessment. The analysis shows that the quantum source presents the expected variability patterns and exhibits closer agreement with an ideal uniform distribution, while pseudo-random shows wider dispersion and bias. These findings indicate that QRNG presents better performance for applications that require the highest levels of randomness integrity.
- 50 1571171272 We demonstrate saturable absorption with a 1T'-MoTe₂ layer placed onto a silicon-on-insulator based microring resonator. We measured and modeled the transmission behavior of the structure as a function of input power. An absorption saturation power as low as 1.8(1.0) micro Watts was observed.
- 51 1571171275 This study applies OPC-LIBS approach to quantify total C, K, Ca, Mg, Cu, Fe, and Na in Brazilian soils. A Boltzmann-based correction model was used to reduce Al interference in the C I 193.03 nm line. While matrix effects limited the correction model across different samples, OPC-LIBS using Al as an internal standard improved the accuracy (>90%) for all elements, comparable to CHNS and AAS. The results demonstrate LIBS as a fast, accurate, and environmentally sustainable alternative for large-scale multielement soil analysis.
- 52 1571171277 This paper presents a theoretical investigation of the transverse mode instability (TMI) threshold in Yb-doped double-clad fibers (Yb-DCFs). The analysis is based on the semi-weak guiding approximation, applied to the LP₀₁ and LP₁₃ modes. The thermally-induced modal coupling is modeled using coupled differential equations, and the TMI threshold is analytically estimated as a function of the fiber core diameter. Results show that, above the critical threshold, power transfer occurs between modes, highlighting the importance of thermal and modal modeling in the design of more stable fibers for high-power applications.

- 53 1571171279 Melanoma is the most aggressive form of skin cancer due to its high metastatic potential. Nonlinear microscopy techniques were employed to analyze human melanoma biopsies. The aim was to quantify the organization of collagen fibers and cellular segments in intratumoral (T) and non-tumoral (NT) regions. Images were analyzed using an automated software to obtain quantitative morphological parameters. Statistical models were applied to compare T and NT and achieved 88% accuracy (95% confidence interval (CI): 84%-91%). These results indicate that alterations in collagen architecture are associated with tumor progression and may serve as potential biomarkers in melanoma.
- 54 1571171345 Fluorescence imaging is a non-destructive photonic technique that offers an alternative to traditional methods for monitoring biotic and abiotic stress in plants. We developed a fluorescence imaging-based platform for greenhouse use and tested it on 300 cotton plants divided into three groups: healthy, under water stress, and inoculated with nematodes. A preliminary classification analysis achieved accuracy above 70%, even at the pre-symptomatic stage of infected plants. These results indicate the platform's potential for acquiring fluorescence images containing stress-related information in plants, highlighting its value as a tool for plant phenotyping and precision agriculture.
- 55 1571171399 The synthesis of nanomaterials with tunable optical and magnetic properties is essential for applications in nanomedicine, sensing, and bioimaging. This work explores Laser Ablation in Liquid (LASiS) as a clean and efficient method for producing hybrid nanoparticles for use as SERS (Surface-Enhanced Raman Spectroscopy) substrates. We synthesize and characterize two types of hybrid nanoparticles: metallic Au-Ag alloys and core-shell Au-Fe(oxide) structures. The study demonstrates how LASiS enables the engineering of nanomaterials with enhanced properties for electric field amplification in vibrational spectroscopy, highlighting its potential as a versatile tool for nanobiophotonics applications through a unified experimental approach.
- 56 1571171409 Light-based therapies, such as photobiomodulation, can induce significant thermal effects due to superficial light absorption, particularly in melanin-rich tissues. This study employed artificially pigmented porcine skin to model pigmented skin and evaluate thermal responses under laser exposure. Three therapeutic laser protocols were tested, with continuous temperature monitoring via infrared thermography. Artificial pigmentation significantly increased heat absorption: carbon black caused rises above 20 °C, while permanent marker remained under 3 °C. Findings emphasize the importance of selecting appropriate pigments in ex vivo thermal safety studies. Future research should incorporate computational modeling and human skin analogs for improved translational relevance.
- 57 1571171459 This work proposes a multi-objective optimization framework using NSGA-II to tune Multilayer Percetron (MLP)-based nonlinear equalizers for digital coherent optical systems. A 400 Gbps DP-16QAM link, compliant with the OIF 400ZR standard, was simulated over 120 km. Hyperparameters such as normalization, activation functions, and network size were optimized to balance bit error ratio (BER) and computational complexity measured in FLOPs. Results show that significant complexity reductions are achievable with minimal BER penalty. The study demonstrates the effectiveness of multi-objective approaches for MLP equalizer design, providing insights into optimal configurations suitable for practical high-speed optical interconnects under resource constraints.
- 58 1571171463 This study explores the optical properties of erbium (Er³⁺)-doped fluoroindate glasses, emphasizing absorption and emission in the near-infrared (NIR) and visible regions. Rare-earth doping enables luminescence and upconversion, relevant for photonics, sensors, and lasers. Fluoroindate glasses stand out for wide transparency, low phonon energy, and high dopant solubility, reducing non-radiative losses and enhancing luminescence. The objective is to investigate energy transfer, upconversion, and luminescence efficiency for advanced optical devices. Results reveal an average $^4I_{13/2} \rightarrow ^4I_{15/2}$ lifetime of 10.1 ms with nearly ~100% quantum efficiency, confirming strong potential for efficient lasers and optical amplifiers.

- 59 1571171695 We report on the early-stage development of a fiber-based quantum key distribution (QKD) testbed using attenuated laser pulses designed to operate under the Coherent-One-Way protocol with decoy-state preparation, reaching photon levels (μ) in the range of 0.1 to 1.0 photons/pulse through intensity modulation. In Coherent-One-Way (COW) protocol, logical bits are encoded in the temporal position of weak coherent pulses, and quantum coherence between successive pulses is monitored to detect eavesdropping. Single-photon detection is achieved with InGaAs SPADs, and calibrated attenuation ensures sub-photon regimes. This setup enables the study of channel loss, error rates, and secure key generation under realistic conditions.
- 60 1571171848 This work presents the use of laser-induced fluorescence spectroscopy (LIFS) and machine learning models to detect signals of nematode infection in cotton plants. The fluorescence spectrum is measured using a laser diode and a spectrometer. We trained several machine learning models and AdaBoost performed the best with accuracy of higher than 85%. The results show that the LIFS technique combined with a machine learning model can effectively differentiate healthy cotton plants from nematode-infected ones with high accuracy and precision. This indicates the great potential of the LIFS technique as an auxiliary tool for nematode detection in cotton crops.
- 61 1571172122 Soils are major carbon sinks, with mineral-associated organic matter (MAOM) playing a key role in long-term carbon storage. This study evaluated the impact of pasture management on MAOM stocks and chemistry in a long-term experiment in Brazil. MAOM from degraded (DP), managed pasture (RMS), and native vegetation (NV) were isolated and analyzed with C K-edge XANES spectroscopy. MAOM stocks were highest in RMS, which showed greater accumulation of aliphatic, carboxylic, phenolic, and O-alkyl carbon. Results indicate that improved pasture management enhances soil organic carbon stocks by increasing forage inputs and promoting biochemical transformations that stabilize carbon in the MAOM fraction.
- 62 1571172142 Lead (Pb) contamination in food, worsened by pesticide use, is a growing global concern. Rapid identification methods for this contaminant are crucial. Laser-Induced Breakdown Spectroscopy (LIBS) is a promising tool, enabling swift spectral analysis without complex preparation. This study contaminated tomato seedlings with Pb and analyzed their leaf spectra using LIBS at 15, 30, and 45 days. A calibration curve allowed quantifying Pb in the leaves, demonstrating LIBS's effectiveness in monitoring.
- 63 1571172144 This work presents a new technique, Polarization-Resolved Heterodyne Z-Scan (PR-HZS), which is capable of discriminating and quantifying three different nonlinear refractive indices: ultrafast nonresonant electronic, molecular orientation (or nuclear) and thermal. This technique explores laser polarization and phase delay introduced by non-instantaneous nonlinearities to separate these nonlinear effects. Femtosecond pulses at megahertz repetition rate are used to induce simultaneously these nonlinear effects in different materials. We characterized Carbon Disulfide (CS₂), SF₆ and LaSF-N30 optical glasses, and a Neutral Density Filter AND-30C-40, which are known to present more than one nonlinearity.
- 64 1571172150 We propose a biodegradable, flexible device made of agar hydrogel for soft manipulation tasks. The device responds to electrostatic forces and performs a contactless-driven deflection by exploring the polar nature of the agar-glycerol matrix. Furthermore, the structure integrates a concatenated multimode optical fiber probe for deformation sensing through speckle pattern analysis. Experimental results validate a simplified Euler-Bernoulli beam modeling and reveal a linear relationship between displacement and specklegram correlation coefficient. A pilot test demonstrated the device's ability to grasp objects through symmetric movement, suggesting its suitability for applications in soft robotics and biomedical micromanipulation.

- 65 1571172319 This study examines the dielectric modulation of silver nanowire (AgNW) networks via atomic layer deposition (ALD) of ~2 nm Al₂O₃ and its effects on plasmonic and optical properties. The coating preserved morphology and reduced roughness, as confirmed by AFM. UV-Vis spectroscopy revealed a redshift and broadening of the LSPR peak. Raman and fluorescence analyses showed wavelength-dependent effects: enhanced SERS at 532 nm, attenuation at 633 nm, and suppressed metal-enhanced fluorescence (MEF) after coating. Time-resolved photoluminescence indicated shorter decay times due to dielectric screening. These findings support ALD-grown Al₂O₃ as a tunable modulator for nanoplasmonic sensing applications.
- 66 1571172356 This study evaluated class balancing strategies for classifying oral squamous cell carcinoma (OSCC) in FTIR hyperspectral images using the XGBoost model. Although the dataset was balanced at the image level, spectral quality filtering introduced pixel-level class imbalance. Resampling methods -SMOTE, Tomek Links, and their combination -were tested, as well as AllKNN for redundancy reduction. All approaches outperformed the unbalanced baseline, but the best overall performance metrics were achieved with the combined use of AllKNN and Tomek Links.
- 67 1571172368 Laser Induced Breakdown Spectroscopy (LIBS) presents advantages such as rapid analysis and low cost per sample when compared to traditional methods like ICP-OES. This study explores the application of double-pulse LIBS combined with the LIBSsa software for automated analysis of macro and micronutrients in plant material. The models developed achieved R² values above 0.78 for Ca, Cu, Mn, and Fe, confirming the technique's potential for agricultural diagnostics. The automation provided by LIBSsa enabled fast and accurate data processing, supporting the use of LIBS for assessing plant nutritional composition and enhancing its applicability in agricultural and environmental research.
- 68 1571172396 This study evaluated the use of Double Pulse Laser-Induced Breakdown Spectroscopy (DP-LIBS) combined with machine learning to detect asymptomatic soybean leaves infected by *Aphelenchoides besseyi*, the causal agent of Green Stem and Foliar Retention Syndrome (GSFR). Spectral lines corresponding to macro- and micronutrients were selected as input features for classification models. The Support Vector Machine achieved 95.7% accuracy, while the Multilayer Perceptron reached 92.9%. The enhanced sensitivity of DP-LIBS allowed detection of additional micronutrient signals, enhancing classification accuracy. Results demonstrate the potential of LIBS as a rapid, non-destructive diagnostic tool for early disease detection in precision agriculture.
- 69 1571172397 This study shows that laser-induced breakdown spectroscopy (LIBS), combined with one-point calibration (OPC) and a dual-laser system, provides a rapid, cost-effective alternative to conventional methods like atomic absorption spectroscopy (AAS) and inductively coupled plasma mass spectrometry (ICP-MS) for detecting heavy metals in tomatoes. OPC-LIBS quantified cadmium and lead with 93% and 89% accuracy, achieving low limits of quantification (0.03 mg/kg for Cd, 0.08 mg/kg for Pb), complying with ANVISA and EU standards. These results validate OPC-LIBS as a scalable, environmentally friendly approach for real-time contaminant monitoring, offering strong potential for integration into agri-food quality control systems.
- 70 1571172407 This work presents an optimization approach for polymer-based electro-optic phase modulators, focusing on the role of the upper electrode width for improving the trade-off between the overlap integral factor and the half-wave modulation voltage. These two parameters are inversely related and are critical for the modulation performance. In contrast to previous studies that adjusted these parameters individually, we optimized the geometry of the upper electrode, waveguide rib, substrate and claddings simultaneously to achieve a high modulation efficiency. The results provide design guidelines for optimizing modulation efficiency in electro-optic polymer modulators.

- 71 1571172409 This study evaluates the use of fluorescence imaging combined with machine learning models for the early detection of water stress in cotton plants. Fluorescence images of UV-excited leaves were used to extract color and texture features, which were then analyzed using different machine learning algorithms. The Discriminant Analysis model achieved an overall accuracy of 0.86. Remarkably, water stress was detected with high accuracy (up to 0.96) even before visual symptoms appeared. These results highlight the potential of this technique as a robust and non-invasive tool for early stress detection in plants.
- 72 1571172414 We experimentally demonstrate a stimulated Brillouin scattering fiber ring laser (SBS-FRL) in which an amplified acetylene-stabilized continuous-wave laser (1542.384-nm) works as a pump while strong nonlinear optical distributed gain for the back-reflected wave is provided by 24-m polarization-maintaining-fiber in a ring optical cavity. A 1542.470-nm continuous wave laser with 81.9-kHz linewidth was generated by stimulated backward Brillouin scattering. A low-phase-noise X-band microwave signal at 10.9-GHz with a signal-to-noise ratio of 53-dB, is generated by optical heterodyne beating on photodiode. Our results show that such SBS-FRL has great potential in applications such as radar, radio-over-fiber, optical sensing and satellite communications.
- 73 1571172415 This work presents the design and implementation of a low-cost driver for controlling a blue laser diode in pulsed mode, intends primarily for treating superficial vascular lesions such as telangiectasias. The system features a microcontroller-based pulse generation unit, power modulation, and active thermoelectric cooling to ensure diode safety and operational stability. Its modular design enables configuration of pulse width, frequency and pulse intensity, allowing it to be scalable to other biomedical laser applications. The proposed driver emphasizes affordability, energy efficiency, and adaptability for clinical and research environments.
- 74 1571172419 Growing interest in integrated photonics is driving demand for efficient, versatile, and scalable materials. Two-photon polymerization (2PP) is a promising method for fabricating high-resolution, low-cost microstructures by embedding functional components in a polymer matrix. In this study, MoS₂ nanoparticles were incorporated into a commercial resin and used for 2PP via direct laser writing. A range of characterization techniques - including SEM, DLS, EDX, AFM, and Raman spectroscopy - examined particle size, morphology, and MoS₂ integration. The characteristic E_{2g}¹ and A_{1g} Raman modes confirmed successful integration, highlighting the potential of these hybrid composites for integrated photonic applications.
- 75 1571172420 Automation in laboratory spectroscopy is still limited by the high cost and restrictive nature of proprietary systems. This work presents a modular, open-source platform designed to enable affordable, scalable, and reproducible spectroscopy experiments. The system integrates a modified computer numerical controlled (CNC) milling machine with interchangeable 3D-printed sensing heads, supporting standard microplate formats for spectroscopic measurements. The hardware is controlled through a Python library that manages motion control, data acquisition, and automated workflows. Validation experiments on LED emission spectra characterization and fluorescence analysis of fluorescein and rhodamine B demonstrate the platform's versatility.
- 76 1571172429 This pilot study investigates whether the position of Optical Coherence Tomography (OCT) measurements affects the thickness of the stratum corneum (SC) and the width of external ridges (ER) at the center of the digital. OCT images were acquired from six healthy male volunteers at four fingertip positions. Statistical analysis revealed no significant differences in SC or ER measurements across positions. These findings suggest that OCT provides stable and position-independent assessments within the digital core region, supporting its use in dermatological and biometric applications, and guiding future clinical studies involving skin microstructure analysis.

- 77 1571172488 The generation of accurate 3D brain models from medical imaging sources, such as Magnetic Resonance Imaging (MRI) scans, is essential for medical visualization, surgical simulation and educational purposes. However, most existing tools often require significant expertise in medical image processing and command-line environments, therefore, this work presents EasyBrainGen, an automated and easy-to-use web-based workflow that transforms MRI images into anatomically precise 3D Brain Models via FastSurfer Deep Learning Convolutional Neural Network (CNN) without any technical configuration and lowering the barriers for researchers, clinicians and educators.
- 78 1571172661 This study evaluates the use of Laser-Induced Fluorescence Spectroscopy to differentiate biotic and abiotic stress in cotton plants. Machine learning algorithms were applied to develop prediction models and characterize the different stresses. The results showed accuracy up to 89% while in asymptomatic phase from both stresses.
- 79 1571172667 Black carbon (BC) nanoparticles, formed by incomplete fossil fuel combustion, pose environmental and health risks. This study examines how dispersion and clustering in different aqueous media: Milli-Q water, alkaline solution (pH 13), and 5% coconut oil-affect their molecular electronic states. Using UV-Vis-IR spectroscopy and confocal microscopy, we found that coconut oil promotes superior dispersion ($n=0.98$), while the alkaline medium also improves dispersion ($n=1.0$). In contrast, neutral water favors agglomeration ($n=0.8$). Results highlight the strong influence of particle-particle interactions on BC's optical and electronic properties, with implications for environmental reactivity and pollution control strategies.
- 80 1571172710 The Dronissil project develops a device for drones to reduce agrochemical use and promote sustainable farming. Using infrared cameras and AI, it identifies pests like caterpillars while protecting beneficial organisms. Once detected, a laser precisely eliminates the pests. Retractable, rotating cylinders improve targeting accuracy. As the drone scans the crops, the AI processes images to distinguish harmful from harmless species before activating the laser. Dronissil reduces chemical residues, benefiting the environment, health, and longevity. This innovation marks a major advance in precision agriculture, merging technology and sustainability for a healthier, more efficient, and environmentally responsible agricultural future.
- 81 1571172711 This study optimizes laser polishing of additively manufactured 316L stainless steel to reduce surface roughness. Using Response Surface Methodology (RSM), optimal parameters were identified and applied to test samples. Initial average roughness of $11.83 \mu\text{m}$ was reduced to $1.08 \mu\text{m}$. The selected condition underwent micrographic analysis to examine microstructural changes. Microhardness testing revealed increased surface hardness. Results confirm that optimized laser polishing significantly enhances surface quality and mechanical performance, highlighting its potential as a finishing technique for 316L parts produced via additive manufacturing.
- 82 1571172713 6G systems are expected to operate in the THz band to support ultra-high data rates. However, severe propagation impairments in THz channels pose significant challenges. This paper presents a new channel model and numerical analysis of a THz system using orthogonal chirp division multiplexing (OCDM). The system includes chirped waveforms at 300 GHz, minimum mean square error (MMSE) equalization, amplitude modulation, and three ray-tracing-derived indoor environments: spacious hall, long corridor, and empty room. Results show OCDM enhances resilience to multipath effects, especially for lower-order modulations. The findings highlight OCDM with environment-aware techniques as a robust solution for future THz communications.

- 83 1571172718 This work reports the development of an automated dip-coating system for fabricating biodegradable fibers with core and cladding made of agar, a biocompatible, transparent, and renewable optical material. Adding an agar-glycerol hydrogel cladding reduces the optical loss and enhances the robustness against environmental effects. Moreover, we investigate the degradation of agar devices under room conditions and evaluate the potential of the automated dip-coating method to improve the uniformity of the samples. Thus, the agar fibers obtained using this technique were characterized for clad thickness and mass loss at room temperature.
- 84 1571172726 This paper presents the design, fabrication, and characterization of a low-cost Fresnel Zone Plate (FZP) array using direct laser writing lithography. The proposed structure act as a microlens array for Shack-Hartmann (SH) wavefront sensors, enabling precise phase modulation through binary microreliefs. The fabrication process eliminates the need for photomasks and complex alignment, significantly reducing fabrication costs. Optical microscopy, profilometry, and optical characterization results show that that the fabricated array exhibit well-defined zones and efficient light focusing. The results validate the viability of this low-cost, scalable approach for wavefront sensing applications.
- 85 1571172737 Curcumin and berberine are natural compounds with demonstrated anticancer, anti-inflammatory, and antimicrobial properties. Selenium nanoparticles (SeNPs) exhibit significant biomedical potential due to their antioxidant, anticancer, and antimicrobial effects, primarily through the generation of reactive oxygen species (ROS), which induce cellular and DNA damage. This study presents the synthesis of SeNPs stabilized with curcumin and berberine via xenon lamp photoreduction, followed by characterization. The functionalized nanoparticles were tested against bacteria and fungi to evaluate their antimicrobial efficacy.
- 86 1571172744 This paper proposes a compact, complementary metal-oxide-semiconductor (CMOS)-compatible architecture for integrated optical sensors based on Photonic Molecules (PMs) operating at a fixed wavelength. The device is implemented on a silicon-on-insulator (SOI) platform and integrates a PM coupled to a U-shaped feedback waveguide. This approach enables dissipative without the need for spectral scanning, relying on detecting variations in the extinction ratio (ER) at a fixed wavelength, as demonstrated by simulations that achieved a sensitivity of up to 195 dB/RIU.
- 87 1571172747 Silver nanoparticles (AgNPs) are widely used in multifunctional polymer nanocomposites due to their antimicrobial, conductive, and optical properties. While conventional synthesis methods involve multiple steps and stabilization agents, limiting scalability and reproducibility, we propose a simpler alternative: the in-situ formation of AgNPs directly in epoxy resin by incorporating an aqueous AgNO_3 solution before curing, followed by thermal treatment. This one-step, surfactant-free process enables controlled nanoparticle formation, reduces waste, and offers a cost-effective, scalable route for producing advanced nanocomposites.
- 88 1571172749 This work reports multiplex Surface-Enhanced Raman Spectroscopy (SERS) detection of Rhodamine 6G (R6G), Methylene Blue (MB), and Crystal Violet (CV) using silver films deposited via low-power (10W) magnetron sputtering. SERS measurements at 1×10^{-7} M revealed wavelength-dependent enhancements: R6G excelled at 532 nm, MB and CV at 633 nm. Unambiguous discrimination was achieved via distinct marker bands. Spatially resolved SERS mapping confirmed simultaneous detection of all three dyes. Sputtered silver films are established as a reproducible, scalable, and cost-effective platform for trace-level multiplex sensing.
- 89 1571172751 Micro size single crystals of Nd^{3+} doped YAG were obtained v regulated cooling of supersaturated glass solutions. In this work we investigate the Raman and optical spectroscopic properties of these micro-crystals. Most of the measurements were obtaining selecting a single micro-crystal using microscope. All results indicated nearly identical properties compared to a reference bulk crystal grown by the Czochralski method.

- 90 1571172754 This work introduces a non-invasive method to monitor moisture dynamics in natural fiber textiles using specklegram analysis. A flax cloth is illuminated with a 633 nm He-Ne laser, and speckle patterns are captured by a lensless CCD camera. Temporal changes are analyzed using Zero-Mean Normalized Cross-Correlation (ZNCC), and the decay is modeled exponentially to extract a characteristic time constant τ . Results show τ increases with drying time and depends on the initial water content. The technique is low-cost, non-destructive, and sensitive, making it suitable for real-time monitoring of natural fiber behavior in composite material applications.
- 91 1571172758 This work presents the structural and optical analysis of porous silicon microcavities fabricated with different silicon types (P++, N++, N+), resistivities, and HF: ethanol concentrations. Layer thicknesses were measured by scanning electron microscopy and used to adjust effective refractive indices through optical simulations, showing good agreement. Lower HF concentrations produced larger pores, affecting porosity and refractive index. Substrate doping influenced corrosion rate, layer thickness, and resonance peak position. P++ substrates generated pores <10 nm, while N++ and N+ yielded pores of 16-24.8 nm. The results highlight the relevance of anodization control for tailoring optical properties in biosensing applications.
- 92 1571172762 Cutaneous melanoma is an aggressive form of skin cancer. This study evaluates 5-aminolevulinic acid (ALA)-mediated photodynamic (PDT), sonodynamic (SDT), and sonophotodynamic (SPDT) therapies in a murine model of early-stage melanoma, using a conical waveguide for ultrasound delivery. Tumor growth was monitored by high-resolution ultrasound imaging, and tumors were later excised for histological analysis (H&E and Ki67). SDT achieved the greatest tumor growth inhibition (87±11%), while SPDT (79±18%) showed no additional benefit over SDT alone. These results underscore the potential of ALA-mediated SDT for melanoma treatment and demonstrate the effectiveness of the waveguide in focusing ultrasound energy on small regions.
- 93 1571172782 Plasma-activated water (PAW), generated via air-fed dielectric barrier discharge (DBD), contains nitrate and other long-lived reactive species with relevance for agriculture. Here, PAW was produced by exposing 50 mL of deionized water to coaxial DBD plasma for 80 minutes and analyzed via surface-enhanced Raman spectroscopy (SERS) after drying 10 μ L on a Ti/Au substrate. Strong SERS signals from nitrate at \sim 1045 cm^{-1} and related species were detected under 633 and 785 nm excitation. Laser-induced aggregation was observed at irradiated spots, revealing localized enrichment. These findings establish gold-based SERS as an effective, label-free tool for PAW characterization and nitrate detection.
- 94 1571172784 The photon statistics of a strongly attenuated continuous-wave laser (1550 nm), characterized by an Avalanche Photodiode operating in Geiger mode, was reconstructed with the aid of an iterative Maximum Likelihood Estimation model and without photon counting. Statistical analysis of the reconstructed distribution was performed to determine the algorithm convergence criteria. Parameters such as reconstruction error, Fischer Dispersion Index, chi-square, and p-value were evaluated. The photon number distribution for attenuated coherent sources was successfully reconstructed according to the defined convergence criteria.
- 95 1571172786 In this work we present optical methodologies used to perform food quality analysis, especially milk, cheese and coffee. We also evaluate non-conformities and adulterations. We show the feasibility of optical techniques for the determination of macroconstituents such as fats, proteins, lactose and moisture in milk and cheeses. The discrimination of robusta and arabica coffee was also possible due to the detection of selected coffee fluorophores, by using optical spectroscopy techniques. The advantage of these techniques lies in the fact that they are remote, fast and of low cost, with sufficient sensitivity to comply with current brazilian legislation.

- 96 1571172790 The increasing adoption of lasers in medical procedures has highlighted some limitations of the technique, such as the influence of melanin on thermal effects. This study focuses on analyzing the local temperature during and after the irradiation for different skin tones using optical phantoms, with a low intensity 660 nm laser. It was shown that as the sample was more pigmented, the temperature increased faster, and it was observed that the temperature rise is equivalent to a logarithmic pattern, while the decreasing temperature after irradiation was well described by Newton's law of cooling.
- 97 1571172807 We present a simple optical setup based on two cascaded reflective phase-only spatial light modulators in a 4f configuration to perform basic logic operations in parallel. By adjusting polarization states and encoding binary input patterns as phase masks, we implemented three logic gates (AND, OR, and XNOR) with results consistent with the expected truth tables. The modulation relies on polarizing components to allow pixel-wise control across the entire image. Experimental results show good agreement with the target amplitude distributions and expected results.
- 98 1571173799 Carbonaceous aerosol pollutants, particularly black carbon (BC) nanoparticles derived from diesel emissions, can produce reactive oxygen species (ROS), such as singlet oxygen (1O_2), through photodynamic activity. This study mapped 1O_2 emission from individual diesel-derived BC nanoparticles using confocal microscopy and time-resolved fluorescence. High-resolution spectral imaging enabled the quantification of localized photochemical reactions, revealing a singlet oxygen quantum yield of approximately 7% for single nanoparticles. The findings indicate that individual BC particles exhibit significant oxidative potential, with localized impacts that may not be detected by conventional steady-state analytical methods.