Physics Centre of Minho and Porto Universities
Minho pole

Gualtar, Braga

Azurém, Guimarães

Annual Report 2024

CF-UM-UP

FCT Fundação para a Ciência e a Tecnologia
COMPETE 2020
PORTUGAL 2020

Contents

Executive Summary

Throughout 2024, the Strategic Project of the Centre of Physics of the Universities of Minho and Porto (CF-UM-UP) was extended, based on previous year (2023) prospects. Still, delays in the allocation of funds for numerous projects persisted, challenging the acquisition of the necessary goods, services, and personnel, a chronicle problem. As expected, the delays affected the scientific progress of several projects. The Human Resources hiring saw an important boost, since many years already, with the FCT-Tenure program. Several Assistant Researcher (3) and Professor (5) positions were approved for hiring at National level, making the CF-UM-UP one of the few Research Centers with a 100% success rate. Despite this success, Human Resources remain a central concern for CF-UM-UP, given the rate of retirements expected in the coming years. The resilience, the determination, and adaptability of researchers have thus become increasingly of utmost importance, over time. As of December 31st, 2024, the Center of Physics at the University of Minho (CFUM) comprised 62 fully integrated members holding a PhD, along with 27 Post-Docs and PhD-holding collaborators, in addition to the current 80 PhD students affiliated with CFUM (who were 77 in 2023, 83 in 2021 and 76 in 2020).

CFUM research has been based on three fundamental core scientific activities: (i) theoretical research in the Physics of 2D materials, (graphene, plasmonics, nonlinear phenomena, materials electronic and optical properties, orbitronics, quantum algorithms, etc.); (ii) research in new materials targeting new technologies and applications (chiral plasmonic thin films, nanofibers, ferroelectric devices for low-power nanoelectronics, sensing, thin-filmed-based multiferroic systems with magnetic-electric-optical responses, etc.); (iii) and research in Optometry and Vision Science, with cutting edge optical equipment and modelling techniques, a natural development of the research pioneered at UM some 25 years ago in Applied Optics. The CFUM 2024 scientific output diversity and international visibility can be better appreciated when looking into the 200 publications in journals with peer review (available through Clarivate Web of Science/Scopus), 1 international patent and 187 oral presentations in international meetings, Conferences and Workshops.

It is worth mentioning high impact factor (IF) publications in Q1 journals namely Advanced Functional Materials (IF:29.5), Advanced Materials (IF:27.4), Nature Communications (IF:24.9), Chemical Engineering Journal (IF: 21.7), Energy Storage Materials (IF: 18.9), Energy Storage Materials (IF:18.9), Advanced Functional Materials (IF:18.5), Nature Physics (IF:18.1), among others.

In 2024, there were slightly fewer projects (37) compared to 2023 (44), yet the contracted funding increased to 3.5 million euros, when compared to the 2.6 million euros in 2023. This increase seems to consolidate the trajectory of recovery, since 2022, suggesting the need for further efforts to sustain this upward trend in the future. This entails implementing suitable measures to boost applications from CFUM members, especially for European funding opportunities. Still a significant fraction (90%) of the CFUM contracted funding in 2024 came mainly from Portuguese funding agencies like the National Innovation Agency (ANI) with 71% and the Foundation for Science and Technology (FCT) with 24.5%. International and H2020 contracted funding was at the level of 1%, quite low with respect to previous years, but this is largely due to the PRR projects. From the 37 ongoing projects during 2024, 21 were funded by FCT, 6 by ANI/PRR, 3 from bilateral programs, 3 by the European Commission and H2020, and 4 by Companies.

The global results show a significant growth in funding during 2024. A high degree of resilience of the Centre's researchers, is to be acknowledged. Finally, I would like to thank the executive team Mikhail Vasilevsky, Madalena Lira, Paulo Coutinho and Carlos Tavares for their support and collaboration, the administrative support of Vitor Pacheco and Fernanda Costa, and the help of the technical staff who collaborated in various ways in the operation of the Centre.

António Onofre
Director, CF-UM-UP

Mission and Objectives

Our Mission

The main goal of the CF-UM-UP as a whole is to perform internationally competitive research in several areas of Physics, fundamental and applied, linked to other disciplines of natural sciences and engineering, with strong international links and relevant, as far as possible, at the local level. CF-UM-UP has a critical mass of highly qualified researchers and aims at keeping equilibrium between applied and fundamental research and being the base for advanced training in Physics and adjacent areas, in the North of Portugal.

Organization structure

Management Entities

Director:
António Joaquim Onofre Abreu Ribeiro Gonçalves

Deputy Director:
Mikhail Igorevich Vasilevskiy

Executive Committee Members:

1. **Maria Madalena Cunha Faria Lira**
2. **Paulo José Gomes Coutinho**
3. **Carlos José de Macedo Tavares**

Strategic Research Lines

The research at the CF-UM-UP is conducted along the following Strategic Reaseach Lines:

(i) Assessment and Enhancing Visual Performance
Coordinator: Madalena Lira

(ii) Physics of Quantum Materials and Bionanostructures
Coordinator: Paulo Coutinho

(iii) Functional and Smart Materials and Surfaces for Advanced Applications
Coordinator: Carlos Tavares

(iv) Quantum Physics and Fields in High Energy and Condensed Matter Theory
Coordinator: Eduardo Castro

Advisory Board

- Prof. Sir Konstantin Novoselov, School of Physics & Astronomy, University of Manchester, Manchester, United Kingdom.

- Prof. Antti-Pekka Jauho, Department of Micro- and Nanotechnology, Technical University of Denmark, Denmark.

- Prof. Emeritus Denis Weaire, School of Physics, Trinity College, Dublin.

- Prof. Norberto López-Gil, Department of Physics, University of Murcia, Spain.

Scientific Activity

Description of the Main Activities by Research Line

Assessment and enhancing visual performance

Research Line Coordinator

Madalena Lira

The Research Line on Assessment and Enhancement of Visual Performance addressed key challenges in vision science in 2024 through innovative research. This year's work focused on areas such as tear film and intraocular pressure, advances in myopia management, and the development of tools for analyzing chromatic changes in vision.

Key highlights include a study on tear film dynamics examining how tear quality variations affect intraocular pressure and corneal biomechanics. Another contribution investigated inflammatory responses in new contact lens users, correlating tear cytokine levels to vascular changes, providing insights into subclinical inflammation in lens wearers. In myopia management, the group explored advanced optical designs such as extended-depth-of-focus and orthokeratology lenses, providing insights into slowing axial elongation in children and optimizing foveal responses in young adults.

The team also contributed to ophthalmic innovation by researching advanced intraocular lens designs and the chromatic changes associated with diffractive ophthalmic optics. These studies enhance our understanding of wavefront aberrations and optical performance, supporting the development of new optical technologies aimed at improving visual outcomes. Additionally, a study examined the relationship between dynamic and static visual acuity in elite soccer players. It explored how refractive errors and binocular vision influence dynamic visual performance, providing valuable insights for optimizing athletic vision.

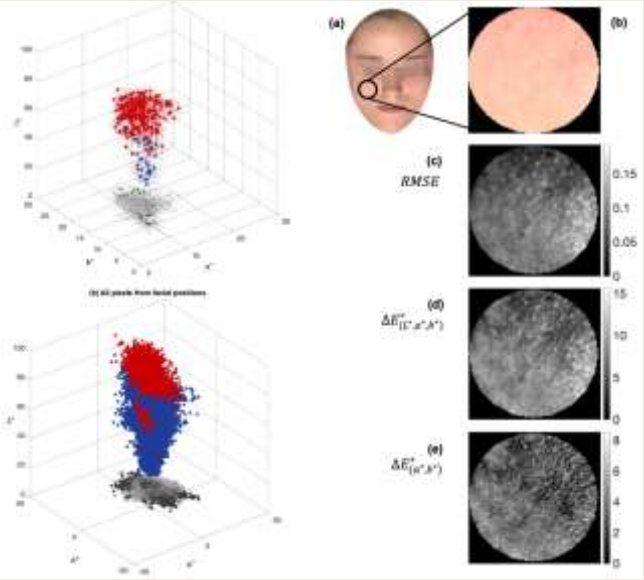
The group's achievements are reflected in a robust portfolio of peer-reviewed publications and active participation in numerous international conferences demonstrating dedication to expanding vision science and contributing to practical solutions to enhance visual health and performance.

Research Highlight

Hyperspectral Imaging Database of Human Facial Skin

The perceived color of human skin is the result of the interaction of environmental lighting with the skin. Only by resorting to human skin spectral reflectance, it is possible to obtain physical outcomes of this interaction. The purpose of this work was to provide a cured and validated database of hyperspectral images of human faces, useful for several applications, such as psychophysics-based research, object recognition, and material modeling. A public database composed of 29 hyperspectral images of human faces was proposed with accompanying computational tools to convert spectral data into RGB colored images.

Data was extensively analyzed to demonstrate that local color variations and chromatic diversity across an entire human face cannot be overlooked, highlighting that punctual sampling of the spectral properties of the face impair the representation and perception of the color of the human face.

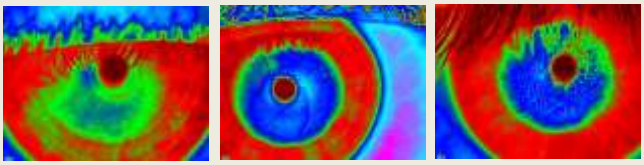


Research Highlight

Tear Film Influence on Intraocular Pressure and Corneal Biomechanics

It was found that the tear film's quality impacts accurate measurements of the intraocular pressure (IOP) and corneal biomechanical properties.

Mainly, changes in the lipid layer interferometric patterns were correlated with changes in measurements of the IOP, especially when measured using the Ocular Response Analyzer (ORA). When considering the measures that are possible to obtain using the ORA, the IOPg and the IOPcc, significant differences were found and associated with changes in the tear film patterns. The corneal hysteresis (CH) and resistance factor (CRF) were also found to have a correlation with the Ocular Surface Disease Index (OSDI) scores, suggesting that biomechanical changes will be impacted by changes in the tear film quality accompanied with increasing symptoms. Overall, the tear film quality and symptoms of ocular dryness influences measures of the IOP and corneal biomechanics, and should not be overlooked.



Research Highlight

Tear levels of Transforming Growth Factor-β 1 and Interleukin 1-β, and clinical correlations in new contact lens wearers

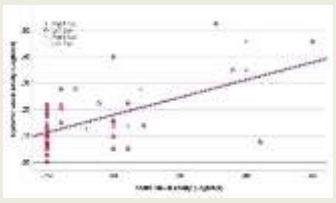
This study examined the impact of contact lens (CL) wear on tear cytokine levels and ocular physiology. IL1-β levels were significantly higher in new CL users compared to non-wearers, correlating with increased bulbar and limbal hyperemia observed throughout the day. In contrast, TGF-β 1 levels remained stable and unaffected by lens wear.

The findings indicate that CL wear disrupts ocular surface homeostasis, as reflected by elevated IL1-β. These results underscore the importance of monitoring tear film stability and cytokine activity to understand and manage the inflammatory responses associated with CL wear.

Research Highlight

Relationship between dynamic visual acuity and static visual acuity, refractive error, and binocular vision in elite soccer players

Dynamic visual acuity is crucial in many sports, including soccer. This study evaluated refractive error, static and dynamic visual acuity, and binocular vision. Results revealed moderate correlations between static and dynamic visual acuity, with poorer dynamic acuity linked to lower static acuity, reduced stereopsis, and higher myopic astigmatism. These findings underscore the impact of specific visual parameters on athletic performance and the potential for targeted visual training.

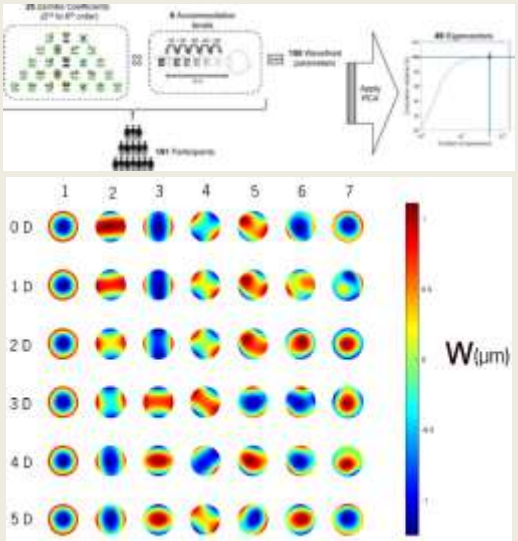


Research Highlight

Statistical Model of Ocular Wavefronts with Accommodation

The purpose of this study was to determine the minimum number of orthonormal basis functions, applying Principal Component Analysis (PCA), to represent the most wavefront aberrations at different accommodation stages. The study also aims to generate synthetic wavefront data using these functions.

PCA significantly reduces the dimensionality of wavefront aberration data across 6 accommodative demands, reducing the variable space by over 66%. The synthetic data generated by the proposed wavefront model for accommodation closely resemble the original clinical data.



Physics of quantum materials and bionanostructures

Research Line Coordinator
Paulo J. G. Coutinho

The focus of the overall research performed in the strategic line Physics of Quantum Materials and Bionanostructures is the development, both at theoretical and fabrication levels, of quantum materials and (bio)nanosystems and their applications in nowadays society, ranging from biomedical to environmental.

The research included theoretical studies on Moiré materials – which display interference patterns due presence of different crystalline structures – in general quasiperiodic, which can induce localization of the electronic degrees of freedom. The interplay between electron-electron interactions and quasiperiodicity, demonstrated that quasiperiodicity can give origin to new ordered phases in 1D systems, and that if can enhance superconductivity.

The mathematical physics team have addressed, in the context of the Generalised Finite Difference Method, the optimal choice of the stencil together with the other parameters that could reduce the global conditioning of the system and bring more stability and better accuracy. A detailed construction of the very high-order polynomial representation was proposed, considering a functional that assesses the quality of the polynomial reconstruction. In this way, a new stencil and kernel optimisation for mesh-free very high-order generalised finite difference method has been proposed and validated. Development of Reconstruction for Off-site Data (ROD) method up to eigth-order finite volume schemes with curved boundary and slip boundary conditions for 3D incompressible flows, as well as new compact discretizations in time for ODE and PDE problems to achieve very high-order still preserving the stability, were focused.

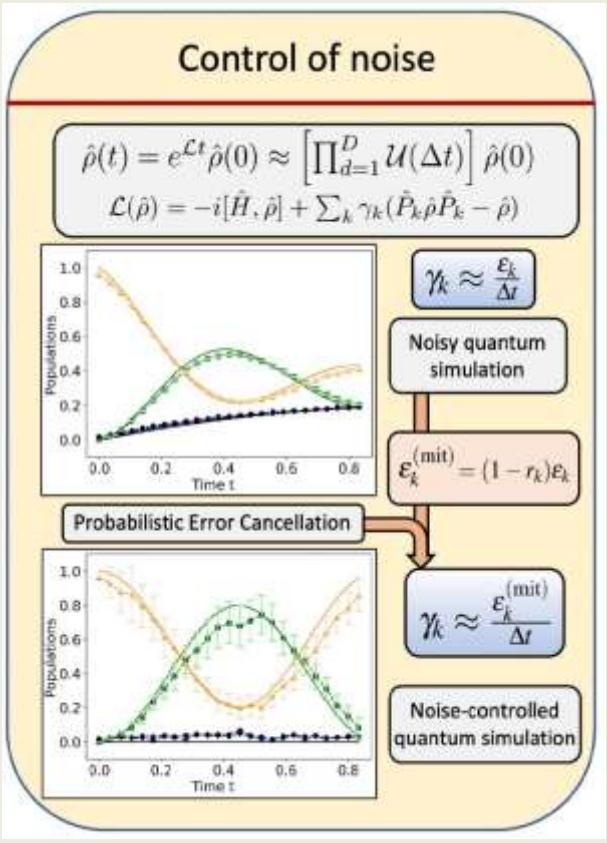
In biomedical applications, research included multifunctional nanosystems for delivery of chemotherapeutic drugs, bioactives and/or graphene based nanomaterials produced from marine biowaste by green synthetic approaches that can be combined with other therapeutic modalities (gene therapy or imaging) for therapeutic screening and diagnosis. 2D and 3D self-assembled mesophases were also developed for pH triggering of drugs release and targeting strategies to overcome cancer challenges.

In environmental applications, research continued on the use of graphitic carbon nitride nanostructures (2D and 3D) for hydrogen production from photoreduction of water.

Research Highlight

Noise-assisted digital quantum simulation of open systems

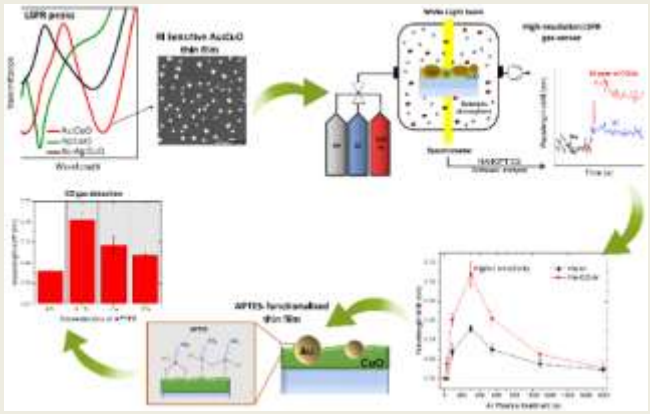
In the current developmental phase of quantum computing, noise is generally considered as a limiting factor. However, our recent research demonstrates that the intrinsic noise can be strategically utilized to efficiently simulate open quantum systems within the Markovian approximation, with application, e.g. to energy harvesting complexes in photosynthesis. It opens the door for a potential exponential speedup in the simulation of open quantum systems when compared to the equivalent closed-system quantum simulations in current noisy quantum devices. We further presented a new methodology for simulating generalized amplitude damping in quantum computers. This approach eliminates the dependence on resource-intensive ancillary qubits or mid-circuit measurements.



Research Highlight

Using the localized surface plasmon resonance phenomenon to develop thin film gas sensors

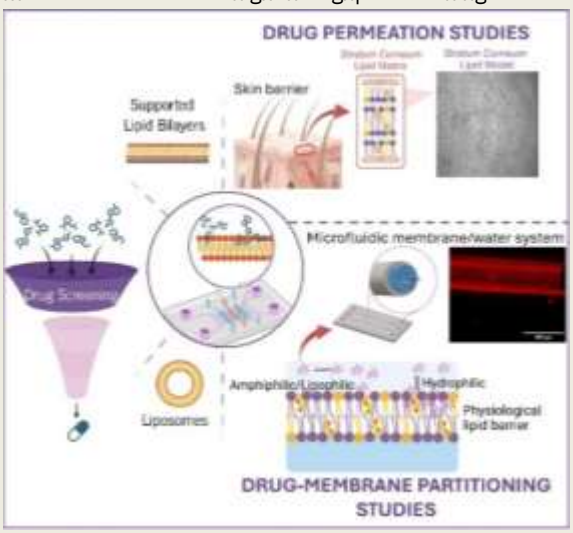
New nanocomposite thin films composed of noble metal nanoparticles dispersed in a CuO matrix are proposed for LSPR gas sensing. Different systems of thin films, namely Au:CuO, Ag:CuO and Au-Ag:CuO, were deposited by reactive magnetron sputtering, after a previous optimization of the deposition parameters. The sputtering process was followed by thermal annealing to induce the formation of the nanoparticles, inside the CuO matrix, which are responsible for the LSPR behaviour. The chemical, micro- and nanostructure, and optical responses of the thin films were thoroughly investigated. Their sensing response was methodically improved by surface plasma treatments and surface functionalization with a self-assembled monolayer (APTES molecule). Gas sensing tests were performed using a home-made gas sensing apparatus that combines a custom-made high-resolution LSPR spectroscopy and a vacuum system, developed within the scope of this work. The developed LSPR-based Au:CuO thin film sensor is able to detect extremely small changes in bulk refractive index, as low as 6×10-5 RIU, highlighting the fact that it performs at room temperature.



Research Highlight

Development of biomimetic membrane models for high throughput screening in drug development

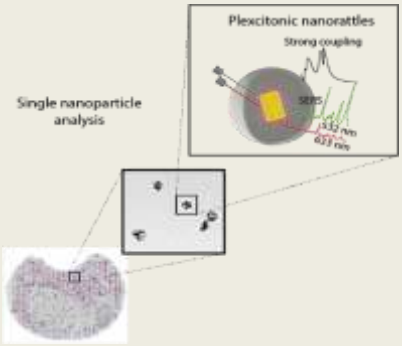
Concerns about sustainability arise from recognizing that both in vivo animal and human research contribute significantly to the large carbon footprint of pharmaceutical companies, which have values comparable to the automotive industry.These concerns have fueled EU 2013 prohibition on using animals in cosmetic product testing and a continual push by pharmaceutical and industry/research to establish alternative in vitro testing, with the goal of replacing or at least lowering reliance on in vivo studies. To address these issues, we created artificial membranes as skin surrogates and estimated bioactive skin permeability by integrating them into microfluidic devices for high throughput screening.



Research Highlight

Quantum Plexcitonic Nanoparticles for Ultrasensitive Single Particle Detection

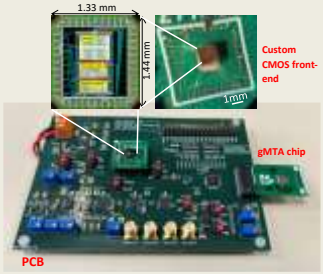
Plexcitonic nanoparticles exhibit strong light-matter interactions between molecular transitions and surface plasmon resonances, holding promise for potential applications in photonics, solar cells, and sensing. In this work, a new type of plexcitonic nanoparticle, optimized for surface-enhanced Raman scattering (SERS) spectroscopies, demonstrated its potential by showing a detection sensitivity down to the single-nanoparticle level. These findings may open new opportunities for ultrasensitive biosensing and bioimaging, providing superbright and highly stable optical labels based on the strong coupling effect.



Research Highlight

A CMOS DC readout for graphene multi-transistor arrays

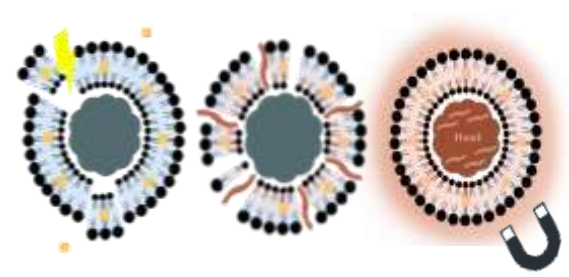
We designed, tested, and fabricated a Complementary metal–oxide–semiconductor (CMOS) readout system for fast DC measurements of graphene multi-transistor arrays (gMTAs). The system can capture the transfer curves of all sensors in the array, use the obtained data to polarize the sensors in an optimized region of operation by applying constant gate-source (VGS) and source-drain (VDS) voltages and read the sensors' currents, which change with the biorecognition events. The CMOS readout system consisting of a time-multiplexing of 32 devices at a sampling rate of 10 kS/s per sensor, resulting in a data throughput of 3.84 Mb/s and compromising an area of 970 µm × 500 µm was fabricated in commercial 180 nm CMOS technology forfast gMTA readout.



Research Highlight

Multi-stimuli-responsive magnetoliposomes and lipogels for advanced therapies

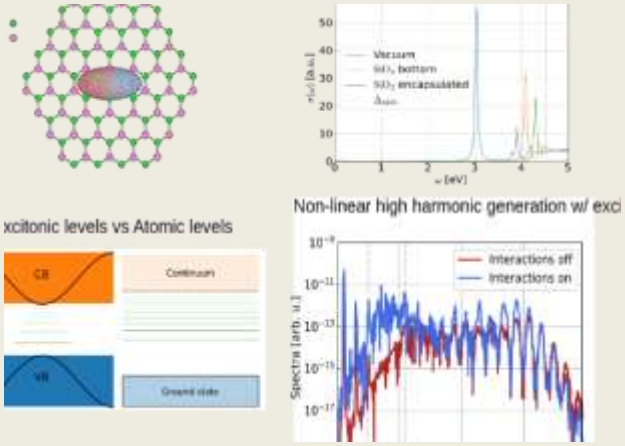
Multi-stimuli-responsive magnetoliposomes were developed for advanced therapies. Particularly, pH-sensitive solid magnetoliposomes containing shape-anisotropic nanoparticles and loaded with the anticancer drug doxorubicin have shown enhanced growth inhibition of human hepatocellular carcinoma cells. A new magnetoliposomes' architecture, with the magnetic nanoparticles anchored on the lipid surface, have exhibited suitable capabilities for synergistic magnetic and photothermal hyperthermia in cancer therapy. Bovine lactoferrin-loaded plasmonic magnetoliposomes, containing functionalized gold nanoparticles, were developed as innovative platforms for antifungal therapeutic applications. Controlled and sustained drug release was achieved by using lipogels containing multicore magnetic nanoparticles or silica-coated gold nanorods, allowing multimodal therapeutic modalities.



Research Highlight

Excitonic effects in strong field response

We developed a time-dependent mean-field method to theoretically model the role of excitons (electron-hole excited bound states) in the optoelectronic response of insulators driven by a strong laser field. With this method we have shown that excitonic effects lead to an enhancement of the high-harmonic generation at frequencies compatible with the energy of the excitons.



Research Highlight

Research Highlight Advancing Orbitronics: Exploring Orbital Angular Momentum in Quantum Materials

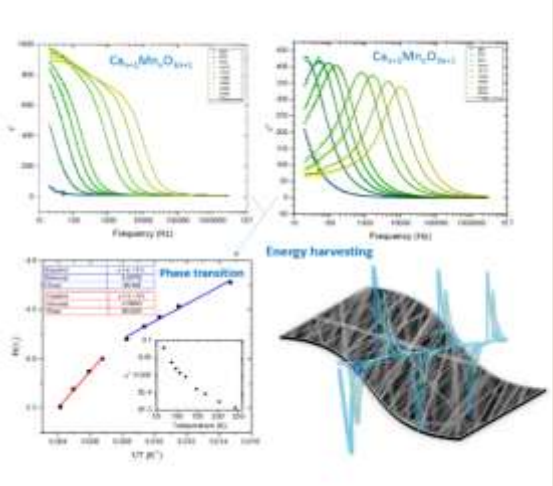
We made significant contributions to orbitronics, a field that focuses on the manipulation and transport of orbital angular momentum in solid-state systems. Unlike spintronics, which deals with electron spin, orbitronics explores how the intrinsic angular momentum of an electron's orbit can be used for electronic and quantum devices. The research included studies on the orbital Hall effect (OHE) in two-dimensional triangular lattices, investigating the interplay between bulk properties and edge states, with a focus on the topological aspects of orbital transport. Work on graphene superlattices demonstrated the generation and control of non-local chiral currents driven by the OHE. Additional studies explored the transport of orbital currents in systems with strong intervalley coupling, such as Kekulé-distorted graphene, and examined the behavior of orbital currents in gapped bilayer graphene within the terahertz regime, highlighting its implications for future terahertz technologies. These efforts provide a deeper understanding of orbitronics and its role in advancing electronic and quantum materials.

Research Highlight

Novel nanofibers and thin film piezo, pyro and magnetic composite systems for energy harvesting and spintronics

Novel chiral and cyclic dipeptides were synthesized. Their electric, dielectric, piezoelectric and non-linear optical properties were characterized. Large-scale hybrid electrospun arrays containing the dipeptides embedded in biocompatible polymers were shown to exhibit strong piezoelectric properties under a periodic mechanical force, functioning as bio-energy harvesting sources. A novel dipeptide polymorph was synthesized and its dielectric, pyroelectric, piezoelectric and non-linear optical properties were studied.

New multiferroic nanostructures consisting of $Ca_3Mn_2O_7$ naturally layered perovskite thin films and $LiNbO_3$-$CoFe_2O_4$ ferroelectric-ferromagnetic bilayer composites were synthesized. Their structural, microstructural, dielectric and magnetic properties were characterized as a function of temperature, applied fields and frequency. The influence of the magnetic phase on the polar cooperative behavior was studied.



Functional and smart materials and surfaces for advanced applications

Research Line Coordinator
Carlos José Tavares

The focus of the overall research done in the strategic line **Functional and smart materials and surfaces for advanced applications** resides in the development of novel materials based on polymer composites, nano structures, alloy oxides and nitride films. The inherent studies involve the understanding of the electrical, magnetic, optical, mechanical, and other physical-chemical properties of these materials, having in mind applications in several types of devices, such as sensors, actuators, battery elements including novel separation membranes, transparent thermoelectric films, solar absorbers, information and energy storage, amongst other functional and smart materials. Energy considerations are essential in nowadays society and increasingly dependent on mobility and interconnectivity with the need to reduce the environmental impacts related to fossil fuels. The Centre of Physics of the University of Minho is undergoing competitive research in advanced materials for energy. The principal techniques for material development in the form of thin film deposition are magnetron sputtering and laser ablation. A low-cost technique by direct inkjet printing of material is also recurred, as other nano and micro structuring techniques to functionalize materials.

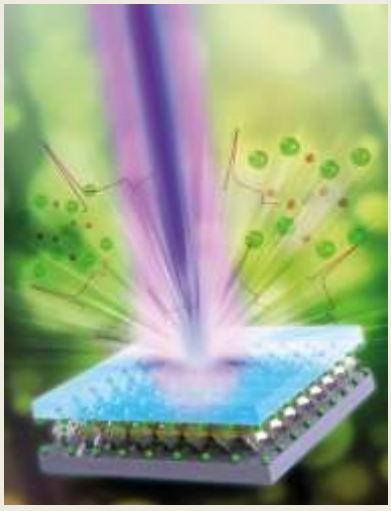
Research Highlight

Electroactive smart strategies for tissue regeneration

The challenge of organ and tissue loss within the healthcare system is not only prevalent but also immensely devastating and costly. Recognizing the profound impact on patients' well-being, there is a heightened focus on innovative strategies for tissue repair and regeneration. Tissue engineering research is at the forefront of this quest, tirelessly seeking alternatives to current treatments.

In this pursuit, the utilization of biomaterials capable of providing cell support and active stimuli is paramount. These materials aim to create permissive environments conducive to tissue regeneration, addressing the critical need for effective solutions in healthcare.

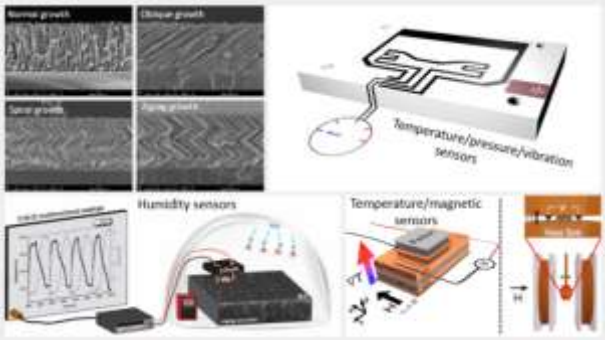
A noteworthy avenue within tissue engineering involves the exploration of electroactive polymers and their influence on various cell types such as cardiac and skeletal muscle, bone, and neural cells. Excitingly, research has already shown that electroactivity can significantly enhance cell adhesion, proliferation, and differentiation across these diverse cell types.



Research Highlight

Thin films for multi-sensing response

New sensors and electrodes, based on nano-designed thin film structures, are developed for providing transduction of physical properties into electronic signals. To reach this target, nanostructured thin film systems are deposited by magnetron sputtering, in oblique and glancing angle deposition geometries. The main idea is to obtain punctual or matrix-like tactile sensing through the targeted applications. The optimized thin film systems can scan shape, texture, friction, force, pain, temperature, and several other physical quantities. To provide some next-generation solutions to control production variables such as temperature, pressure, humidity, or vibration, to improve on-site and real-time products quality, constant monitoring of materials behavior, processes development, and devices/materials sustainability are analyzed. Working in a close loop with industrial partners, the group acts also in the development of key hardware and software features that are important in the design of sensors and sensor systems for different environments.



Research Highlight

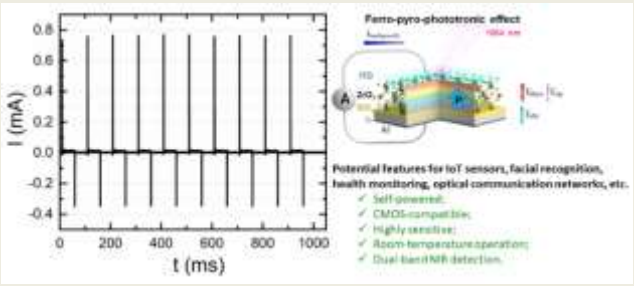
Magnetoactive materials for sustainable energy, sensing, actuation and biomedicine

Printing techniques are used for the production of self-powered multifunctional devices (capable of being simultaneously used as a permanent magnet, sensor, actuator, and energy harvester) whose main components derive from magnetic hazardous waste. The environmentally friendly technological platforms are based on piezoelectric P(VDF-TrFE), magnetic waste, and paper; and are processed by screen-printing, presenting a record maximum magnetic energy product. Such approach allows to recover/reuse all major components of the system, saving raw materials, energy, and production time in the fabrication of recycled smart materials with suitable functional response. The same platform, due to its magnetoelectric coupling, can also be used for switching the magnetization of spintronic devices. This is highly attractive due to their non-volatility, high-speed operation, reduced heat dissipation, miniaturization, and scalability.

Research Highlight

Ferroelectric thin films for information, energy storage and photodetection

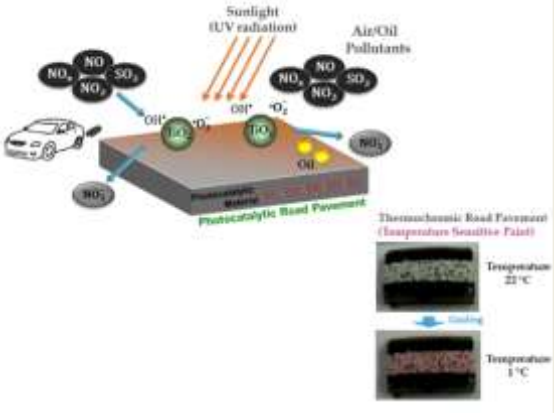
Ferroelectric oxide thin films are attracting tremendous attention for neuromorphic, energy-related applications and sensing. However, their ferroelectric properties are only achieved if the films crystallize in the orthorombic phase. To achieve that, the control of the growth and post-deposition annealing are crucial. Researchers at CF-UM-UP revealed that it is possible to achieve ferroelectric orthorombic ZrO2 films by sputtering followed by a rapid thermal annealing treatment, which is extremely relevant for CMOS-compatible near-infrared photodetectors



Research Highlight

Smart asphalt pavements

Nanomaterials Applied on Innovative Road Pavements for Air Cleaning (NanoAir) have been an important strategy to mitigate environmental and social problems related to air pollution due to road traffic and to promote road safety. The main goal of NanoAir comprises the development of innovative multifunctional road pavements that can clean up the surrounding air (NO_x and/or SO_2 pollutant gases from vehicle exhaust emissions). In areas with high density of urban mesh and also having the ability to promote the photodegradation of organic compounds (oils and greases) adsorbed to road surface, cleaning it and therefore preventing the reduction of friction caused by organic compounds (leading to serious road accidents).



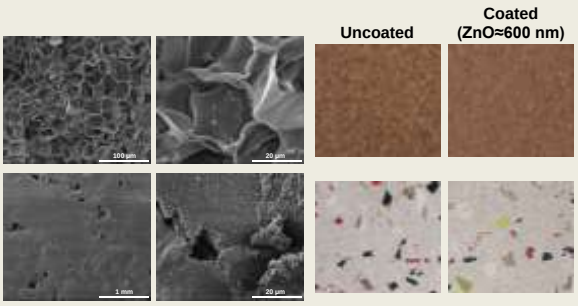
The inclusion of specific nano/micromaterials allows road pavements to acquire important new functions and applications such as: to improve reflectivity and visual definition of road edges or to provide anti-icing coatings applied to pavement surfaces to improve road safety in cold regions.

Research Highlight

Cork and rubber are widely used in applications ranging from wine stoppers and gym flooring to footwear and aerospace. However, exposure to sunlight causes UV-induced aging, while friction leads to significant mechanical wear. Portuguese cork and rubber companies sought solutions to address these issues while preserving the materials' original properties.

A promising solution to the aging issues of cork and rubber involves the deposition of metal oxide thin films, known for their high transparency in the visible spectrum, strong UV absorption, and resistance to mechanical wear in certain applications. Coating these materials with TiO_2 and ZnO, however, presents significant challenges due to their granular structure, high deformability, rough surface texture, and sensitivity to temperature. Despite these difficulties, the thin films were successfully deposited on cork and rubber and demonstrated encouraging results, effectively protecting against UV radiation and mechanical wear.

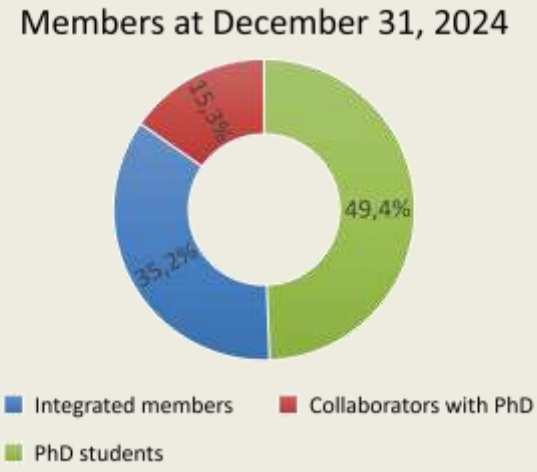
The findings highlight a strong correlation between film thickness and protective performance, with thicker ZnO films offering superior UV shielding and wear resistance. Additionally, we successfully employed atomic layer deposition (ALD) to coat cork and rubber grains with metal oxides, followed by magnetron sputtering deposition on the bulk material to enhance the ability to block harmful UV radiation. These advancements underscore the potential of tailored coatings to significantly improve the durability and performance of cork and rubber in demanding environments.

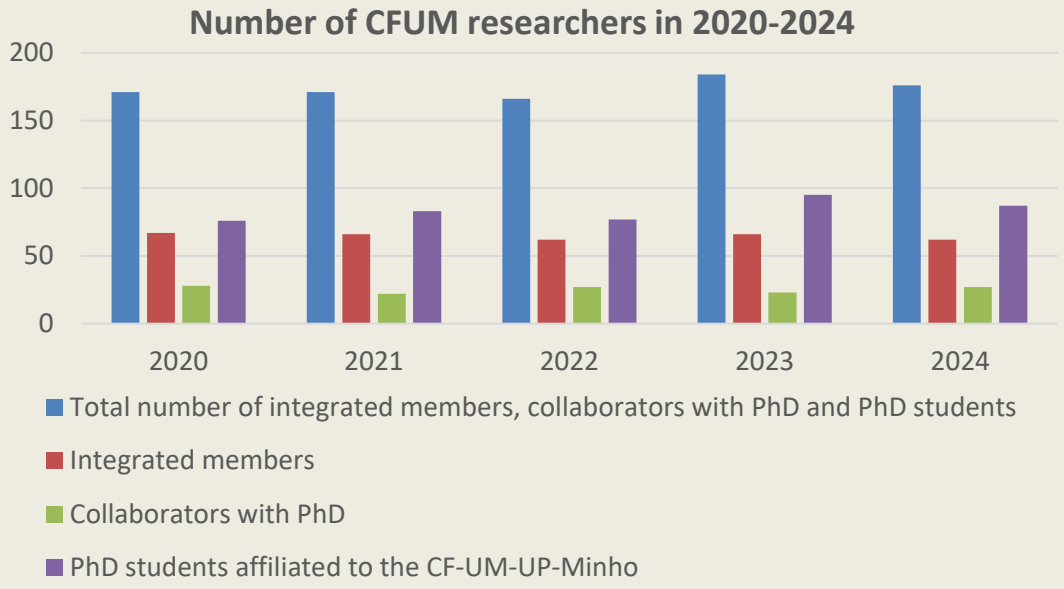


CFUM in numbers

Members (as of December 31, 2024)

Integrated Members with PhD	62
Post-Docs and Collaborators with PhD	27
PhD Students with CFUM affiliation	80



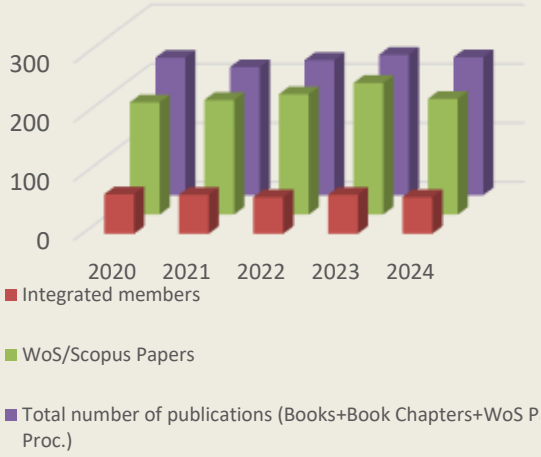


Number and type of Publications

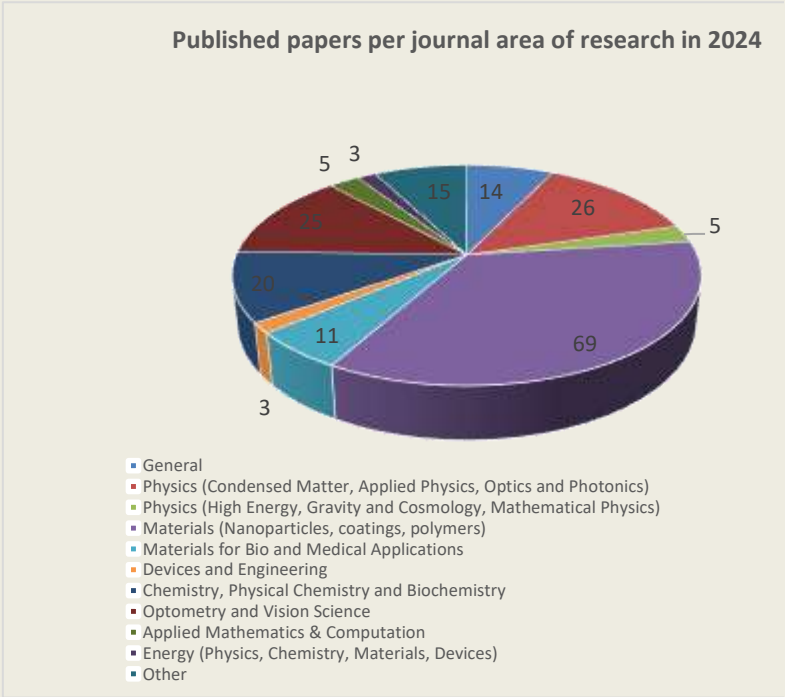
Publications in 2024

WoS/Scopus papers regular journal articles	200
Books (written/edited)	4
Book chapters	17
Patents (national /international)	0/0
Oral Presentations in International Conferences (total/by invitation)	187/56

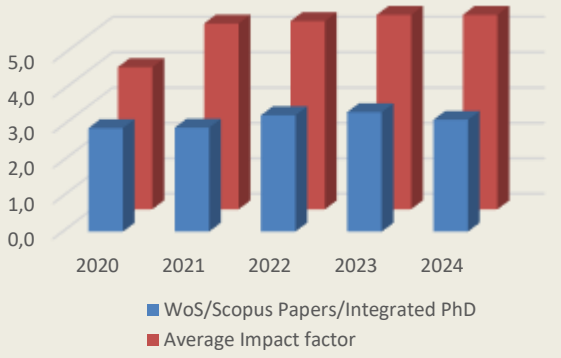
Publications in the period 2019-2024



Published papers per journal area of research in 2024



Number of ISI publications per integrated member and average impact factor of journals where the papers were published



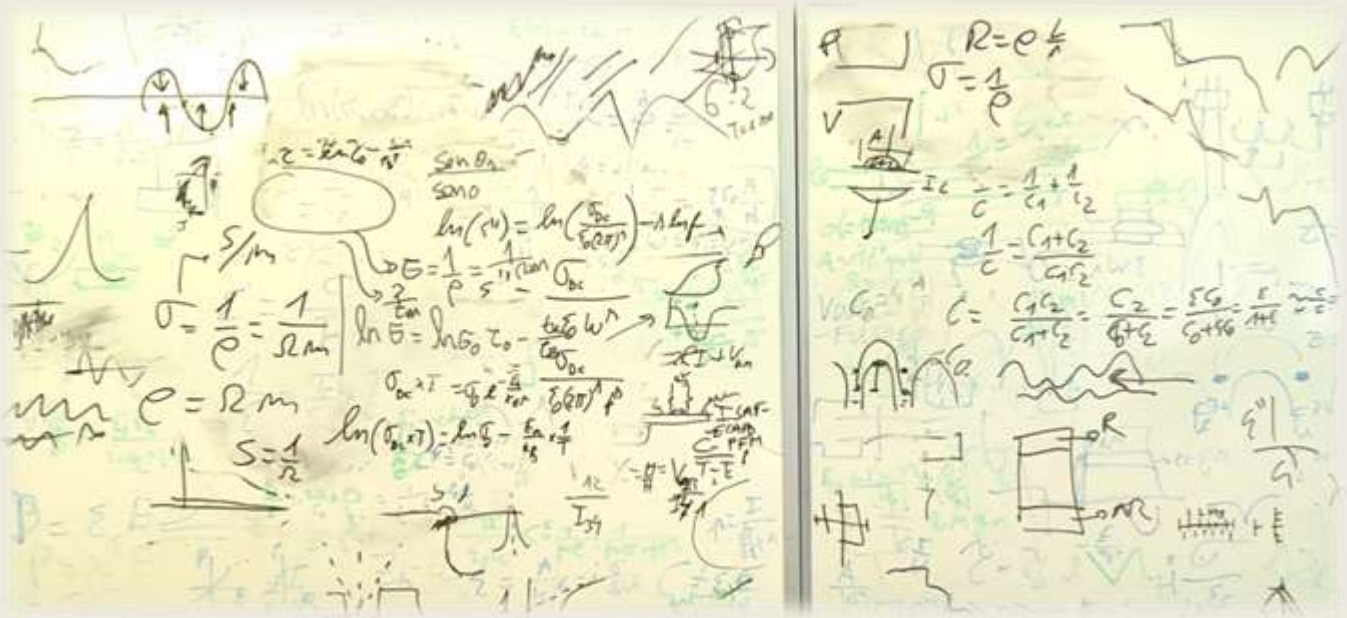
Scientific Supervision Numbers

			total
Master Theses	COMPLETED	-	28
PhD Theses affiliated to CFUM (supervised /co-supervised by a centre member)	ONGOING	62/23	85
	COMPLETED	17/7	24

Funding Summary

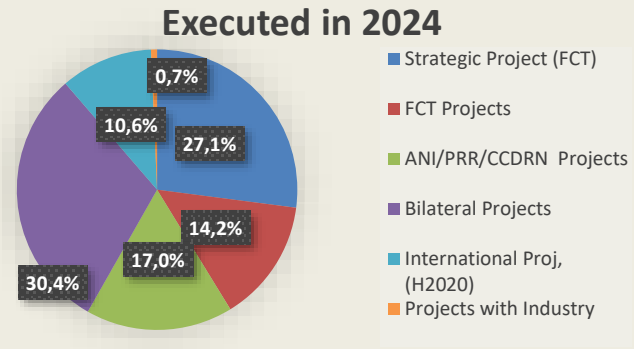
Funding in 2024

	Contracted in 2024	%	Received in 2024	%	Executed in 2024	%	Number of projects in 2024
Strategic Project (FCT)	309846,65	8,9%	435187,38	54,0%	324068,65	27,1%	2
FCT Projects	544890,36	15,6%	28065,81	3,5%	170017,78	14,2%	19
ANI/PRR/CCDRN Projects	2482337,25	71,1%	119701,04	14,8%	203247,7	17,0%	6
Bilateral Projects	3666,66	0,1%	2400	0,3%	364619	30,4%	3
International Proj, (H2020)	107546,81	3,1%	205009,59	25,4%	127389,92	10,6%	3
Projects with Industry	44 262,92 €	1,3%	15905,71	2,0%	8401,14	0,7%	4
Total	**3 492 550,65 €**	**100%**	**806 269,53 €**	**100%**	**1 197 744,19 €**	**100%**	**37**



The contracted value includes overheads and the university's contribution to European projects with allocation of teacher´s salaries. The amount received and the amount executed do not include overheads or the university's contribution. Thus, both the amount received and executed must be significantly smaller than the amount contracted.
The values of the contracted projects were obtained by dividing, in each project, its global financing equally throughout its duration.

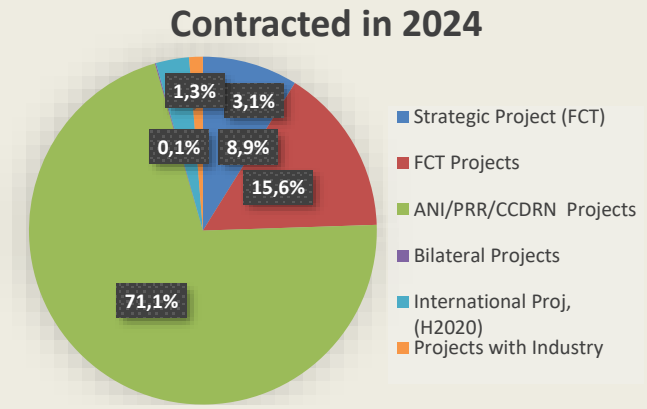
Funding executed in 2024



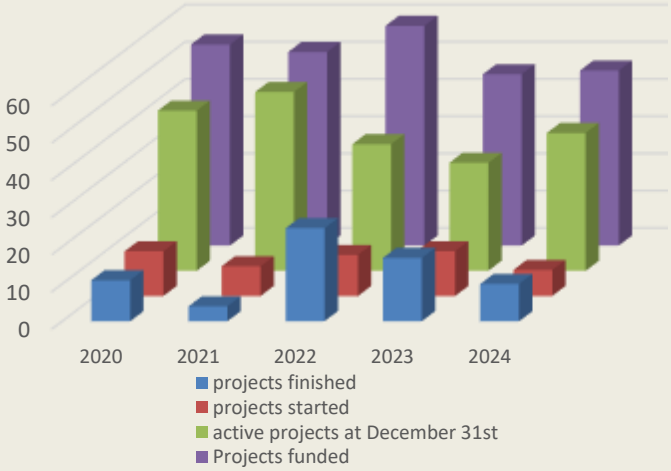
The funding history from the period 2019-2024 is divided into European projects, FCT Strategic Project, individual FCT projects, as well as ANI/PRR projects, which dominate overtime the global funding. The contracted funding in 2024 is largely dominates by the ANI/PRR projects (71.1%). The active projects attained a maximum number in 2021, followed by a slight decreased until 2023, and a recovery in 2024.

Funding history 2019-2024 (Contracted values by funding agency). Values in k€.

Funding contracted in 2024 according to projects' contracts



Active Projects (started and finished) in the period 2019-2024



Members (as of December 31, 2024)

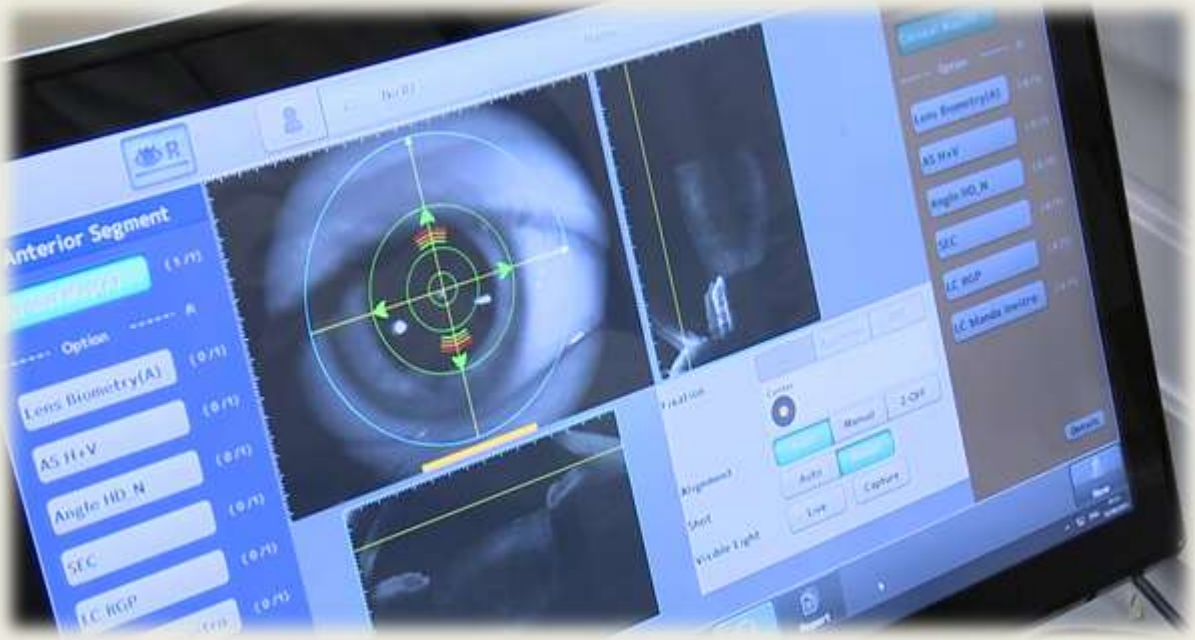
Integrated members

António Filipe Teixeira Macedo
António Joaquim Onofre Abreu Ribeiro Gonçalves
António Manuel Gonçalves Baptista
António Manuel Marques Queirós Pereira
António Tavares Costa Junior
Armando José Barros Ferreira
Bernardo Gonçalves Almeida
Bruno António Campos Amorim
Cacilda Maria Lima de Moura
Carlos José de Macedo Tavares
Carlos Miguel da Silva Costa
Clarisse Marta Oliveira Ribeiro
Claudia Jesus Ribeiro Lopes
Daniela Patricia Lopes Ferreira
Elisabete Maria dos Santos Castanheira Coutinho
Francisco José Machado de Macedo
Gaspar José Brandão Queirós Azevedo Machado (until 06/02/2024)
Gueorgui Vitalievitch Smirnov
Iran Gomes Rocha Segundo
João Manuel Maciel Linhares
João Pedro Santos Hall Agorreta Alpuim
Joaquim Alexandre dos Santos A. de Oliveira Carneiro
Joel Nuno Pinto Borges
Jorge Manuel da Silva Figueiredo (until 06/02/2024)
Jorge Manuel Martins Jorge
José Carlos Viana Gomes
José Filipe Vilela Vaz
José Manuel González Méijome
José Pedro Basto da Silva
Luís António Carvalho Gachineiro da Cunha
Luís Manuel Fernandes Rebouta
Luís Manuel Gomes Vieira
Luís Silvino Alves Marques
Manuel Filipe Pereira da Cunha Martins Costa
Maria de Fátima Guimarães Cerqueira
Maria de Jesus Matos Gomes
Maria José Bastos Pires Lima
Maria Madalena da Cunha Faria de Lira
Mário António Caixeiro de Castro Pereira
Mário Rui da Cunha Pereira
Marlene Susana Dionísio Lúcio
Marta Maria Duarte Ramos
Michael Scott Belsley
Miguel Faria Ribeiro
Mikhail Igorevich Vasilevskiy
Nuno Miguel Machado Reis Peres
Paulo José Gomes Coutinho
Paulo Rodrigues Botelho Fernandes
Pedro Filipe Ribeiro Costa
Pedro Libânio Abreu Martins
Ricardo Pedro Lopes Martins de Mendes Ribeiro
Rosa Maria Ferreira Batista
Rui Miguel Soares Pereira (until 06/02/2024)
Rute Juliana Ferreira Macedo de Araujo
Sandra Maria de Braga Franco
Sara Núñez Sánchez (until 16/12/2024)
Senen Lanceros-Mendez
Sérgio M. Cardoso Nascimento
Sylvie Oliveira Ribeiro
Sofia Oliveira Lopes (until 06/02/2024)
Stanislav Lazarov Ferdov
Tatiana Gabriela Rappoport
Teresa Maria Santos Ribeiro Viseu
Vasco Manuel Pinto Teixeira
Veniero Lenzy
Yuliy Bludov

Other affiliated members with PhD

Ana Rita Oliveira Rodrigues
Anabela Gomes Rolo
Anna Paula Safenraider Crema
António Mário Lourenço da Fonseca Almeida
Cristiana Filipa Almeida Alves
Diego Martinez Martinez
Eya Hergli
Filipe André Peixoto Oliveira
Flávia Vieira Barbosa
João Pedro Nunes Pereira
Jorge António Silva Mendes
Júlia Maria Simões Dias Barata de T. Ayres de Campos
Marcio Correa
Margarida Maria Macedo Francesko Fernandes
Maria Elisabete da Cunha Dias Real Oliveira
Maria Teresa Pitta de Lacerda-Arôso
Mário Jorge Dias Zamith Silva
Martin Andritschky
Nelson Miguel Macedo Silva Pereira
Pedro Filipe Ribeiro Costa
Peter Michael Schellenberg
Sandra Maria Fernandes Carvalho
Vasco Miguel Nina de Almeida
Kishor Sapkota

Member Engagements and Achievements



Outreach Activity

VAMOS EXPERIMENTAR A UMINHO
“De Olho” no Método Científico através das Ciências da Visão (José Manuel González-Méijome, Rute J. Macedo-de-Araújo)

Talk
'Efeitos da Gravidade Zero no Olho e no Sistema Visual', Agrupamento de Escolas Alcaides de Faria, Barcelos. (José Manuel Méijome)

- Ciência ao almoço, School of Sciences
- Explorando o Universo das Ciências
- NEI 2024: European Researchers' Night
- Noite Europeia dos Investigadores em ambientes rurais
- VI Journeys of Science 2024
- Researchers go back to Schoo
- ¬Visitas ao Dep. de Física por Escolas Secundárias na atividade “Eletromagnetismo e campos na matéria”
- Outreach activity talk “Mundo da ciência não linear”, Ciência ao almoço, School of Sciences.
- Outreach activity at “lunch talks”, Faculty of Health Sciences, University Fernando Pessoa.

The Members of the Centre also gave Lectures and Workshops in high schools or to high schools’ students visiting University. Other research awareness activities included the presence in radio and TV

Manuel Filipe Costa, Palestra: Robótica e Aprendizagem das Ciências, 21 de novembro de 2024, 17:30-18:30, Ciclo de Conversas com Ciência, Clubes Ciência Viva na Escola, Pavilhão do Conhecimento Ciência Viva (online)

VEM 2024: Materiais inteligentes para uma sociedade digitalizada e sustentável, dezembro 2024

NEI 2024, Science for Global Challenges: Sustainable Sensors: Printing the Future European Researchers' 27th of Setember 2024
NEI 2024 , 2D and 3D Printing Workshop, 19 th of july 2024
NEI: BioFuturo: Biomateriais e Bioimpressão para a Medicina do Futuro”, setembro 2024

UPA- UMInho de Portas Abertas com a atividade Geração de Energia
UPA 2024, sensors and energy harvesters, 18-20 april 2024
UPA - UMinho de Portas Abertas - Sensores magnéticos sustentáveis”, Escola de Ciências, Universidade do Minho, Braga, Portugal.
Verão no Campus com a atividade: Desenvolvimento de materiais de base polimérica para sensores e geração de energia
Verão no Campus” at University of Minho with the theme “Materiais amigos do ambiente com propriedades óticas”. University of Minho July 22-26, 2024

programs, such as “Communicating Science” of radio station «Antena Minho», and “Consultório” of TV channel «Porto Canal».
“Conversar com um Cientista’ na Escola Ciência Viva de Braga.

Verão no Campos 2024, Sensors and Energy Harvesters, 22-26 of july 2024.

UPA 2024, sensors and energy harvesters, 18-20 april 2024
Manuel Filipe Costa, 12ª Feira de Ciências Hands-on Science, e 8º Concurso “À Descoberta da Luz”, Viana do Castelo, 23 de Maio de 2024
Ação de divulgação de ciência e tecnologia (responsável)

Manuel Filipe Costa, VII Informal Digital Photography Contest "The Light and the City", May 13 to July 17, 2024
Ação de divulgação de ciência e tecnologia (responsável)

Manuel Filipe Costa, VIII Informal Digital Photography Contest "The Light and the City", September 23 to 27, 2024
Ação de divulgação de ciência e tecnologia (responsável)

Manuel Filipe Costa, Palestra: Água, Física e Ciência, 12 de abril de 2024, 10:00-11:00, Colégio do Ave, Guimarães.

Verão no Campos 2024, Sensors and Energy Harvesters, 22-26 of july 2024.

Fabricação de filmes magnetoelectricos e avaliação das propriedades piezoresistivas e termoeléctricas - Verão no campus 2024 (22-07-2024/26-07-2024)

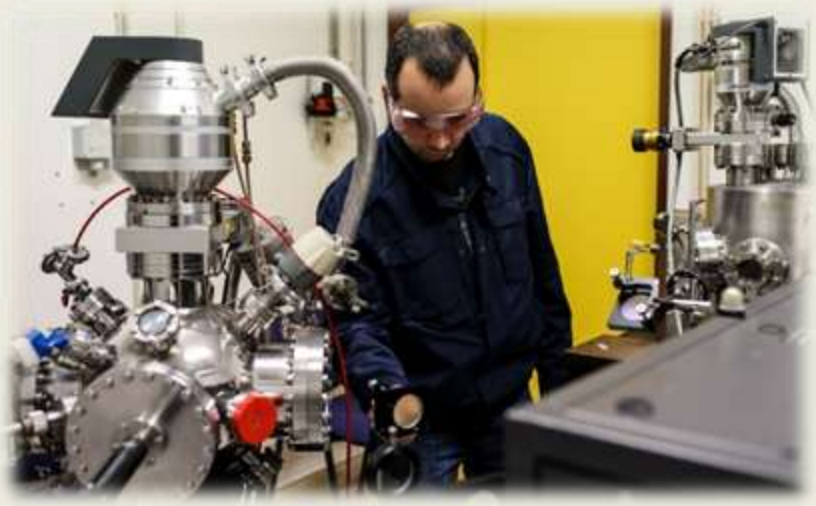
Investigadores voltam à Escola: Nanotecnologia: o que é, onde estamos e para onde caminhamos. Palestra à Escola Secundária Henrique Medina, Esposende, Janeiro 2024 (Sylvie Ribeiro).

Investigadores voltam à Escola: Das necessidades energéticas aos problemas ambientais: onde estamos e para onde caminhamos. Palestra à Escola Secundária Padre Benjamim Salgado, Joane, Abril 2024 (Sylvier Ribeiro).

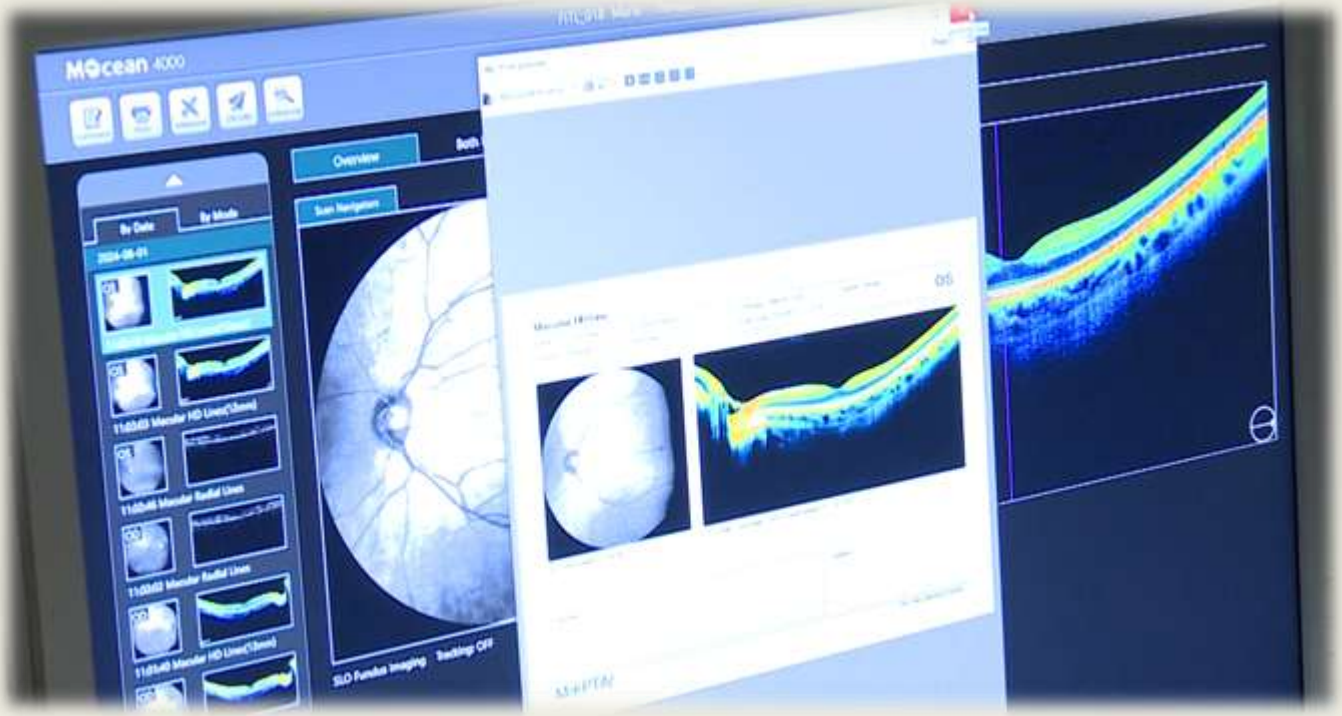
Degradation and detection of antibiotics in water - How to produce membranes using 3D printing and portable sensors" European Researcher´s Night: 2024 (27-09-2024)

Research Laboratories

Laboratory – location	Research Line	Responsable
Biophysics – Gualtar	2	Paulo José Coutinho
Ceramics Research – Azurém	3	Mário António de Castro Pereira
Computational Physics – Gualtar	3	Luís Silvino Alves Marques
Corrosion and electrochemical testings – Azurém	3	Joaquim Carneiro
Crystal Growth – Gualtar	2	Bernardo Gonçalves Almeida
Dielectric Properties – Gualtar	2	Bernardo Gonçalves Almeida
Electromechanical properties of materials – Azurém	3	Senen Lanceros-Mendez/Filipe Vaz/Armando Ferreira
Femtosecond Laser Spectroscopy –Gualtar	2	Michael Scott Belsley
Fluorescence Lifetimes - Gualtar	2	Mário Rui da Cunha Pereira
Functional Coatings I – Azurém	3	Martin Andritschky
Functional Coatings II – Azurém	3	Luís Rebouta
Functional Coatings III – Azurém	3	José Filipe Vilela Vaz
Magnetic and Electromechanical Properties – Gualtar	2	Bernardo Gonçalves Almeida
Materials Processing – Azurém	3	Stanislav Lazarov Ferdov
Microtopography – Gualtar	3	Manuel Filipe Costa
Visual Optics and Ophthalmic Instrumentation – Gualtar	1	Sandra Maria Braga Franco



Laboratory – location	Research Line	Responsable
Optoelectronics – Azurem	3	Carlos José Tavares
Photoconductivity – Gualtar	2	Maria de Fátima Cerqueira
Photophysics I – Gualtar	2	Elisabete Coutinho
Photophysics II – Gualtar	2	Elisabete Coutinho
Preparation – Azurém	3	Stanislav Ferdov
Preparation I – Gualtar	2	Elisabete Coutinho
Preparation II – Gualtar	3	Maria de Jesus Matos Gomes
Raman Spectroscopy and Photothermal Measurements – Gualtar	3	Francisco Macedo
Research in Clinical and Experimental Optometry – Gualtar	1	José González Meijome / António Queirós
Science of Vision and Colour – Gualtar	1	João Manuel Maciel Linhares
Surface analysis – Azurem	3	José Filipe Vilela Vaz
Thin Films I – Gualtar	3	Maria Jesus Matos Gomes
Thin Films II – Gualtar	3	Mário António Castro Pereira
Visual Rehabilitation – Gualtar	1	António Manuel Baptista
Electrophysiology Research Lab	1	Paulo Fernandes / José González Meijome
Clinical and Experimental Optometry Research Lab (CEORLab) - Gualtar	1	José González Meijome / António Queirós
Clinical and Experimental Optometry Research Lab (CEORLab) - Famalicão	1	José González Meijome / António Queirós
Applied Optics Laboratory	2	Luis Rebouta
Raman Imaging and 2D Materials and Devices - INL	2	João Pedro Alpuim



Supervision of Research Students

PhD completions in 2024 (26)

Alshaarawi M. A. Salem
Supervised by Sandra Franco and António Baptista
The effect of near vision tasks in the visual system: university students
Optometry and Vision Sciences

Andreia Esteves Gomes
Supervised by Sérgio M.C. Nascimento and João M.M Linhares
Tuning illumination and colored optical filters for optimal viewing of human skin Optometry and Vision Sciences

Salomé Aurora Pereira.
Supervised by Paulo Fernandes
Objective Eye Care Measurements Obtainment with Eyetracker and their Influence on Ophthalmic Lens Adaptation
Optometry and Vision Sciences

Celso Joel Oliveira Ferreira
Supervised by Bruno F.C. Silva, Cláudia Botelho (CEB) and M. Elisabete C.D. Real Oliveira
Microfluidics for size-controlled cationic liposome-DNA complexes: going beyond the universal transfection curve
(MAP-Fis)

Diogo Emanuel Carvalho Costa
Supervised by Filipe Vaz, Paula Sampaio (CBMA), Graça Minas (DEI)
Development of optical (T-LSPR) biosensors, based in nanoplasmonic thin films, for fast Legionella pneumophila detection in patients or environmental samples
(MAP-Fis)

Maurício Quintela
Supervised by Nuno Peres
Excitons in 2D Materials
(MAP-Fis)

Sérgio Rafael da Silva Veloso
Supervised by Elisabete M. S. Castanheira Coutinho, Paula M.T. Ferreira (CQUM), Miguel Correa-Duarte (U.Vigo)
Development of multifunctional supramolecular magnetogels for multimodal cancer therapy
(MAP-Fis) (foreign supervisor)

Diana Isabela Faria Meira
Supervised by José Filipe Vilela Vaz, Joel Borges e Vitor Correlo (I3Bs) s
Development of nanoplasmonic thin film biosensors with enhanced sensitivity for detection of Ochratoxin-A

Bruno Rodrigues Pacheco e Murta
Supervised by Joaquín Fernandez Rossier and Nuno M. R. Peres
Quantum Many-Body Ground States via Digital Quantum Simulation
(MAP-Fis) (foreign supervisor)

Diana Isabela Faria Meira
Supervised by Filipe Vaz, Joel Borges, Vitor Correlo (ICVS/3B's)
Development of nanoplasmonic thin film biosensors with enhanced sensitivity for detection of Ochratoxin-A
(MAP-Fis)

Eduarda Barbosa Fernandes
Supervised by Marlene Lúcio, Vanessa Cardoso, S. Lanceros-Méndez
Biomimicry profiling supporting drug discovery for topical applications
(Materials Engineering)

Maria Manuela Carvalho Proença
Supervised by Filipe Vaz and Joel Borges
Nanoplasmonic thin films of Au-Ag/MOx functionalized with molecular recognition elements to enhance sensitivity and selectivity of LSPR gas sensors
(MAP-Fis)

Viviana Lima de Sousa
Supervised by Pedro Alpuim, Yuri Kol'enko (INL)
Unconventional Thermoelectrics Based on Self-Organized Nanocrystal Superlattices
(Materials Engineering) (foreign supervisor)

Joana Margarida Fernandes da Silva Ribeiro
Supervided by: Carlos José Tavares (UMinho) e Torben Boll (Karlsruhe Institute of Technology, Germany).
Transparent thermoelectric titanium dioxide-based thin films for thermal energy harvesting

Daniela Morais
Supervised by: Vítor Vilar e Francisca Moreira (FEUP), Carlos José Tavares (UMinho)
A continuous-flow photoelectrocatalytic static mixer microreactor applied to the synthesis of high-value organic chemicals

Estela Marisa Oliveira Carvalho
Supervised by Margarida Fernandes, Clarisse Ribeiro, Senentxu Lanceros-Mendez
Improving Titanium-Bone interfaces with electroactive and antimicrobial materials for effective orthopedic implants

Ioana L. BORŞAN (University of Brasov, Romania)
Supervised by Daniel Munteanu and José Filipe Vilela Vaz
The influence of the structural architecture on the mechanical and tribological properties of TiN, (Ti,Al)N and (Ti,Si)N coatings

Liliana Sofia Fernandes
Supervised by S. Lanceros-Mendez, Pedro Libânio Martins, Daniela Correia
Magnetic ionic liquid/polymer composites for printable sensors and actuators

João Luís Rodrigues
Supervised by Gabriela Botelho, Pedro Martins, Senentxu Lanceros-Méndez Multifunctional air filters based on emerging natural polymers for VOCs removal, Doctoral programm on Materials Engineering, Universidade do Minho,

Miguel Alexandre Martins Franco,
Supervised by Asal Kiazadeh, Senentxu Lanceros-Mendez
Development of conductive inks and memristive active material for printed electronic applications,
Doctoral programm on Materials Engineering, Universidade do Minho,

Tiago Rodrigues Marinho
Supervisionada por Pedor Costa, Vitor Correia e Senentxu Lanceros-Mendez
Printable energy harvester systems for wearable sensor devices
Doctoral Program in Materials Engineering

Luis Amaro Ribeiro Martins,
Supervised by José Luís Gomez-Ribelles, Senentxu Lanceros-Mendez, Clarisse Ribeiro
Microfluidic processing of Smart polymers for Tissue Engineering
Universitat Politècnica de València

Arthur Lanne Ricardo de Souza
Supervised by Marcio Assolin Correa (UFRN) and Armando Ferreira
Caracterização e manipulação do fator de amortecimento em nanoestruturas ferromagnéticas produzidas via GLAD Sputtering

Diogo Emanuel Carvalho Costa, com o trabalho
Supervised by José Filipe Vilela Vaz, Paula Sampaio e Graça Minas (EEUM)
Development of Optical (T-LSPR) Biosensors, based in nanoplasmonic thin films, for early pathogen detection

PhD projects in progress at December 31, 2024

Name	Supervisor	Title	Doctoral Program
Alcinda Valéria Gomes Silva	Elisabete Maria dos Santos Castanheira Coutinho	Plasmonic dehydropeptide-based lipogels: functionalizing post-surgical patches against melanoma recurrence and	Engenharia de Materiais
Alexandre Daniel Mendonça Faria da Silva	Luís Silvino Alves Marques	Emergence of novel properties at the interfaces in oxide heterostructures and superlattices	MAP-Fis
Ana Sofia Ribeiro de Castro	Senen Lanceros Mendez	Nanocomposite membranes for water remediation and raw materials recuperation	Engenharia de Materiais
André Gustavo Silva de Macedo	Clarisse Marta Oliveira Ribeiro	Multiresponsive hydrogels as a novel approach for bone cancer therapies	Engenharia de Materiais
André Rino Amorim	Miguel Faria Ribeiro, José Manuel González Méijome	Improving objective csf estimates using as oct densitometry data	Optometry and Vision Sciences
Anita Camillini	Ernesto Galvão (INL)	Architectures for scalable quantum photonic computing	MAP-Fis
Áureo Capuma Ucuanjongo	Bernardo Almeida	Nanofibras compósitas por electrospinning para dosimetria	MAP-Fis
Bárbara Daniela Duarte Cruz	Senen Lanceros Mendez	Nanoparticle free functional materials for printable sensors	Engenharia de Materiais
Belgacem Tiss	Luís António Carvalho Gachineiro Cunha	Deposition of UV-protective oxide films on complex substrate: cork and rubber.	Engenharia de Materiais
Bruna Machado da Silva	Bernardo Gonçalves Almeida	Naturally Layered Perovskyte Heterostructures	MAP-Fis
Dana Swidan	Jorge Jorge, Madalena Lira	Computer Vision Syndrome in The Role of Contact lenses	Optometry and Vision Sciences
Daniela Filipa Magalhães dos Santos	Bernardo Gonçalves Almeida	Biofunctional Cyclic Dipeptide Nanofibers for Energy Harvesting and Nonlinear Optical Conversion	MAP-Fis
Diana Margarida Ferraz Bogas	Clarisse Marta Oliveira Ribeiro	Spatially and temporally modulated active patches for skin cancer treatment	Map-Fis
Diogo Filipe Pinto Cunha	Mikhail Igorevich Vasilevskiy	Theory and modelling of two-dimensional materials and hybrid structures for nanophotonics	MAP-Fis
Dora Nazaré Marques	Sérgio M.C. Nascimento e João M.M Linhares	Environmental spectral statistics and brain plasticity – testing hypotheses about the mysterious vision of X-linked forms of colour vision deficiencies	Optometry and Vision Sciences
Eduardo Ínsua Pereira	Madalena Lira e Paula Sampaio	Evaluation of cytotoxic potential and inflammatory response induced by contact lenses	Optometry and Vision Sciences
Eduardo José de Sousa Pimetel	Daniel António da Silva Miranda	Printable piezoresistive materials based on natural polymers for medical device application	Engenharia de Materiais
Élida Melo Margalho	Elisabete Fraga de Freitas	Demonstration of the impacts of photocatalytic asphalt pavements	Engenharia Civil
Elmahdi Amar	Nicoleta Nicoara (INL), Pedro Alpuim	Characterization do single-photon emitting defects in 2D materials by scanning probe microscopy	MAP-Fis
Eloy Arroyo	Jorge Jorge	Effectiveness of orthokeratology treatment in myopic children from Quito-Ecuador	Optometry and Vision Sciences
Fábio Alberto Costa Lopes	Paulo José Gomes Coutinho	Development of multifunctional magnetic/plasmonic nanosystems for combination therapy and radiosensibilization	Engenharia de Materiais

Filipe Miguel Gonçalves da Silva	Madalena Lira, João Linhares	The influence of ocular and external factor in measuring intraocular pressure	Optometry and Vision Sciences
Francesco Viviano	José M. González Méijome, Rute Araújo	Scleral lens fitting in keratoconus patients	Optometry and Vision Sciences
Francisca Marçal Queiroz Pinheiro Guedes	Mário Rui Pereira (DF, ECUM), Susana Costa (DQ, ECUM), Martin Lopez Garcia (INL)	Novel quantum materials inspired by natural phot onic photosynthetic structures	Química aplicada
Ghulam Muhammad	António Queirós / Paulo Fernandes	The impact of digital device use on myopia incidence and progression in children and adolescents.	Optometry and Vision Sciences
Giorgia Schmidt de Siqueira	José Filipe Vilela Vaz	Next-Generation Cutting Tools: Enabling In-situ Process Monitoring through Nanostructured Multimodal Sensor Networks	Engenharia de Materiais
Henrique Emanuel Araújo Silva	Andreia Gomes (CBMA), Marlene Lúcio (CFUM/CBMA)	2G4CANCER – Green graphene/lipid nanosystems for cancer imaging and treatment	Molecular and Environmental Biology
Iñaki Blanco Martínez	Miguel António Faria Ribeiro,José M. González Méijome	Off-axis wavefront model of young and ageing human eyes	Optometry and Vision Sciences
Ioana L Borsan	José Filipe Vilela Vaz	The influence of the structural architecture on the mechanical and tribological properties of TiN, (Ti,Al)N and (Ti,Si)N coatings	Engenharia de Materiais
Isabel Alves Lopes	Rui Vilar	Optical and tribological properties of femtosecond laser nanotextured surfaces	AdvaMTech
James Caleb Peters	João Pedro Santos Hall Agorreta Alpuim	Correlation of transport and structural properties of Graphene and Bismuth Telluride as a function CVD growth parameters	MAP-Fis
Jessica Gomes	Sandra Franco	Real-time changes in ocular optical properties with accommodation	Optometry and Vision Sciences
Joana Catarina Dias Moreira	Senen Lanceros Mendez	Physical active antimicrobial surfaces for preventing the spread of pathogenic microorganisms	Engenharia de Materiais
Joana Marina Silva Queirós	Senen Lanceros Mendez	Wide range polymeric membranes towards water remediation of contaminants of emerging concern	Engenharia de Materiais
João Dinis Castro Alves	Senen Lanceros Mendez	Advanced 3D printed multi-layered multi-functional hybrid membranes for wide range water remediation.	Engenharia de Materiais
João Duarte Gonçalves Azevedo	Michael Scott Belsley	Development of nanophotonic computational devices inspired by neural circuits in insect brains	Map-Fis
João Miguel Peixoto Oliveira	Bernardo Gonçalves Almeida	Multiferroic bilayer composites for coupled magnetic-electric-optical functionalization	MAP-Fis
João Pedro Cruz Serra	Senen Lanceros Mendez	Natural polymer based multifunctional materials for sensing applications	Engenharia de Materiais
Jorge Manuel Pereira Sousa	Elisabete Fraga de Freitas	Incorporation of Composite Phase Change Materials into Asphalt Mixtures for Cooler Pavements	Engenharia Civil
Jorge Miguel Leite Gonçalves	Alice Maria Esteves dias	Synthesis and evaluation of novel pyrimidine and purine derivatives as fluorescent probes for cancer diagnosis	Química aplicada
José Alexandre Monteiro	João M.M Linhares e Sérgio M.C. Nascimento	Neural networks applied to the preservation and restoration of artistic paintings.	Optometry and Vision Sciences
José Diogo da Costa Guimarães	Mikhail Igorevich Vasilevskiy	Investigação de efeitos quânticos no transporte de energia e cargas em sistemas fotossintéticos com simulações quânticas	MAP-Fis

Juliana Filipa Gouveia Marques	Carlos José Macedo Tavares	Difusão controlada de compostos ativos de microcápsulas mediada por ativação solar	Engenharia de Materiais
Kateryna Oleksandrivna Shvydyuk	Abílio Manuel Pereira da Silva	Self-sensing and self-healing ceramic composites using functionally graded materials and additive manufacturing technologies for thermal barrier coatings in aerospace applications	Engenharia Mecânica
Luis Proença Oliveira	Jorge Jorge	Estudo da influencia da Visão no atletismo	Optometry and Vision Sciences
Mafalda Inês Gonçalves de Abrantes	João Pedro Santos Hall Agorreta Alpuim	Graphene nanobioelectronics for neural interfacing	Engenharia de Materiais
Marcelo Silva Barreiro	Andrei Postnikov (Univ. of Lorraine, Metz, France), Mikhail Vasilevskiy	Polariton-assisted energy harvesting in bio-inspired hybrid structures	University of Lorraine, France
Maria Inês Fernandes Monteiro	Renato Ferreira Gonçalves	New smart batteries with self-sensing capabilities for enhanced lifespan and safety	Engenharia de Materiais
Maria João Caetano da Costa	Sílvio Santos (CEB-UM), Daniela Silva (ALS), Pedro Alpuim	Improved detection of Pseudomonas aeruginosa: developing the next-generation diagnostics based on bacteriophage proteins	Chemical and Biological Eng.
Maria João Fernandes Faria	Marlene Susana Dionísio Lúcio	MeYeDEAR – Monoolein-based EYE DElivery systems for Age-related Retinopathies	Optometry and Vision Sciences
María Mechó García	Paulo Fernandes, Rute J. Macedo de Araújo, Jos Rozema	Statistical wavefront model of accommodation: analysis and synthesis	Optometry and Vision Sciences
Marina do Carmo Alves	Sascha Sadewasser	Fabrication and characterization of micro-concentrator solar cells based on Cu(In,Ga)Se2	Engenharia de Materiais
Marta Sofia Vilela Barreira Teixeira	Maria Alice Gonçalves Carvalho	Development of a drug carrier nanosystem for a new anticancer drug and optimization of the new drug	Química
Misha Khalid	Michal Pawlak (Nicolaus Copernicus University)	Thermoelectric properties of TiO2:Nb, Sb, Bi and ZnO:Sb, Bi transparent films	Nicolaus Copernicus University (Poland)
Muhammad Qasim	Paulo Fernandes, Jorge Manuel M. Jorge	Electroretinogram as a tool to measure efficacy in management of myopic young adults	Optometry and Vision Sciences
Nathalia Hammes	Iran Gomes da Rocha Segundo		
Nelssom Fernandez da Cunha	José Carlos Viana Gomes, Luís Rebouta	Design and construction of a Rangefinder/LiDAR testbed	MAP-Fis
Nuno Pacheco	Luís Silvino Marques	Desenvolvimento de um sistema de gasificação por plasma para a conversão termoquímica de lamas de depuração	Mechanical Enginnering
Orlando de Sousa Lima Júnior	Elisabete Fraga de Freitas	Color-based road nanosensors based on thermochromic and self-cleaning abilities	Engenharia Civil
Osvaldo Gramaxo de Freitas	António Joaquim Onofre Abreu Ribeiro Gonçalves	Application of deep learning networks to GW astronomy	Map-Fis
Patrícia Alexandra Pereira da Silva	Joel Borges, Ana Paula Fernandes Monteiro Sampaio Carvalho	Development of nanocomposite ZnO thin films with antibiofilm and antimicrobial properties to revent pathogens' transmission	Molecular and Environmental Biology
Paulo Tchimbumbuanjila Boano	Bernardo Gonçalves Almeida, Etelvina Gomes, Rosa Maria Ferreira Batista	Nanofibras por electrospinning com inclusões para as funcionalizações (magnéticas, ópticas)	MAP-Fis
Pedro Alexandre Ferreira Passos	António Joaquim Onofre Abreu Ribeiro Gonçalves	Search for Exotic Compact Objects in the Universe	Map-Fis
Pedro Tiago Jesus	Jorge Jorge	O Efeito da compensação das disfunções acomodativa/vergenciais na progressão da miopia	Optometry and Vision Sciences

Rafael dos Santos Pinto	Carlos Miguel da Silva Costa	Two- and three-dimensional sustainable solid-state printed batteries for portable electronic devices	Engenharia de Materiais
Rafael Wagner	Mikhail Igorevich Vasilevskiy	Coherence and Contextuality as Quantum Resources	MAP-Fis
Rafaela Marques Meira	Senen Lanceros Mendez	Electroactive polymer-based materials as a novel approach for cardiac tissue engineering	Engenharia de Materiais
Raquel Gaudência Dias Andrade	Elisabete Maria dos Santos Castanheira Coutinho	Functionalized magnetoliposomes for enhanced anticancer activity of lactoferrin against triple	Engenharia de Materiais
Ricardo Jorge Cunha Fernandes	Paulo José Gomes Coutinho	Photocatalytic degradation of PFAS under visible light: development of nanomaterials as novel photocatalysts and process scale-up	Engenharia de Materiais
Ricardo José da Silva Lima	João Nunes Pereira	Advanced self-sensing polymer composites with self-healing capabilities for high responsibility applications	Engenharia de Materiais
Rita de Magalhães Policia	Senen Lanceros Mendez	High-performance printable luminescent and chromic materials for improved device integration	Engenharia de Materiais
Rita Maria Martins Alves	Fernanda Cássio, Madalena Lira, Ana Vera Machado	Contact lens materials: An ecosystem issue and a contribution to a circular economy	Molecular and Environ. Biology
Rui Guilherme Coelho Silva	João Pedro Santos Hall Agorreta Alpuim	Software Defined Antenna for THz Applications	Electrical Engineering
Rui Miguel Gonçalves Carvalho	Pedro Libânio de Abreu Martins	SuSprinting: Sustainable materials and technologies for printable spintronic applications	Engenharia de Materiais
Sara Leite	Paulo Fernandes, José M. González Méijome	Evaluation of the potential of the retinal electrical activity as a biomarker for the development of myopia control treatments	Optometry and Vision Sciences
Solange da Silva Nunes	António Joaquim Onofre Abreu Ribeiro Gonçalves	Deep-Learning Classification and Parameter Inference of Rotational Core-Collapse Supernovae	Map-Fis
Talita Nicolau de Oliveira Vidal de Negreiros	Andrea Zille (UMinho), Carlos Carlos José Tavares (UMinho), Nuno Osório (UMinho)	The development of synergistic ozone and light-emitting diode activation system for the disinfection of fiber-based materials	Doutoramento Maria de Sousa – 2022 (FCT)
Telma Campos Domingues	João Pedro Santos Hall Agorreta Alpuim	Multiplex detection of circulating tumor DNA using graphene electrolyte-gate field-effect transistors	MAP-Fis
Tiago Alves Queirós	João Pedro Santos Hall Agorreta Alpuim	Single Photons on Demand from a 2D Material Heterostructure	MAP-Fis
Tiago Fernando Abreu Rodrigues	Bernardo Gonçalves Almeida, José Pedro Basto da Silva, João Pedro Araújo	Lead-free multiferroic heterostructures for enhanced magnetic field sensing	MAP-Fis
Tiago Saraiva Fernandes	António Joaquim Onofre Abreu Ribeiro Gonçalves	Deep Learning for transient signals in gravitational-wave astronomy	Map-Fis
Timothy Albert	José M. González Méijome, Rute Araújo	Validation of an Italian Language Vision-Related Quality of Life Questionnaire and Evaluation of Corneal and Retinal Modifications in Patients with Keratoconus	Optometry and Vision Sciences
Vitor Filipe Henriques da Silva	Paulo Mendes (DEIC-UM)	Radio-frequency graphene technology oscillators for biomedical devices	Electrical Engineering
Yelko del Castillo Hernández	Joaquín Fernández Rossier	Single spin resonance magnetometry with scanning tunneling microscopy	MAP-Fis

Master theses completed in 2024

Name	Supervisor	Title	Master Course
Fabiana Fernandes Sousa	Madalena Lira, Beatriz Remeseiro	Evaluation and characterization of blinking and other parameters for dry eye detection	Advanced Optometry
Sara Ribeiro	Madalena Lira e Jorge Jorge	Caraterização de erros refrativos	Advanced Optometry
Inês da Silva Pinheiro	Paulo Fernandes António Queirós	Efeito do erro periférico no controlo da progressão da miopia: Revisão sistemática e meta-análise	Advanced Optometry
Inês Mota Silva	António Queirós	O impacto do tratamento da ortoqueratologia em olhos míopes	Advanced Optometry
Ana Leonor Gonçalves Sousa	Miguel Faria Ribeiro José Manuel González Méijome	Avaliação teórica e experimental da função visual de pacientes adaptados com lentes de contacto multifocais	Advanced Optometry
Edite Fernanda Sá Menezes	Sandra Franco	Impacto da Realidade Virtual na qualidade ótica do olho e nos parâmetros acomodativos	Advanced Optometry
Elaine Costa	Sandra Franco	Impacto da realidade virtual no sistema visual	Advanced Optometry
Miguel Antunes Gomes	Paulo Fernandes	Alterações oculares em profundidades aquáticas	Advanced Optometry
Bárbara Marinho	Paulo Fernandes, José Manuel Meijome	Retinal electrophysiological activity and visual function after ocular stimulation with repeated low-level red-light for myopia control	Advanced Optometry
Beatriz Costa Pereira	João Manuel Maciel Linhares	Optometry in the clinical practice / Optometria em âmbito clínico	Advanced Optometry
Marcelo Silva Barreiro	Bruno Amorim, Mikhail Vasilevskiy	Exciton generation by inelastic tunnelling in heterostructures with two-dimensional semiconductors	Physics
Luís Filipe Dias Ferreira	Bernardo Almeida, Rosa Baptista	Eletrospinning de nanofibras híbridas para geração de energia	Biophysics and Bionanosystems
Mariana Sampaio Terroso	Marlene Lúcio Maria Pia M. Alvim Ferraz Fernando J. Mendes Monteiro	Flavonoids-loaded liposomes as promising antimicrobial biofilm strategies for enhanced wound healing	Bioengineering (Fac. Eng., UPorto)
Hugo da Silva Pinho	Carla M. Lopes Marlene Lúcio	Desenvolvimento de nanopartículas lipídicas contendo quercetina e ómega-3: Avaliação do seu potencial antioxidante	Pharmaceutical Sciences (Fac. Health Sciences; Univ. Fernando Pessoa)
Mohamed Somai	Carla M. Lopes Marlene Lúcio	Non-lamellar lipid nanosystems for topical application	Pharmaceutical Sciences (Fac. Health Sciences; Univ. Fernando Pessoa)
Igor Samuel Peixoto Gomes	Mário Rui da Cunha Pereira	Contribuição do Fotovoltaico para a Mobilidade Sustentável	Environment Sciences and Technologies
Gabriel Cabral de Freitas Lopes Moreira	Andrea Capasso (INL) Pedro Alpuim	Graphene-based substrates com controlled wetting properties for cell growth scaffolds	Engineering Physics
Maria Miguel de Oliveira Soares	Jana Nieder (INL) Pedro Alpuim	Development of a genosensing platform for antimicrobial-resistant bacteria based on Graphene's nearfield effects	Engineering Physics
Tiago Rafael Marques Pereira	Luís M. Jacinto (FM-UP) Pedro Alpuim	Graphene nanobioelectronic neural interfaces	Engineering Physics
Vicente Silva Lopes	Andrea Capasso (INL) Pedro Alpuim	Functional graphene-based protective coatings for contact lenses	Engineering Physics
Fabíula Pereira Lessa	Iran R. Segundo Joaquim Carneiro	Desenvolvimento de Painéis Cimentícios Autolimpantes para Fachadas de Edifícios através da Pulverização e Imersão de Nano-TiO2 e Micro-Zn". Conclusão: UMinho, 20 de Dezembro 2024	Mestrado em Ciências e Tecnologias do Ambiente (MCTA)
Sara Patrícia de Castro e Silva	Armando Ferreira	Desenvolvimento de processos de caracterização de massa negra	Integrated Master's in Materials Engineering

Sara Maciel de Sousa Inácio,	Cláudia Lopes	"Desenvolvimento de elétrodos híbridos para Neuro-Reabilitação: Uma Abordagem Integrada com Filmes Finos Biocompatíveis	Integrated Master in Materials Engineering
Leonardo Macedo Domingues	José Pedro Basto da Silva, Professor Doutor Luís Silvino Alves Marques	Simulação, fabrico e caracterização de fotodetetores para o visível e infravermelho próximo autoalimentados baseados em óxidos de semicondutor	Physics
Simão Carvalho Antunes Viana	Maria José Bastos Pires de Lima Joel Nuno Pinto Borges	Filmes de $MoSe_2/Cu^0$ depositados em estruturas tridimensionais para a redução eletrocatalítica do CO_2	Integrated Master in Materials Engineering
Eva Melo dos Santos	Diogo Albano Cavaleiro Ventura de Carvalho Maria José Bastos Pires de Lima	Desenvolvimento de eléctrodos para a produção electrocatalítica de H_2	Mestrado em Engenharia do Ambiente (UC)
Cecília Antónia Teixeira Mendes	Manuel Filipe Costa	Mobilidade Elétrica: Desafios e Oportunidades para a Sustentabilidade Energética	Mestrado em Ciências e Tecnologias do Ambiente – Ramo de Energia
João Miguel Rodrigues Mirra	Pedro Costa e SenentxuLanceros-Méndez	Printable thermal polymer composites for energy harvesting applications	Mestrado em Engenharia Física

Externally funded projects

Projects finished in 2024

In 2024, 7 research projects were completed with CF-UM-UP as a partner

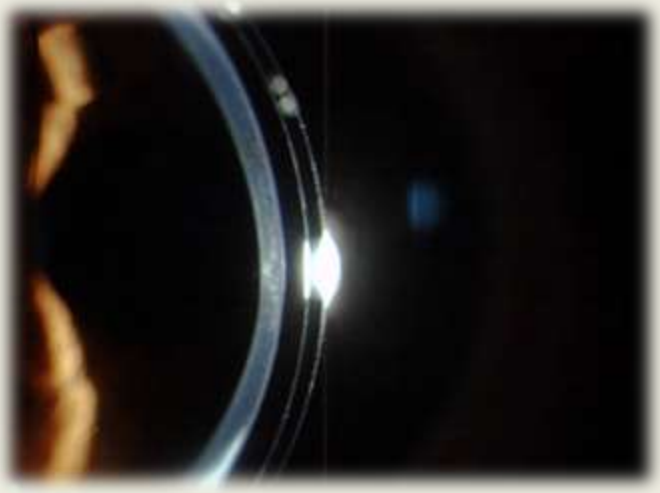
Funding entity	Reference	Researcher	Global Budget - UM
FCT	PTDC/CTM-REF/0155/2020	Luís Gachineiro Cunha / IR na FCT: Diego Martínez	202 719,44 €
FCT	EXPL/FIS-MAC/0947/2021	Luis Silvino Alves Marques	49 993,99 €
FCT	EXPL/FIS-MAC/0953/2021	Bruno António Campos Amorim	49 946,38 €
FCT	PTDC/CTM-CTM/2241/2021	Carlos José Macedo Tavares	69 472,05 €
FCT	EXPL/EQU-EQU/1110/2021	Manuel Filipe Costa	49 912,30€
FCT	2021.09183.CBM	José Pedro Basto Silva	4 000,00 €
FCT	MyopiaX	José Manuel González Meijome	140 811,09 €

Projects in progress at December 31, 2024

32 projects with CF-UM-UP as a partner, which worked in 2024, are still active in 2024:

Funding entity	Title	Researcher	Start date	End date	Global Budget - UM
FCT	2022.03931.PTDC	Carlos Miguel Silva Costa	01/01/2023	31/12/2025	186 262,94 €
CE	OBERON - 956720	José Manuel González Meijome	01/01/2021	28/02/2025	721 680,48 €
FCT	PTDC/FIS-MAC/6606/2020 PTDC/NAN-MAT/0098/2020	Joaquim Alexandre Santos Almeida Oliveira Carneiro	29/03/2021	28/03/2025	249531,73€
FCT	PTDC/FIS-MAC/2045/2021 M-ERA-NET3/0003/2021	Ricardo Pedro Lopes Martins Mendes Ribeiro	01/01/2022	30/09/2025	49163,95€
FCT	2022.03781.PTDC	Carlos Miguel Silva Costa	01/02/2023	31/01/2026	93290€
FCT	2022.01740.PTDC 2022.02697.PTDC	José Pedro Basto Silva	12/03/2023	11/03/2025	49982,307€
FCT	2022.05540.PTDC 2022.03564.PTDC	Pedro Libânio Abreu Martins	01/01/2023	31/12/2025	137550€
FCT	2022.04128.PTDC	Luis Silvino Alves Marques	12/03/2023	11/03/2026	10601,25€
Projeto Direto	Precilens (Projeto Direto)	António Queirós	16/02/2022	15/02/2026	34548,46€
FCT	UIDB/04650/2020	António Joaquim Onofre Abreu Ribeiro Gonçalves	01/01/2020	31/12/2024	1315741,28€

FCT	UIDB/04650/2020	António Joaquim Onofre Abreu Ribeiro Gonçalves	01/01/2020	31/12/2024	829111,02€
FCT	LA/P/0095/2020	Luís Manuel Fernandes Rebouta	01/01/2021	31/12/2025	216148,62€
PRR	PRR n.º 58 - NGS – New Generation Storage	Carlos Miguel Silva Costa	01/01/2023	31/12/2025	1 346 046,59 €
PRR	Agenda Drivolution 01/C05-i01/202	Armando José Barros Ferreira	01/10/2022	30/09/2025	1 245 133,99 €
ANI	3431	Cláudia Jesus Ribeiro Lopes	01/09/2023	31/08/2026	256 941,32 €
CCDR-N	0140_BIOIMP_ACE_MAS_6_E	Senen Lanceros Mendez Sylvie de Oliveira Ribeiro	01/07/2023	30/06/2026	221 378,80 €
CE	101129661	Sara Núñez Sánchez	01/04/2024	31/03/2028	558 500,00 €
POLO	DIABETIC	Jorge Manuel Martins Jorge	01/02/2024	31/01/2025	35 000,00 €
Bilateral	2023.09567.CBM	Cláudia Jesus Ribeiro Lopes	03/04/2024	02/04/2026	4 000,00 €
AICEP, E. P. E	179826	Nuno Filipe Silva Fernandes Castro	01/12/2021	30/11/2024	4 714 234,71 €
FCT	CETP-2022-00046	Luís Manuel Fernandes Rebouta	01/12/2023	30/11/2026	125 000,00 €



2024 Affiliated Publications

2,4,5-Tri-aminopyrimidines as blue fluorescent probes for cell viability monitoring: synthesis, photophysical properties, and microscopy applications; J.M. Gonçalves, J.N.D. Gonçalves, L.F. Sousa, L.R. Rodrigues, P. Correia-de-Sá, Paulo J.G. Coutinho, Elisabete M.S. Castanheira, R. Oliveira, A. M. Dias; Organic & Biomolecular Chemistry 22 (2024) 2252-63; doi:10.1039/D4OB00092G(with CQUM, CBMA)

A 3D-Printed Portable UV and Visible Photoreactor for Water Purification and Disinfection Experiments, Castro N., Queirós J.M., Alves D.C., Fernandes M.M.M., Lanceros-Méndez S., Martins P.M. (2024) Nanomaterials, 14 (6), art. no. 525, DOI: 10.3390/nano14060525

A composite proton exchange membrane with a three-dimensionally-reinforced hydrogen bonding network for durable hydrogen fuel cells Dong Y., Feng C., Xie H., He Y., Costa C.M., Lanceros-Méndez S., Han J., He W. (2024) Inorganic Chemistry Frontiers, 11 (14), pp. 4459 - 4468, DOI: 10.1039/d4qi01074d

A Label-Free Multitechnique Approach to Characterize the Interaction of Bioactive Compounds with Biomimetic Interfaces; E. Fernandes, R. R. Costa, R. Machado, R. L. Reis, I. Pashkuleva, M. Lúcio; Small Science 4 (2024) 2300271, doi:10.1002/smsc.202300271 (with CBMA)

A New Grinding Wheel Design with a 3D Internal Cooling Structure System; D. Costa, S., Capela, P., Souza, M. S., Gomes, J. R., Carvalho, L., Pereira, M., and Soares; Journal of Manufacturing and Materials Processing 8, (2024) 159. Doi: 10.3390/jmmp8040159

A Review on the Rheological Properties of Single Amino Acids and Short Dipeptide Gels; Sérgio R.S. Veloso, M. Rosa, C. Diaferia, Célio Fernandes; Gels 10(8) (2024) 507; doi:10.3390/gels10080507 (with Centro de Matemática)

AC/DC Magnetic Field Sensing Based on a Piezoelectric Polymer and a Fully Printed Planar Spiral Coil, Fernández Maestu J., Pereira N., Lanceros-Méndez S., (2024) ACS Applied Materials and Interfaces, 16 (36), pp. 48547 - 48555, DOI: 10.1021/acsami.4c09409

An injectable composite co-assembled dehydropeptide-based magnetic/plasmonic lipogel for multimodal cancer therapy; Sérgio R.S. Veloso, M. Vázquez-González, C. Spuch, L. Freiría-Martínez, M. Comís-Tuche, M.I. Martínez-Almeida, T. Rivera-Baltanás, L. Hilliou, C.O. Amorim, V.S. Amaral, Paulo J.G. Coutinho, P.M.T. Ferreira, Elisabete M.S. Castanheira, M.A. Correa-Duarte; Advanced Functional Materials 34 (2024) 2402926; doi:10.1002/adfm.202402926 (with CQUM)

An Interactive Hybrid Book Integrating Capacitive, Piezoelectric, and Piezoresistive Polymer-Based Technologies Gonçalves S.A.P., Pereira N., Costa C.M., Branco P., Lanceros-Mendez S. , (2024) Advanced Engineering Materials, 26 (5), art. no. 2301571, DOI: 10.1002/adem.202301571

Artificial Intelligence-Enhanced Colorimetric Assessment of Self-Cleaning Road Marking Paints. Orlando Lima Jr, Iran Rocha Segundo, Laura Mazzoni, Manuel F. M. Costa, Elisabete Freitas, Joaquim Carneiro (2024). Applied Sciences, 14(21), 9718. https://doi.org/10.3390/app14219718

Assemblable 3D biomimetic microenvironment for hMSC osteogenic differentiation Martins L.A., García-Parra N., Ródenas-Rochina J., Cordón L., Sempere A., Ribeiro C., Lanceros-Méndez S., Gómez-Ribelles J.L., , (2024) Biomedical Materials (Bristol), 19 (6), art. no. 065013, DOI: 10.1088/1748-605X/ad7dc4

Asymmetries in invisible dark matter mediator production associated with $t\bar{t}$ final statesE. Chalbaud (LIP and Coimbra U.), Rui M.

Silva (LIP and Coimbra U. and Minho U.), António Onofre (LIP, Coimbra and Minho U.), Ricardo Gonçalo (LIP, Coimbra), Miguel C.N. Fiolhais (LIP and Coimbra U. and Kingsborough Coll. and City Coll., N.Y. and CUNY, Graduate School - U. Ctr.) e-Print: 2404.10852 [hep-ph] DOI: 10.1103/PhysRevD.110.076016 (publication) Published in: Phys.Rev.D 110 (2024) 7, 076016

Asymptotic Upper Bound for the Peak-Effect in Linear Control Systems; G. V. Smirnov; Computational Mathematics and Mathematical Physics 64 (2024) 614; doi:10.1134/S0965542524700088

Ay N. hBN/PVDF-HFP and BNNS/PVDF-HFP nanocomposites as flexible and lightweight dielectric capacitors: High energy storage performance via electrically insulating nanoparticles Koroglu L., Tubio C.R., Correia D.M., Costa C.M., Ayas E., Lanceros-Mendez S., (2024) Polymer Composites, 45 (18), pp. 16556 - 16573, DOI: 10.1002/pc.28911

BCLA CLEAR Presbyopia: Epidemiology and impact. M. Markoulli, T. R. Fricke, A. Arvind, K. D. Frick, K. M. Hart, M. R. Joshi, H. Kandel, A. Filipe Macedo, D. Makrynioti, N. Retallic, N. Garcia-Porta, G. Shrestha and J. S. Wolffsohn. Cont Lens Anterior Eye, 47(4)(2024):102157. 10.1016/j.clae.2024.102157

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