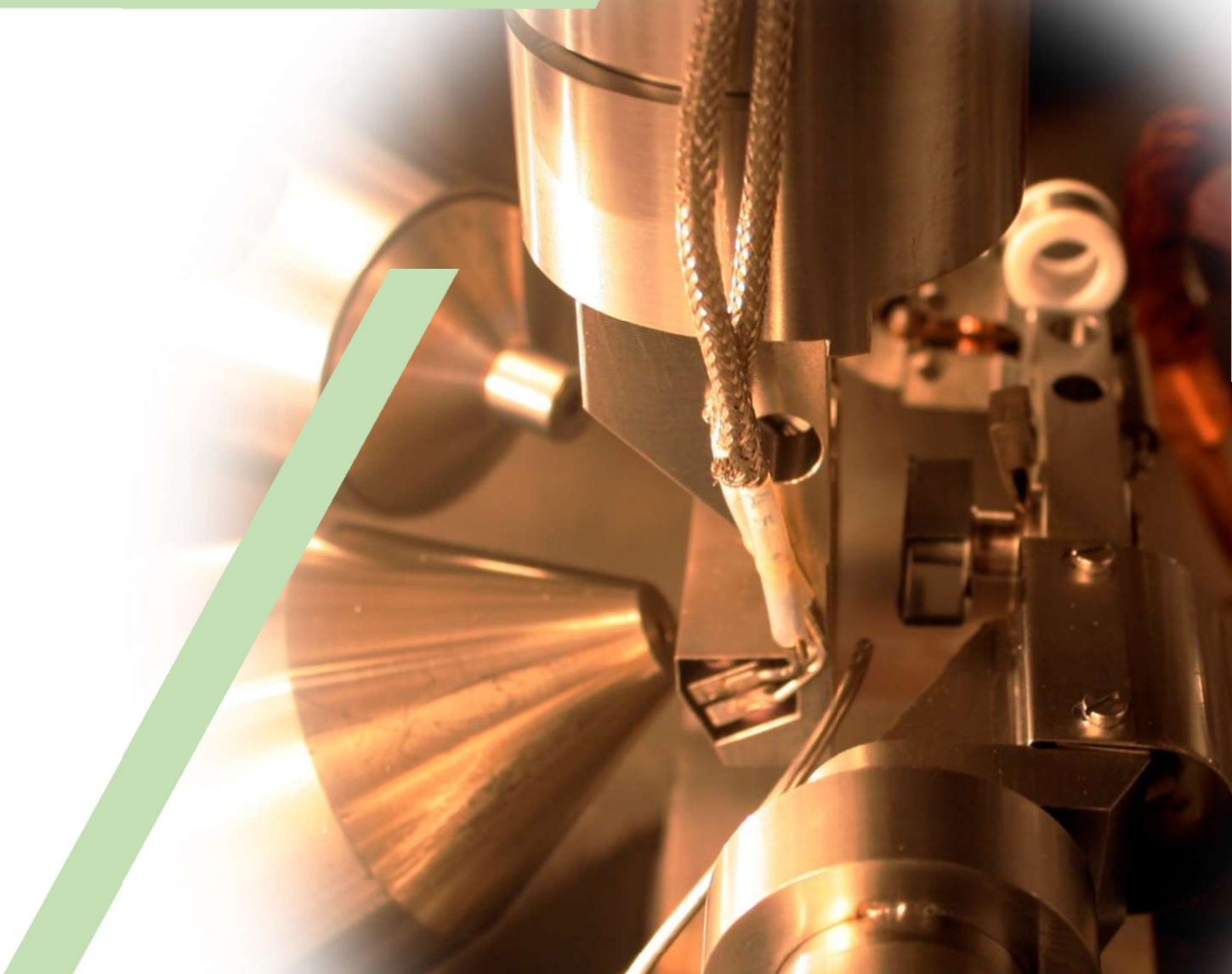
NOVA SCHOOL OF
SCIENCE & TECHNOLOGY

CEFITEC
CENTRO DE FÍSICA E INVESTIGAÇÃO TECNOLÓGICA
Centre of Physics and Technological Research
www.cefitec.fct.unl.pt

2022-23
Activity Report



Front cover: ‘Inside’ a time-of-flight secondary ion mass spectrometry instrument.

Contents

Foreword

Another two years have passed with an accelerated pace at CEFITEC. The years 2022 and 2023 proved to be highly rewarding for our team of researchers. Despite challenges in securing national funding, we successfully embarked on two new large-scale European projects aimed at studying the effects of high-energy radiation on the environment and human health, and establishing metrology frameworks for carbon capture, utilization, and storage. Moreover, two of our integrated researchers secured CEEC researcher positions, while several students obtained PhD scholarships through competitive calls. Our services have generated increased funds to support research activities, and our close collaborations with industry have continued to flourish. Furthermore, significant technological advancements were achieved, underpinned by a solid understanding of fundamental principles.

Progress in solar-pumped laser technology has been particularly noteworthy, signaling promising advancements towards enhancing its efficiency and competitiveness as a renewable energy source. A significant milestone for our team was the publication of the first book on Solar Lasers, by invitation from Springer Nature, further acknowledging CEFITEC's leadership in the field. Additionally, our studies on radiosensitizers have unveiled electron transfer processes as potential key drivers, elucidating the molecular mechanisms underlying the role of these chemical compounds in cancer therapy.

In the domain of advanced training, our efforts have reached a peak, with 14 students successfully completing their PhDs, approximately one per integrated researcher. Furthermore, 15 students have concluded their master's degrees, further reinforcing our contribution in preparing skilled professionals.

As we transition into 2023, we have concluded an assessment period. With the evaluation process on the horizon, CEFITEC is confident in the proper recognition of its performance. Despite our small size, we have solidified our position as important international players in vacuum metrology and instrumentation, charge exchange processes in molecular physics, and solar-pumped lasers. Our momentum is high, with a clear trajectory towards further progresses. Active collaborations with respected institutions such as CERN, numerous National Metrology Institutes, universities across Europe, and private companies continue to amplify the impact of our research and development activities not only on the scientific community, but also on industry, regulatory bodies, and society in general.

Orlando Teodoro

Mission

CEFITEC is devoted to exploring Engineering and Applied Physics activities, merging selected topics in Physics, Chemistry, Materials Science and Engineering.

It is our goal to achieve technological developments based on firm scientific grounds. Therefore, our research ranges from basic principles to proof of concept, system prototype and, in some cases, deployment in operational environment.

We are fully committed in advanced training preparing young professionals to face the ever-growing challenges of our society.

For this purpose, CEFITEC has well-equipped laboratories and a team of physicists, chemists, and engineers, with a strong experimental background in Surface Science, Vacuum Technology, Atomic and Molecular Interactions and Solar-Pumped Lasers.

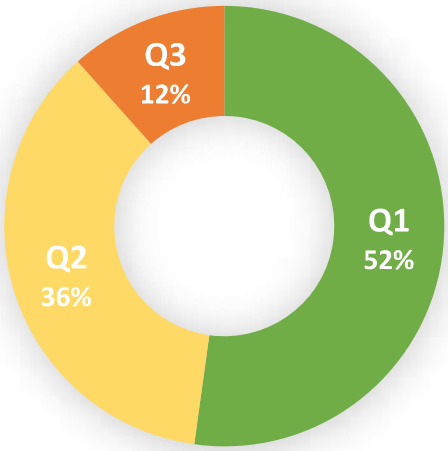
Highlights 2022-23

Publications 2022	Publications 2023
35	34

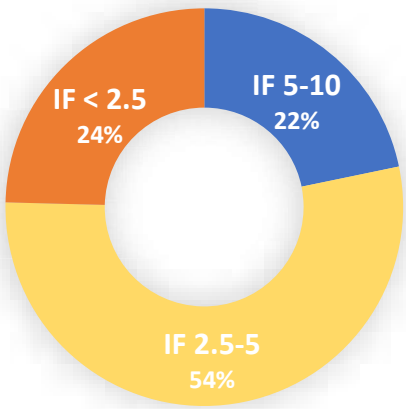
More than **50%** of publications are in the **Q1 quartile**.

60% of publications have **citescore between 5 and 10**.

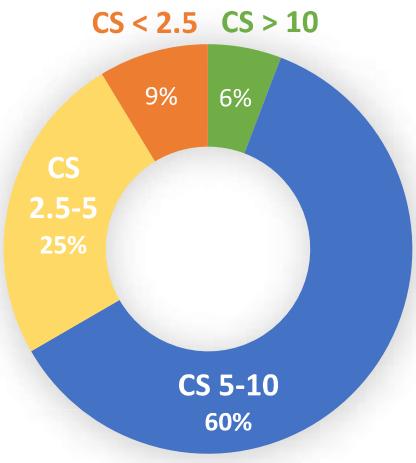
Quartile



Impact Factor



Citescore



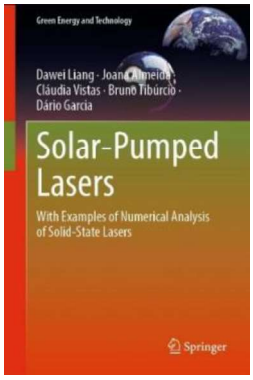
Two **CEFITEC researchers** have been **awarded contracts** in the 2023 **Individual Scientific Employment Stimulus Competition** (**CEEC**).

Dawei Liang was elected as **Associate Editor** in **Journal of Photonics for Energy** in 2022, **Academic Editor** in **Academia Green Energy** in 2023, and **Editorial Member** of **Clean Energy and Sustainability** in 2023.

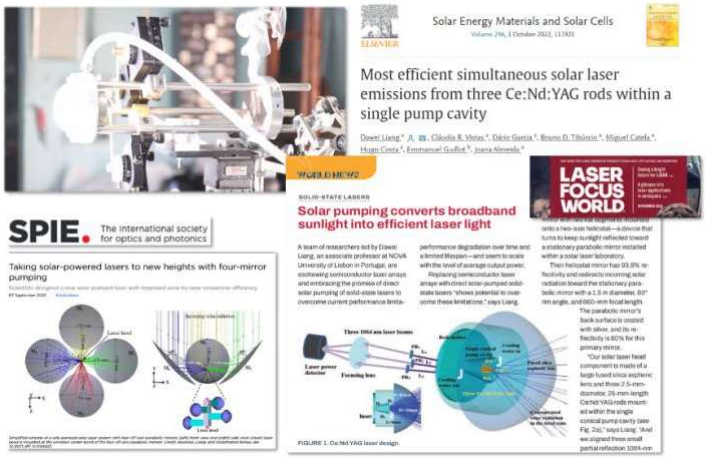
CEFITEC students were **awarded** with the **best oral presentation and poster** at the 68th American Vacuum Society (**AVS**) International Symposium and Exhibition.

João Ameixa won **The Young Researcher Award** at the Modelling and Design of Molecular Materials Conference (**MDMM 22**) and the **best poster prize** at the Collisional Physics and Chemistry and their Applications Conference (**COPCA 2022**).

The European projects **MetCCUS** and **BIOSPHERE**, each with **two million euros** in **funding**, include the participation of CEFITEC researchers.

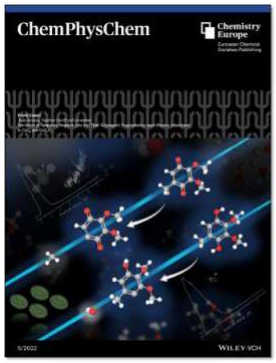


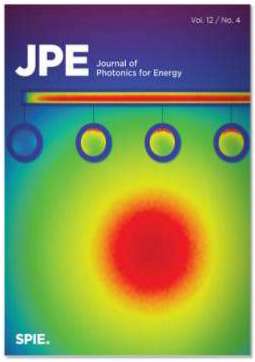
The **first textbook on *Solar-Pumped Lasers* (312 pages)** written by five CEFITEC members was published by **Springer-Nature**.



Breakthroughs on solar-pumped laser collection and solar-to-laser conversion efficiencies were spotlighted by the editors of ***Laser Focus World*** and ***SPIE***.

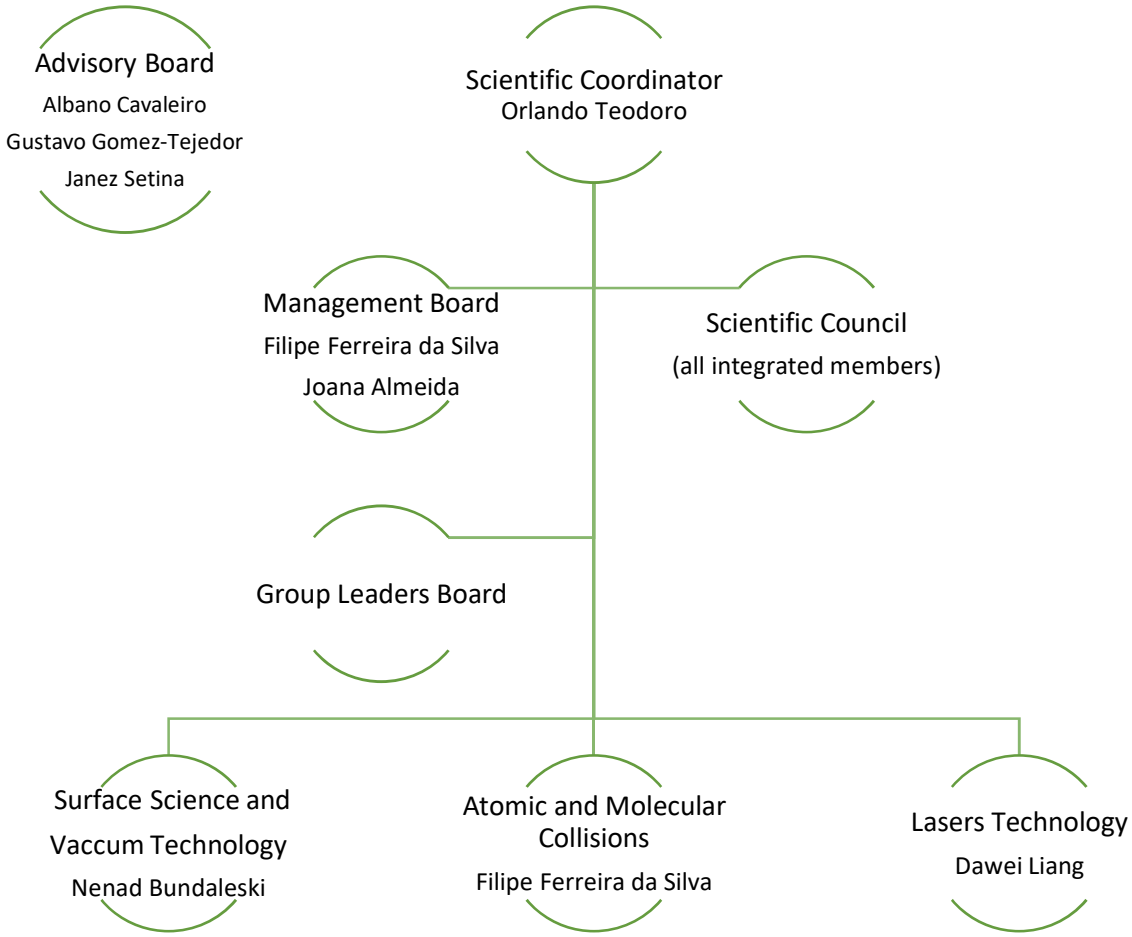
CEFITEC researchers authored **three cover page publications**.





Organization

Governance


Advisory Board
Albano Cavaleiro
Gustavo Gomez-Tejedor
Janez Setina
Scientific Coordinator
Orlando Teodoro
Management Board
Filipe Ferreira da Silva
Joana Almeida
Scientific Council
(all integrated members)
Group Leaders Board
Surface Science and
Vaccum Technology
Nenad Bundaleski
Atomic and Molecular
Collisions
Filipe Ferreira da Silva
Lasers Technology
Dawei Liang

Research team

Active members in 31/12/2023

Integrated members

Ana Gomes Silva

Ana Lozano Martinez

Ana Luísa Fonseca

Bruno D. Tibúrcio

Cláudia Vistas

Dawei Liang

Filipe Ferreira da Silva

Joana Almeida

João Ameixa

Mónica Mendes

Nenad Bundaleski

Orlando Teodoro

Paulo Limão-Vieira

Pedro Pereira

Sarvesh Kumar

External collaborators

Alessandra de Souza Barbosa, Department of Physics, Universidade Federal do Paraná, Brazil

Alexander Tolstoguzov, Utkin Ryazan State Radio Engineering University, Russian Federation

Augusto Moutinho, Nova School of Science and Technology

Dário Garcia, Nova School of Science and Technology

Gustavo Garcia, Consejo Superior de Investigaciones Científicas (CSIC), Spain

Jimena Diaz Gorfinkiel, Faculty of Science, Technology, Engineering & Mathematics, School of Physical Sciences, The Open University, UK

Kevin Michael Prise, School of Medicine, Dentistry and Biomedical Sciences, Centre for Cancer Research and Cell Biology, Queen's University Belfast, UK

Nigel John Mason, Department of Physics & Astronomy, University of Kent, UK

Samuel Eden, Department of Physical Sciences, The Open University, UK

Stephan Denifl, Institute for Ion Physics and Applied Physics, University of Innsbruck, Austria

Research Groups

Surface Science and Vacuum Technology

In the early 90s, this group emerged as a branch of the Centre of Molecular Physics of the Universities of Lisbon, establishing a new laboratory equipped with modern surface analysis techniques. Their focus was on ion interactions with surfaces in the keV energy region, encompassing sputtering, scattering, and charge exchange.

With a solid background in high and ultra-high vacuum, the group expanded its efforts to serve the national industry offering vacuum gauge calibration and consultancy services. In 2002, METROVAC gained official recognition as an accredited calibration laboratory. The laboratory's scope was subsequently broadened to include the metrology of ultra-low flows, involving reference leaks and leak detection. These new capabilities spurred research into the transport of gases and vapors through cork and to the study of desorption of contaminants from cork, fostering collaborations with the cork industry.

Simultaneously, the surface science lab collaborated with CERN on studying secondary electron emission from carbon coatings used in accelerator walls. This work aimed to mitigate the formation of the electron cloud, a significant limitation in particle accelerators and a source of technological challenges in telecommunication satellites and spacecraft. The project successfully led to recommendations for modifying deposition parameters, which are proven to reduce the secondary electron yield. This achievement resulted in a Framework Collaboration Agreement between CERN and Nova School of Science and Technology, enabling our researchers to access CERN's equipment and software and organize short stays to perform their experiments.

The surface science lab, now equipped with two fully operational XPS systems and one Tof-SIMS, has gained extensive experience in secondary electron emission from surfaces and the chemical characterization of nanostructured surfaces.

Combining their expertise, the two labs collaborated to design and construct a high-accuracy ionization gauge, addressing challenges induced by secondary electron emission from the ion collector. The group's most recent undertaking involves the development of a novel ion trap for use in vacuum technology for pressure measurement and residual gas analysis. The ion trap is under development in the frame of a funded PhD project, and it includes the collaboration of INFICON, a leading provider of innovative instrumentation.

Atomic and Molecular Collisions

The Atomic and Molecular Collisions Laboratory (LCAM) was established in 2004 with the main purpose to explore the electronic state spectroscopy of aeronomic, plasma processing, interstellar medium and biological relevant molecules by interaction with photons and electrons. LCAM's unique nature has allowed to comprehensively investigate environmental selected molecules related to global warming and ozone depletion, while modelling photolysis rates and local lifetimes in the Earth's atmosphere (0-50 km altitude).

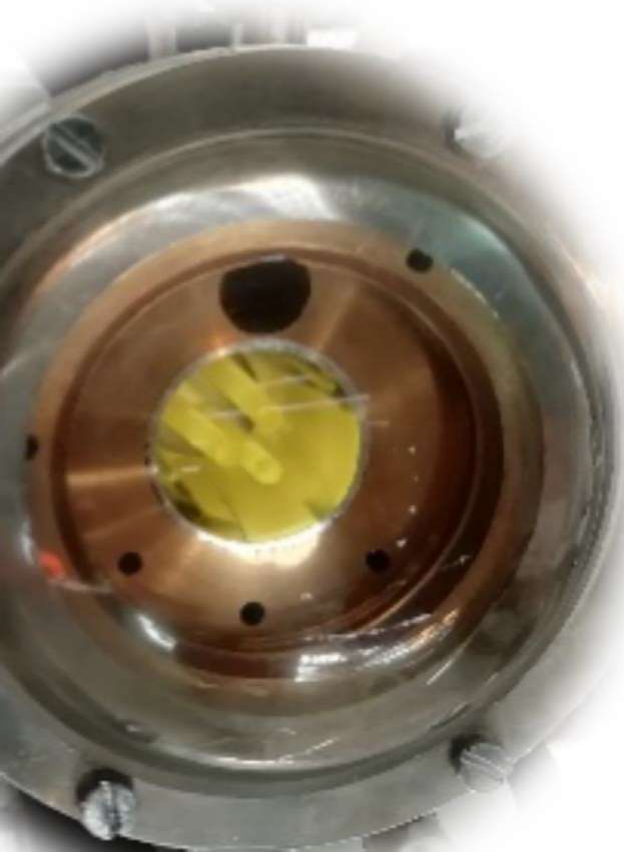
At the forefront of worldwide interest in electron induced processes at the molecular level, LCAM assembled a unique gas-phase crossed molecular beam setup to explore electron transfer to biological relevant molecules, e.g. DNA/RNA nucleobases and even nucleosides. Additionally, and given the role of modern tailor-made radiation induced protocols for cancer treatment, radiosensitizers have been comprehensively investigated in order to provide essential information as to the underlying molecular mechanisms relevant to radiosensitization.

Further to LCAM's mission and installed technical abilities, new gas-phase experimental setups have been successfully installed to explore the electronic and molecular structure of a diversity of molecules, either through high-resolution electron energy loss and He(I) photoelectron spectroscopies or through implementation of a low-energy electron impact setup for attachment and ionisation studies.

Since its foundation, LCAM keeps relevant international partnerships with universities and reference research laboratories, at the national and international scenes, with the main purpose to reinforce and bring in contributions of complementary experimental and theoretical techniques essential for its indoors scientific achievements. Also central to our mission is undergraduate and postgraduate advanced training which we have successfully performed by attracting national and international students.

Laser Technology

Laser technology group of CEFITEC was established more than a decade ago to further enhance both solar-to-laser power conversion efficiency and beam quality of the state-of-the-art solid-state lasers. The group holds the world record in solar laser collection efficiency of 41.3 W/m^2 and solar-to-laser power conversion efficiency of 4.64%. Achievements were repeatedly featured by Editors of CSP Today, Spotlights on Optics in 2012, Laser Physics in 2013, Laser Focus World in 2013, 2016 and 2022, and Journal of Photonics for Energy during 2019-2023. These main achievements have been supported by the solar facility of the Laser Technology group, composed of a solar heliostat and a 1 kW solar furnace (primary solar mirror), a mechanical supporting unit, several solar laser heads and a solar tracker. The laser technology group has also a strong collaboration with the PROMES-CNRS institute (in France) since 2011, in the framework of nine funded projects by SFERA (Solar Facilities of European Research Area), SFERA-II and SFERA-III programs. The first textbook on *Solar-Pumped Lasers* published by the prestigious Springer-Nature was written by the Laser Technology group of CEFITEC.

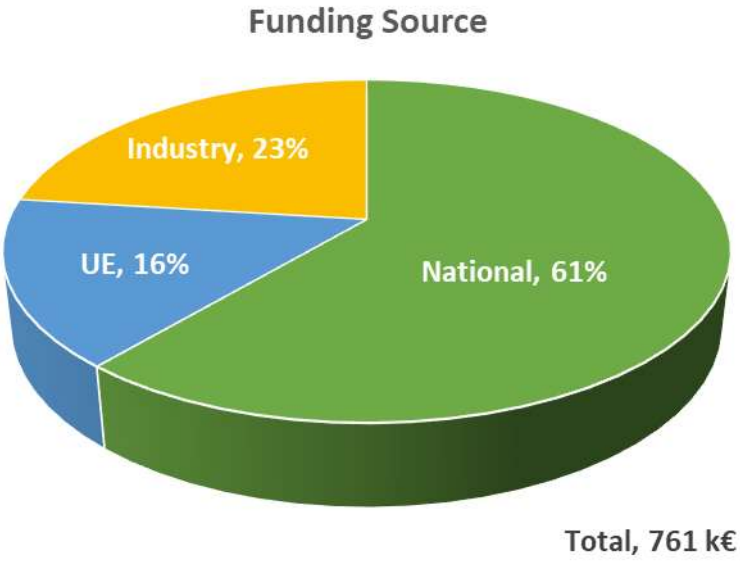


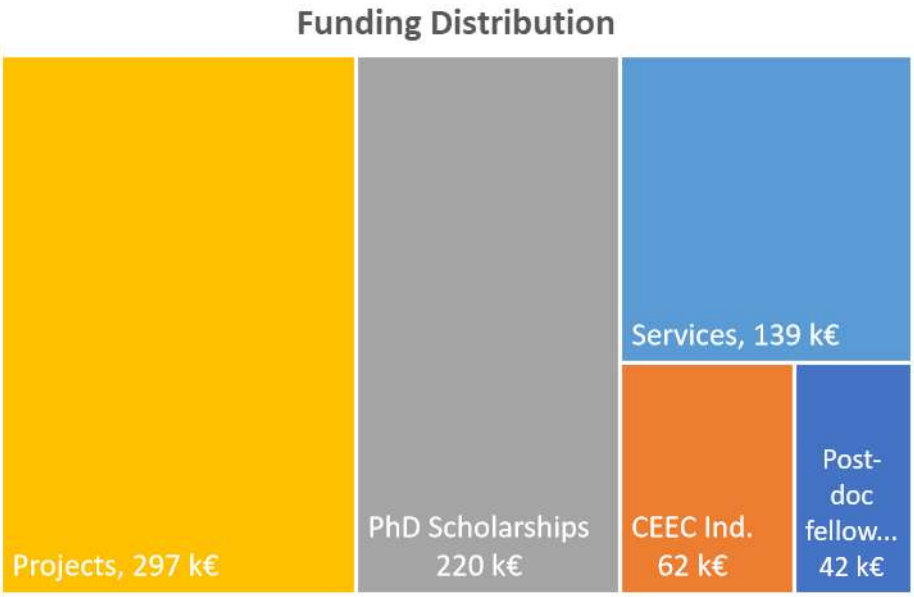
Currently, the laser technology group is seeking for high solar laser performance through the development of alternative prototypes for the simultaneous pumping of several laser crystals with broader absorption spectrum in the visible region. The goal is to enable the simultaneous emission of multiple renewable beams with enhanced thermal performance and efficiency. The study of innovative solar concentrators to substantial improve the solar energy flux and, consequently, the solar laser pumping efficiency, as well as storing IR solar heat, have also been an important subject of research.

Thanks to the scientific expertise and dedicated facilities of the laser technology group, it is now possible to carry out advanced solar laser research and postdoctoral, Ph.D., MSc. degree student trainings, essential to ensure its further progress in renewable laser technologies in the next decade.

Funding & Projects

Overview





Total funds expended in 2022 and 2023: **761 k€.**

All funds were obtained in competitive calls, except those from industry.

Part of the revenue from services was also invested in research.

Salaries of permanent staff is excluded.

Funded projects

Projects running during the reporting period of 2022-23, with the exception of 'base' and 'programmatic' projects:

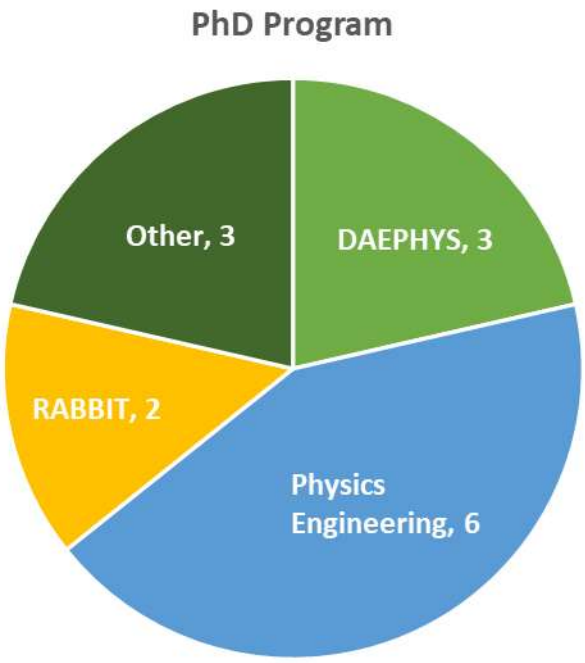
Title	Reference	Funding agency	PI (in CEFITEC)	Period
Metrology Support for Carbon Capture Utilisation and Storage	21GRD06 MetCCUS	EMPIR, EURAMET	Orlando Teodoro	2022-2025
Metrology for decarbonizing the gas grid	20IND10 DECARB	EMPIR, EURAMET	Orlando Teodoro	2021-2023
Metrology for Earth Biosphere: Cosmic rays, ultraviolet radiation and fragility of ozone shield	BIOSPHERE	EMPIR, EURAMET	Filipe Silva	2022-2025
High-resolution VUV photoabsorption experiments on acetoacetates	Grant Agreement 730872	CALIPSOplus, HORIZON 2020	Paulo Limão-Vieira	2022-2023
Electronic Excited States of Naphthalene and Halogenated Derivatives	Grant Agreement 730872	CALIPSOplus, HORIZON 2020	Filipe Silva	2021-2022
Identifying the electronic excited states of cyano containing molecules detected in the interstellar medium	Grant Agreement 730872	CALIPSOplus, HORIZON 2020	Mónica Mendes	2021-2022
New breakthroughs in Ce:Nd:YAG solar laser	Breakthrough	SFERA-III, HORIZON 2020	Dawei Liang	2023
Ce:Nd:YAG multi-beam solar laser	CeNdYAG	SFERA-III, HORIZON 2020	Dawei Liang	2022
Improving of carbon-based low secondary electron yield coatings	CERN/FIS-TEC/0039/2019	FCT, IP	Nenad Bundaleski	2021-2023

Production of seven-beam Ce:Nd:YAG solar laser in TEM00-mode regime	EXPL/FIS-OTI/0332/2021	FCT, IP	Joana Almeida	2022-2024
Scientific support to the industrialization of process NATURITY	License agreement under the contract dated from 18/07/2017	Amorim Cork	Orlando Teodoro	2017-2023
Scientific support to the industrialization of process BACO	License agreement under the contract dated from 03/01/2022	Amorim Cork	Orlando Teodoro	2022-2025
Wireless charging of Unmanned Aerial Vehicles by solar-pumped laser	WiLASER	NOVA Impact office & Santander Universities	Dawei Liang	2023

Advanced Training

In these last two years, CEFITEC have been involved in six doctoral programs, covering a total of 14 PhD projects. Of special relevance was the engagement of CEFITEC in the coordination of the international doctoral program RaBBiT - Radiation Biology and Biophysics Doctoral Training Program.

Most of the PhD students were awarded scholarships by the national funding agency FCT IP in competitive calls. Moreover, three post-doctoral research positions were also funded by FCT IP.



DAEPHYS - Doctorate in Applied and Engineering Physics Program

RABBIT - Radiation Biology and Biophysics Doctoral Training Program

Post-Doc Researchers	Research fellows	PhD students (concluded)	Master students (concluded)
3	2	14	15

Finished PhD theses:

	Year, PhD Program	Title	Student (PhD grant)	Supervisor(s)
1	2022, Physics Engineering	Monitoring adsorption dynamics on the rutile TiO2(110)-(1×1)	João Trigueiro Santos (SFRH/BD/82258/2011)	Orlando Teodoro, Nenad Bundaleski
2	2022, Applied Physics and Physics Engineering (U. Aveiro)	Enabling Technologies	José Miguel Cunha	Ana G. Silva (Co-supervisor)
3	2022, RABBIT, Radiation Biology & Biophysics Doctoral	Electron transfer processes in biologically relevant molecules	Sarvesh Kumar (PD/BD/142831/2018 | COVID/BD/152673/2022)	Paulo Limão-Vieira
4	2022, DAEPHYS, Doctorate in Applied and Engineering Physics	Solar-pumped laser technology	Bruno D. Tibúrcio (PD/BD/128267/2016)	Dawei Liang, Paulo Morais
5	2023, RABBIT, Radiation Biology & Biophysics Doctoral	Electron–molecule reactions: computational study of methods and their applications	José Romero (PD/BD/142846/2018)	Michael Probst, (University of Innsbruck), Paulo Limão-Vieira
6	2023, Physics Engineering	Low-energy electron interactions with boron containing compounds for pharmaceutical applications	João Pereira da Silva (PD/BD/142768/2018)	Filipe Ferreira da Silva
7	2023, DAEPHYS, Doctorate in Applied and Engineering Physics	Solar concentrators and solar-pumped lasers	Dário Garcia (PD/BD/142827/2018)	Dawei Liang, Paulo Morais

Finished master theses:

	Year, Master Course	Title	Student	Supervisor(s)
1	2022, Engineering Physics	Analysis of micro and nanoplastics with X-Ray photoelectron spectroscopy	Ana Sofia Mendes	Ana G. Silva, Nenad Bundaleski
2	2022, Engineering Physics	From SiC ultra-thin films to heterostructures, surface and interfaces	João Fonseca	Ana G. Silva
3	2022, Engineering Physics	Novo algoritmo de integração do sinal cromatográfico	Bruno dos Santos	Orlando Teodoro
4	2022, Engineering Physics	Influence of hydrogen contamination on electron emission properties of amorphous carbon coatings used in particle accelerators	Carolina Adame	Nenad Bundaleski , Pedro Costa Pinto (CERN)
5	2022, Computational and Electrotecnical Engineering	Dimensionamento e implementação de fontes de tensão para lentes eletrostáticas de monocromador trocoidal de electrões	Alexandru Botnari	João Goes (FCT-NOVA), Filipe Ferreira da Silva
6	2022, Biomedical Engineering	Interacção de electrões de baixa energia com radiosensibilizador temozolomide	Ana Margarida Nunes	Mónica Mendes, Filipe Ferreira da Silva
7	2022, Engineering Physics	Dimensionamento e implementação de sistema de controlo digital de lentes eletrostáticas de monocromador trocoidal de electrões	João Araújo	Filipe Ferreira da Silva, Bruno Guerreiro (FCT-NOVA)

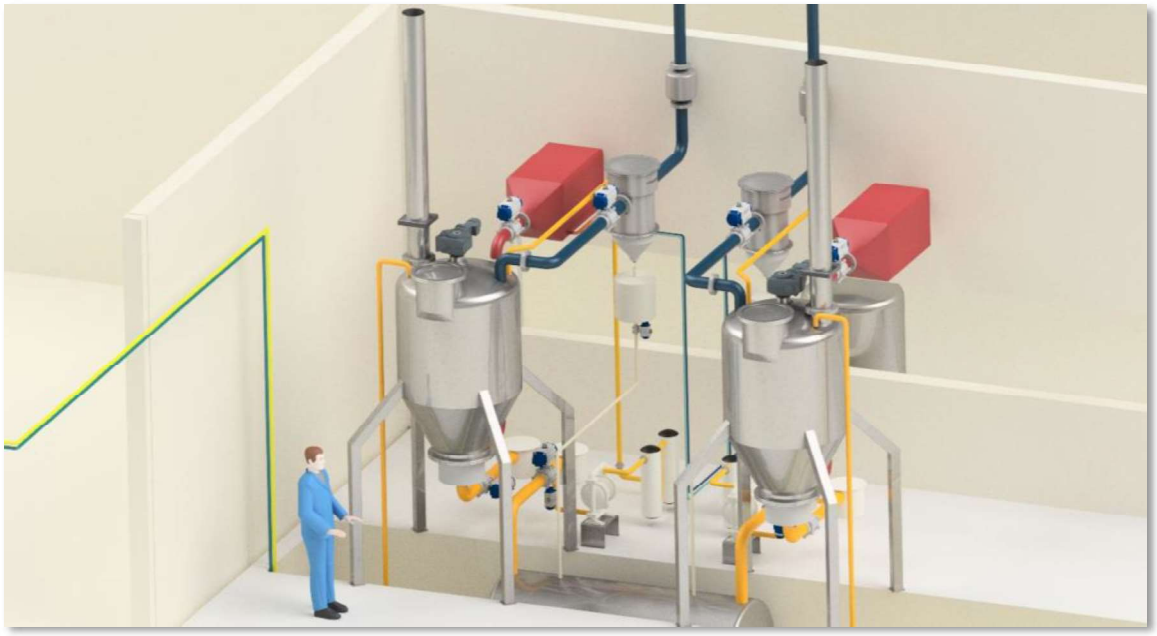
8	2022, Engineering Physics	Intercomparação entre dosimetria fotográfica e dosimetria em fantoma para a técnica SRS	Rodrigo Silva	Filipe Ferreira da Silva, Filomena Santos (IPO)
9	2023, Engineering Physics	Elétrodos de compostos de grafeno para células de combustível microbianas	Filipe Dourado	Ana G. Silva, João Coelho (CENIMAT)
10	2023, Engineering Physics	Desenvolvimento de uma Fonte de Iões de Ionização Química	Catarina Guerreiro	Filipe Ferreira da Silva, Orlando Teodoro
11	2023, Engineering Physics	Deposition of carbon coatings with low secondary electron yield by magnetron sputtering	Susana Fidalgo	Nenad Bundaleski
12	2023, Computers and Electronic Engineering	Registo e controlo automático de tensões de lentes electrostáticas de um monocromador trocoidal de eletrões	Miguel Pacheco	Bruno Guerreiro (FCT-UNL), Filipe Ferreira da Silva

Industry Engagement

Patented technology for TCA extraction was introduced by Amorim Top Series

Amorim Top Series has adopted a patented TCA extraction technology developed at CEFITEC for their bartop cork stoppers. This innovative process utilizes heated organic solvents to extract TCA (2,4,6-trichloroanisole) from natural cork stoppers, fully preserving their mechanical properties.

The industrial pilot installation initiated extensive tests in 2022, successfully reaching its full production capacity in 2023. This milestone marks the realization of TRL 7, showcasing the system's demonstration in an operational environment.



Commercially available high accuracy ionization gauge

A revolutionary ionization gauge was developed in the frame of a European consortium, to provide accurate measurements of high vacuum (10^{-4} mbar to 10^{-8} mbar) with a precision of ± 1% for a known gas. This project had the collaboration of two leading manufacturers of vacuum equipment. This new gauge is now commercially available (the model IRG080, Inficon).

INFICON

IRG080

Ion Reference Gauge

The same design was used to submit an ISO Standard (**ISO TS 6737:2023**) entitled "Characteristics for a stable ionisation vacuum gauge" in collaboration with the ISO Technical committee 112 – Vacuum Technology.

Services

METROVAC is the Vacuum Technology and Metrology Laboratory of CEFITEC. It is an ISO 17025 **accredited laboratory** for calibration and testing. This accreditation means that our capabilities are **internationally recognized** after the annual audits by IPAC to check the compliance with the technical and quality management accreditation requirements.

Actual accredited services of CEFITEC are:

- Calibration of vacuum gauges.
- Calibration of reference leaks.
- Testing of refrigerant gas leak detectors.

METROVAC is also a **hub for other services** offered by CEFITEC to the community and to scientific partners, as:

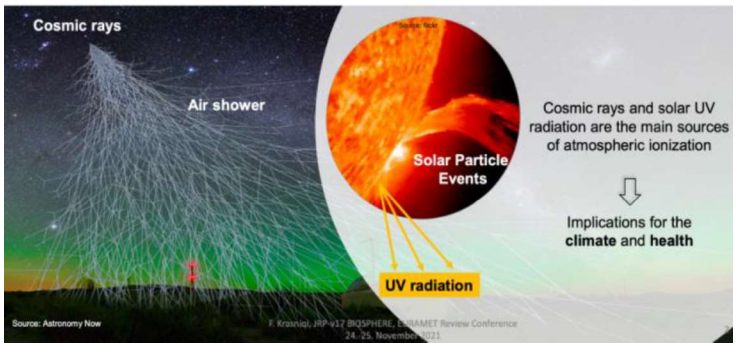
- Design/manufacture of refrigerant reference leaks
- Permeation tests.
- Leak testing.
- Surface analysis by XPS and SIMS.
- Consultancy in vacuum technology.

METROVAC is engaged in **research** in topics related to vacuum metrology and ultra-low flow measurements. This includes health & safety aspects related to the introduction of **hydrogen** in the gas grid, the transport of gases through **cork** and development of **new instruments** to measure low pressures.

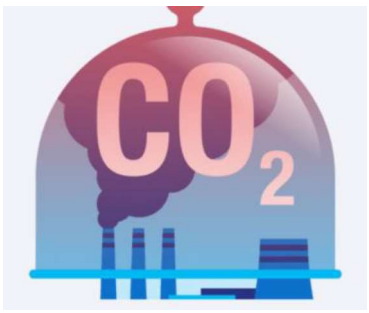
Societal Impact

Do you know that…

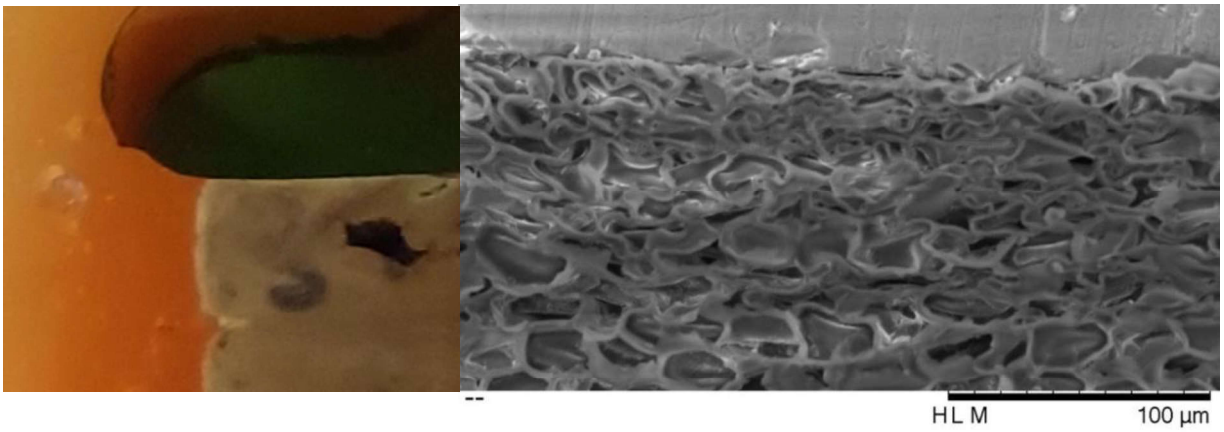
CEFITEC participates in a **European project** that will study the **impact of cosmic and ultraviolet radiation on the environment and human health**.



The **MetCCUS** project, with participation of CEFITEC, aims to create **metrology frameworks for carbon capture, utilisation and storage** to help Europe reach **carbon neutrality**.

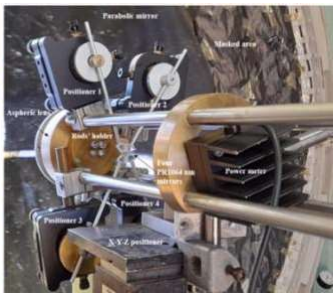


Cork stoppers may leak without a lubricating **coating**. METROVAC entered into a research contract to investigate the impact of various coatings on the **sealing properties** of natural (single piece) cork stoppers.



CEFITEC researchers reported **stable solar laser emissions with high tracking error compensation capacity** which may help to extend the **applicability** of this **renewable technology either on Earth or in Space**.

The **four-Ce:Nd:YAG solar laser** of the laser technology group was **selected to be installed in Mont Louis solar furnace museum** in France in 2023, which will create an important societal impact.



The project *Wireless charging of Unmanned Aerial Vehicles by solar-pumped laser,* proposed by **Dawei Liang**, was selected by **NOVA impACT! Challenges competition** program to support the development of **impactful solutions putting knowledge and innovation at the service of society**.

The work developed at **CEFITEC** in 2022-2023 had **contributed** to **seven sustainable development goals (SDG)** of the 2030 Agenda.

Outreach

Science dissemination

CEFITEC was actively involved in several outreach activities for pre-university students. These activities included:

Summer schools, such as ***Academia Quantum***, an initiative of the Physics Department of FCT NOVA to provide young people with contact with the scientific research carried out in this department.

Science and Technology Week, which aims to promote public awareness of the research carried out in Portugal and its contributions to the advancement of knowledge and the well-being of society.

International Science Festival, which offers pedagogical and scientific experiences for all ages.

Annual open days, *such as* ***EXPO FCT***, an event organized by FCT NOVA that constitutes a showcase of activities in the areas of science and engineering, providing opportunities to help pre-university students to make their choices.

In 2022, CEFITEC researchers also participated in ***NOVA Sustainability Week*** to debate their ideas and work developed around the Sustainable Development Goals among the NOVA Community.

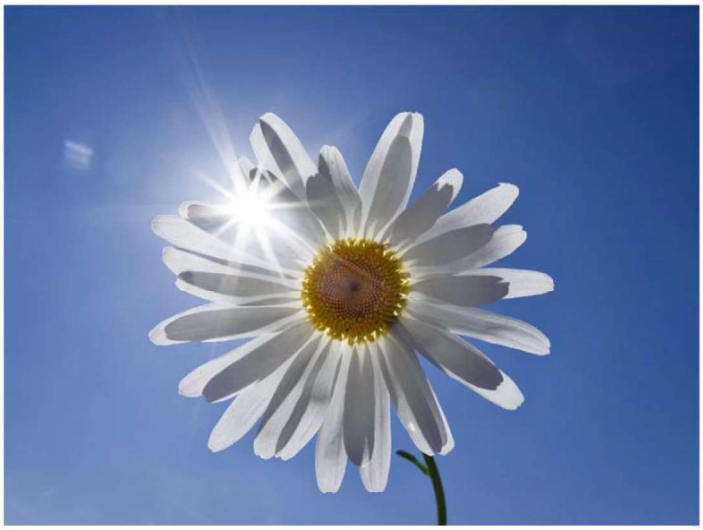
CEFITEC in media

SAPOLIFESTYLE ≡ Menu

Projeto com participação portuguesa vai estudar impacto da radiação no ambiente e saúde

N.N./Lusa · 21 out 2022 16:38 · Atualidade

Portugal participa num projeto europeu que vai estudar o impacto da radiação cósmica e solar (ultravioleta) no ambiente e na saúde humana e criar uma base de dados que servirá de suporte à investigação de doenças como o cancro.



O projeto Biosphere (Biosfera), financiado com 1,85 milhões de euros, tem a participação do Centro de Física e Investigação Tecnológica da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, a única instituição científica portuguesa entre as 22 europeias que se associaram ao projeto.

Filipe Ferreira da Silva, especialista em física molecular que coordena a equipa portuguesa, disse hoje à Lusa que o projeto visa "desenvolver ferramentas, metodologias e infraestruturas de medida necessárias", como sensores de medição e detetores, "para avaliar o impacto da radiação cósmica e radiação solar na biosfera terrestre".

Projeto europeu vai estudar impacto da radiação no ambiente e saúde

Portugal também participa neste projeto, cujo objetivo é estudar o impacto da radiação cósmica e solar (ultravioleta) no ambiente, assim como na saúde humana.

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16:52 - 21/10/22 POR LUSA
LIFESTYLE INVESTIGAÇÃO

Portugal participa num projeto europeu que vai estudar o impacto da radiação cósmica e solar (ultravioleta) no ambiente e na saúde humana e criar uma base de dados que servirá de suporte à investigação de doenças como o cancro.

OPINIÃO

Nobel da Física de 2023: "fotografar" a dinâmica dos electrões

Podemos questionar o porquê de Portugal ser apenas pontualmente laureado: temos dois casos. Talvez haja uma relação entre a aposta feita em ciência nos países dos laureados e no nosso país.

Francisco Ferreira da Silva e Filipe Ferreira da Silva

3 de Outubro de 2023, 17:28

Dom Ruinart
É luxo, é ciência portuguesa e uma coreografia quase perfeita

Reportagem A Maison Ruinart substitui as caricas de metal por rolhas de cortiça no processo de estágio dos seus champanhes *ultra premium*. E, por isso, comprometeu-se com a plantação de 220 mil sobreiros. Raramente nos ocorre, mas o luxo francês não existiria sem o montado português

Por Edgardo Pacheco

Amorim investe 8,5 milhões de euros por ano em I&D

A rolha em causa, tendo em conta o Dom Ruinart e os champanhes *premium* de outras casas, não pode ser uma rolha qualquer. E, como se sabe, há rolhas e rolhas. Além de ter de vedar bem ao longo do tempo, cada rolha deve estar isenta de TCA – o malvado tricloroanisol, que é um composto químico que provoca aquilo que por cá designamos por "cheiro a rolha" e que grande irritação causa, em particular quando a garrafa custou algum dinheiro. E é essencialmente por casa do TCA que a Corticeira Amorim investe, todos anos – há muitos anos – cerca de 8,5 milhões de euros.

Volta e meia, ouvimos os responsáveis da Amorim garantirem que o TCA foi eliminado das rolhas e, vai-se a ver, ele anda por aí. Aqui há várias questões a ter em conta. Primeiro, garantir que nunca mais aparecerá TCA numa rolha vale tanto como alguém dizer que encontrou a perfeição neste mundo; segundo, é necessário ter em conta que nem todas as empresas de rolhas investem o que investe a Amorim e, terceiro, diferentes produtores de vinho garantem-nos que não encontram TCA nas rolhas *premium* da empresa líder de mercado.

As criações mais recentes da Amorim são a Naturity e a Xypur. A primeira é uma rolha inteira extraída de uma prancha de cortiça e a segunda é um microaglomerado de cortiça em forma de rolha. Se nesta, como se trata de uma reconstrução, a eliminação do TCA foi mais fácil, no caso da Naturity isso demorou mais tempo, mas Carlos de Jesus afirma que, ao contrário do anterior sistema de rastreabilidade chamado "NDtech" (detectava a rolha com TCA e eliminava-a da linha), "o processo de construção Naturity pura e simplesmente elimina o TCA, quando o encontra uma rolha".

WINEMAG.CO.ZA

Everything to do with South African fine wine.

Malu Lambert: Can cork taint be eradicated for ever?

By Malu Lambert, 9 May 2022

SHARE:

It's not all high tech. Palates are employed in the lab to taste wines under different cork samples.

The gauntlet thrown down from the wine world's luminaries was backed by a growing consumer resistance – who wants to be disappointed when opening something special at the table? Amorim has risen to the challenge; work began in 2016, and in 2021 they launched Naturity and Xpür, technologies designed to remove detectable TCA from natural corks as well as to create a new segment of micro-agglomerated stoppers, these sciences were augmented by 'Non Detectable Technology' called NDtech, which is a quality screening system that uses gas-chromatographs. Unbelievably precise, individual corks are assessed at an industrial scale and those with more than 0.5 nanograms of TCA per litre are rejected.

In contrast to the mechanised din, in another wing were the super-quiet Naturity machines, lined up like space pods in stasis. This project is in conjunction with the NOVA School of Science and Technology is employed for whole natural corks. It works, in layman's terms, by steam cleaning (geekier description: thermal desorption through the use of pressure, temperature, purified water and time). The method is able to extract over 150 volatile compounds, including TCA, resulting in a cleaner cork all round.

Publications & Editorial Activity

Publications

2023

Books:

Liang, D.; Almeida, J.; Vistas, C.; Tibúrcio, B.; Garcia, D. Solar-Pumped Lasers - With Examples of Numerical Analysis of Solid-State Lasers. Book Series: Green Energy and Technology. *Springer*, Cham. (2023). https://doi.org/10.1007/978-3-031-24785-9

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2022

Peer reviewed publications:

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Editorial activity

CEFITEC integrated members were engaged in the following editorial activities:

Journal	Assignment	Member
Journal of Photonics for Energy (SPIE)	Associate Editor	Dawei Liang
The European Physical Journal D (Springer-Nature)	Editorial board member	Filipe Ferreira da Silva
Clean Energy and Sustainability (SCIEPublish)	Editorial board member	Dawei Liang
Web of Conferences, EDP Sciences	Editorial board member	Paulo Limão-Vieira
Academia Green Energy	Academic Editor (Editorial Board)	Dawei Liang
Photonics (MDPI)	Topical Advisory Panel Member	Dawei Liang
Energies (MDPI)	Guest Editor of the Special Issue Advances in Photovoltaic/Solar Collectors and Their Potential for an Industrial Decarbonization	Bruno Tibúrcio
Processes (MDPI)	Guest Editor of the Special Issue "Advances in Solar Cells and Photovoltaic Nanomaterials"	Ana Gomes Silva
Energies (MDPI)	Guest Editors of the Special Issue "Challenge and Research Trends of Solar Concentrators II"	Dawei Liang Joana Almeida Cláudia Vistas
Sustainability (MDPI)	Guest Editors of the Special Issue "Solar-Pumped Lasers and Sustainable Laser Beams"	Bruno Tibúrcio Dawei Liang
Frontiers in Chemistry and Frontiers in Physics, Chemical Physics and Physical Chemistry (Frontiers)	Topic Editor *"Current Challenges and Advances in Nanotechnology for Cancer: From Emerging Experimental and Theoretical Approaches to Future Directions"*	João Ameixa

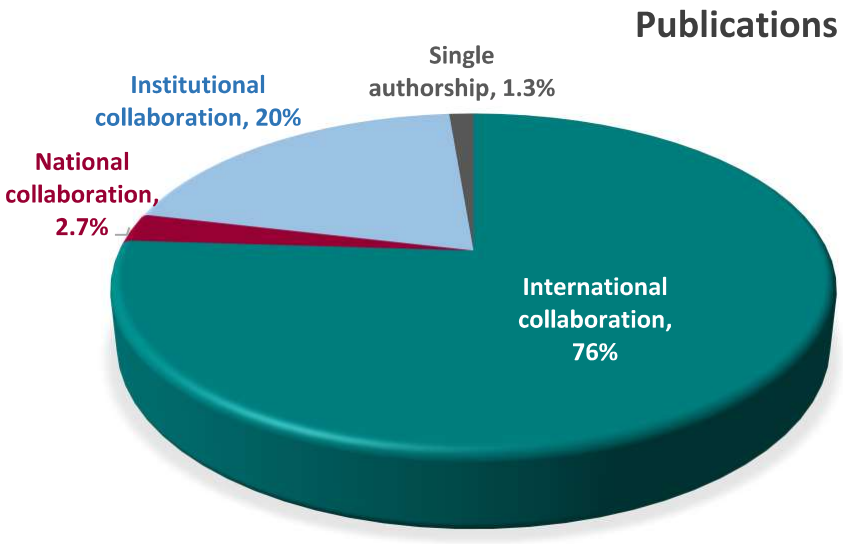
Peer reviewed journals that invited CEFITEC members to review manuscripts:

Journal	Publisher
Advanced optical materials	Wiley
Advanced photonics research	Wiley
Alloys and Compounds	Elsevier
Applied energy	Elsevier
Applied Physics B	Springer
Applied sciences	MDPI
Applied Surface Science	Elsevier
Applied Surface Science Advances	Elsevier
Atoms	MDPI
Brazilian journal of physics	Springer
Chemical Physics Letters	Elsevier
ChemPhysChem	Wiley-VCH GmbH,
Coatings	MDPI
Chemical physics letters	Elsevier
Crystal growth	American Chemical Society
Crystal research and Technology	Wiley
Crystals	MDPI
Electronic Structure	Institute of Physics
Electronics	MDPI
Energies	MDPI
Energy Technology	Wiley
European Physical Journal D	Springer-Nature
Heliyon	Elsevier
High power laser science and engineering	Cambridge
IEEE access	IEEE
IEEE photonics technology letters	IEEE
Information	MDPI
Infrared physics & technology	Elsevier
Journal of Applied Physics	American Institute of Physics
Journal of Modern Optics	Taylor & Francis
Journal of Photochemistry and Photobiology A: Chemistry	Elsevier
Journal of Physical Chemistry Letters	American Chemical Society
Journal of Physics B: Atomic, Molecular and Optical Physics	Institute of Physics
Journal of Quantitative Spectroscopy and Radiative Transfer	Elsevier
Journal Vacuum Sience and Technology A	American Institute of Physics
Laser physics	Institute of Physics
Machines	MDPI
Materials	MDPI
Micromachines	MDPI

Nanomaterials	MDPI
Nanoscale advances	Royal Society of Chemistry
New Energy Exploitation and Applications	UK Scientific Publishing Limited
Optics & Laser Technology	Elsevier
Optics Communications	Elsevier
Optics letters	Optica Publishing Group
Optik	Elsevier
Photonics	MDPI
Physical Chemistry Chemical Physics	Royal Society of Chemistry
Processes	MDPI
Physics Solid State a	Springer
Quantum beam science	MDPI
Renewable energy	Elsevier
Results in Optics	Elsevier
Sensors	MDPI
Small methods	Wiley
Solar energy	Elsevier
Sustainability	MDPI
Technologies	MDPI
The European Physical Journal D	Springer
The Journal of Chemical Physics	American Institute of Physics
The Journal of Physical Chemistry A	American Chemical Society
Vacuum	Elsevier
Water	MDPI

Internationalization

The **majority of CEFITEC's publications** in 2022-2023 were the result of **international collaborations**:



The **top 10 international institutions** with which CEFITEC co-authored **papers**:

1. CSIC - Consejo Superior de Investigaciones Científicas, Spain.
2. CNRS - Centre National de la Recherche Scientifique, France.
3. Aarhus University, Denmark.
4. Complutense University, Spain.
5. Universidade Federal do Paraná, Brazil
6. University of Wollongong, Australia
7. University of Innsbruck, Austria
8. CERN - Conseil Européen pour la Recherche Nucléaire, France.
9. CIEMAT - Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Spain
10. Universidade Estadual de Campinas, Brazil

CEFITEC had also active collaborations with several National Metrology Institutes in Europe.

Conferences & Scientific Societies

Participation in conferences

Online Workshop - Standardisation of a new ionisation vacuum gauge as reference gauge, PTB, Berlin, 7th of February 2022	Study of the influence of electron trajectories on the performance of the new gauge, N. Bundaleski, invited lecture
Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic 30th March 2022	Electron Transfer Processes in Molecules of Biological Relevance, Sarvesh Kumar, seminar
RaBBiT International Meeting, Portugal, 9-11th May 2022	Electronic state spectroscopy of polyatomic molecules using different methods, Sarvesh Kumar, oral presentation
1st Annual Multiscale Irradiation and Chemistry Driven Processes and Related Technologies COST Action Meeting (MultIChem 2022), Boppard am Rhein, Germany, May 16th to 18th 2022	DNA radiation damage studies using DNA origami nanostructures, João Ameixa, oral presentation
11th International Meeting on Atomic and Molecular physics and Chemistry (11th IMAMPC) Vila Lanna, Prague, Czech Republic, June 13th - 17th 2022	Bound electron enhanced radio sensitization of nimorazole upon charge transfer, Sarvesh Kumar, oral presentation Bound electron enhanced radiosensitisation of nimorazole upon charge transfer. S Kumar, B. Kerkeni, G García and P Limão-Vieira, poster contribution
The 22nd International Vacuum Congress, Japan, September 11-16th 2022	Synchrotron and XPS spectroscopies studies of Al and Ga heterostructures on SiO2/3C-SiC (111), A. G Silva, J. Fonseca, T. Bendikov, Z. Li, K. Pedersen, oral presentation
1st International Congress on Advanced Computational Modelling of Materials (CAMOM), 18-22 September 2022, Pretoria	Removal of antibiotics by carbon based materials: selectivity and adsorption capacity, O. Jakšić, Z. Jakšić, A. G. Silva, poster contribution
Modelling and Design of Molecular Materials Conference (MDMM 2022), Gdańsk, Poland, September 19th to 21st 2022	Mechanisms of radiosensitization in fluorinated DNA: DNA origami studies, João Ameixa, oral presentation
16th International Conference on Fundamental and Applied Aspects of Physical Chemistry, Belgrade, 26–30 September 2022	Al and Ga heterostructures on SiO2/SiC/Si(111), A. G Silva, J. Fonseca, T. Bendikov, Z. Li, K. Pedersen, oral presentation
Dynamics of Energetic & Electronic Processes in molecules and clusters in the GAS Phase (DEEP-GAS 2022), Madrid, Spain, October 4th to 7th 2022	Gas phase studies on electron attachment processes in model systems of mitochondrial electron carrier molecules, João Ameixa, oral presentation
Collision Physics and Chemistry and their Applications (COPCA 2022), Valletta, Malta, October 31st to November 4th 2022	The fluorination effect in electron-induced DNA strand breaks, João Ameixa, poster contribution

Physics Academic Week, Federal University of Paraná, Curitiba, Brazil, October 2022	Investigating atmospheric and biological relevant molecules by experimental methods, Paulo Limão-Vieira, topical lecture
68th International Symposium and Exhibition of the American Vacuum Society AVS68, Pittsburgh, USA, 6-11 November 2022	Novel Cylindrical Hot Cathode Ionisation Gauge, R.A.S. Silva, N. Bundaleski, O.M.N.D. Teodoro, oral presentation
	Towards an ionisation vacuum gauge suitable as a reference standard, N. Bundaleski, invited lecture
	Amorphous carbon thin films: Influence of hydrogen contamination on the secondary electron emission properties, C. Adame, E. Alves, N.P. Barradas, N. Bundaleski, P. Costa Pinto, J. Deuermeier, Y. Delaup, I.M.M. Ferreira, H. Neupert, M. Himmerlich, S. Pfeiffer, M. Rimoldi, M. Taborelli, O.M.N.D. Teodoro, poster contribution
Federal University of Paraná, Curitiba, Brazil, November 2022	The quest for key molecular mechanisms in biological molecules by electron transfer, Paulo Limão-Vieira, topical lecture
Federal University of ABC, São Paulo, Brazil, November 2022	Concerted and competitive fragmentation mechanisms in DNA/RNA nucleobases and radiosensitizers, Paulo Limão-Vieira, topical lecture
Federal University of São Carlos, São Carlos, Brazil, November 2022	Molecular decomposition of polyatomic molecules in electron transfer processes, Paulo Limão-Vieira, topical lecture
CERN, Geneva, Switzerland on 1st of December 2022	SEY of amorphous carbon – the role of hydrogen impurities, N. Bundaleski, invited lecture
eSSENSE-EMMC Meeting, Multiscale Modeling of Materials and Molecules, Uppsala, Sweden (2022)	Electronic Structure and Reactivity of Tirapazamine as a Radiosensitizer. 52. J Romero T Maihom, P Limão-Vieira, M Probst, poster contribution
	Electron-impact ionization cross sections of small molecules containing Fe and Cr. 34. J Romero, P Limão-Vieira, M Probst, poster contribution
6th International workshop on Advanced Atomic Force Microscopy techniques, Potsdam, Germany, March 6th-7th 2023	Using AFM imaging to study electron-induced strand breaks in fluorinated DNA sequences, João Ameixa, poster contribution
European Metrology Network for Energy Gases Workshop, Lisbon, 21-23 March 2023	Traceability of Portable Hydrogen Leak Detectors, O.M.N.D. Teodoro, oral presentation

Techniques and Instrumentation for Monitoring Molecular Evolution in the GAS phase (COST Action CA18212). Borovest, Bulgaria, 28-30 March 2023	A. I. Lozano, L. Álvarez, A. García-Abenza, J. C. Oller, F. Blanco, P. Limão-Vieira, and G. García, Magnetically confined electron beam transmission system: highly accurate total electron scattering cross section measurements, invited lecture
Synchrotron SOLEIL, Paris, France, April 2023	More than 21 years of AU-UV beam line at ASTRID(2): a few case studies, Paulo Limão-Vieira, topical lecture
2nd conference of the COST ACTION CA20129 – MultiChem, Prague, Czech, April 26th to 28th, 2023	Electron interactions with astrochemical relevant molecules, F. Ferreira da Silva, Invited lecture
ENOFORUM Conference, Vicenza, 16 May 2023	The relevance of surface treatments on the transmission of oxygen in cork stoppers, O.M.N.D. Teodoro, oral presentation
DCE23-Doctoral Congress in Engineering, Porto, Portugal, 15-16 June 2023	Amorphous carbon thin films: Influence of hydrogen contamination on the secondary electron emission properties, C. Adame, E. Alves, N.P. Barradas, N. Bundaleski, P. Costa Pinto, J. Deuermeier, Y. Delaup, I.M.M. Ferreira, H. Neupert, M. Himmerlich, S. Pfeiffer, M. Rimoldi, M. Taborelli, O.M.N.D. Teodoro, poster contribution
	Solar Laser Operation under Tracking Error Condition, M. Catela, D. Liang, C. R. Vistas, H. Costa, D. Garcia, B.D. Tibúrcio, J. Almeida, oral presentation
	Achievements and developments in design and simulation of ionisation gauges, R.A.S. Silva, N. Bundaleski, O.M.N.D. Teodoro, poster contribution
ENURS 2023 9th Meeting, 21st June 2023	In-situ high-surface/interface sensitivity high-resolution studies by synchrotron radiation photoelectron spectroscopy, A. G Silva, K. Pedersen, Z. Li, P. Morgen, oral presentation
Workshop Vácuo 2023 (SOPORVAC), IST UL, Lisbon, Portugal, 30th of June 2023	Traceability of Hydrogen Leak Detectors, O. Ferreira, O.M.N.D. Teodoro, oral presentation
	Leaking in cork stoppers, C. Adame, O.M.N.D. Teodoro, oral presentation
	Ultrathin oxides and atomically sharp interfaces: in-situ surface/interface studies, A. G Silva, K. Pedersen, Z. Li, P. Morgen, oral presentation
The 11th International Symposium "Atomic Cluster Collisions" – ISACC 2023, Hveragerði, Iceland, July 20th to 22nd, 2023	Boron complexes stability under electron interactions, F. Ferreira da Silva, invited lecture

ICPEAC XXXIII 2023, Ottawa, Canada. 25 July - 1 August 2023	Electron Induced Bond Breaking in Radiosensitizing Compounds, A. I. Lozano, F. Kossoski, F. Blanco, P. Limão-Vieira, M. T. N. Varella, G. García, invited lecture
	Efficient molecular oxidation in collisions with superoxide anions. S Díaz-Tendero, C Guerra, S Kumar, F Aguilar-Galindo, A I Lozano, M Mendes, P Limão-Vieira, J C Oller, and G García, poster contribution
	Valence photo double ionization of CH3OD: Insights onto Molecular Dynamics and Electron Correlation, S. Kumar, M. Shaikh, W. Iskandar, R. Thurston, M. A. Fareed, D. Call, R. Enoki, C. Bagdia, N. Iwamoto, T. Severt, J. B. Williams, I. Ben-Itzhak, D. S. Slaughter, and Th. Weber, poster contribution
XXI International Workshop on Low-Energy Positron and Positronium Physics and XXIII International Symposium on Electron-Molecule Collisions and Swarms – POSMOL 2023, University of Notre Dame, Notre Dame in Indiana, USA, August 3rd to 6th, 2023	Electron interaction with boron containing molecules, F. Ferreira da Silva, invited lecture
	Dynamics of negative ions in H2O and D2O observed through dissociative electron transfer experiments, Sarvesh Kumar, M Hoshino, B Kerkeni, G García, and P Limão-Vieira, invited lecture
	Low-lying negative ion states probed in potassium – ethanol collisions. A I Lozano, S Kumar, P J S Pereira, B Kerkeni, G García, and P Limão-Vieira, poster contribution
	Electron impact excitation of the lowest-lying state in ammonia from near threshold to high-intermediate energy. M Hoshino, A Yodo, P Limão-Vieira and H Tanaka, poster contribution
	Low energy electron interactions with 2-cyanonaphtalene: PAH identified in the interstellar medium. R. Rodrigues, M. Mendes, L. C. Cornetta and F. Ferreira da Silva, poster contribution
Université de Sherbrooke, Canada, August 2023	The electronic state spectroscopy of polyatomic molecules by photon and charge transfer experiments, Paulo Limão-Vieira, topical lecture
Lawrence Berkeley National Laboratory, USA, August 2023	Charge transfer in polyatomics: formation of negative ions, Paulo Limão-Vieira, topical lecture
XVII Iberian Joint Meeting on Atomic and Molecular Physics (IBER 2023), Coimbra, Portugal, 5 - 8 September 2023	Breakthroughs in Solar-Powered Lasers, J. Almeida, D. Liang, H. Costa, M. Catela, D. Garcia, B.D. Tibúrcio, C. R. Vistas, invited lecture

The 2nd International Conference on Green Energy Conversion System (GECS 2023), Djerba, Tunisia, September 29-October 1, 2023	Uniform and Stable TEM00 mode Multibeam Solar Laser Approach, M. Catela, D. Liang, C. R. Vistas, H. Costa, D. Garcia, B.D. Tibúrcio, J. Almeida, oral presentation
19th International Conference on Thin Films, Burgos, Spain, September 26-29th 2023,	Highly surface and interface sensitive studies of oxidation mechanisms of thin amorphous Si films at room temperature, A. G Silva, K. Pedersen, Z. Li, P. Morgen, oral presentation
XV WFME, Workshop on Molecular Physics and Spectroscopy, São Paulo, Brazil, October 2023	Isotope effect in D2O negative ion formation in electron transfer experiments: DO–D bond dissociation energy, Paulo Limão-Vieira, plenary talk
Leverage of IT for Engineering and Science International Conference, Istanbul, Turkey, October 30th to 1st November 2023	innoFSPEC Transfer Lab Potsdam, João Ameixa, oral presentation
Annual Meeting of the Japan Society of Vacuum and Surface Science 2023, Nagoya, October 31st - November 2nd 2023	The early growth stages of Ga and Al on SiO2-SiC-Si followed in-situ by high-surface sensitivity photoemission spectroscopy, A. G Silva, oral presentation
Workshop-SFERA-III Final Event Solar Facilities for the European Research Area, France, December 2023	Progress in solar-pumped laser research within the framework of SFERA programs, D. Liang, J. Almeida, C. R. Vistas, B.D. Tibúrcio, D. Garcia, M. Catela, H. Costa, E. Guillot, invited lecture
XV WFME, São Paulo, Brazil (2023)	Valence and Rydberg excitations of 4-fluorotoluene in the VUV photoabsorption energy range. PI-25, L V S Dalagnol, S Kumar, A I Lozano, M H F Bettega, N C Jones, S V Hoffmann, A S Barbosa, P Limão-Vieira, poster contribution Electronically excited states of the trifluoroacetic acid. PI-11, P S Puppi, N C Jones, S V Hoffmann, P Limão-Vieira, A S Barbosa, poster contribution
ANM 2023- International Conference on Advanced Nanomaterials	Development of microbial fuel cells electrodes with graphene for sustainable electricity production, J. Coelho, F. Dourado, C. M. Cordas, A. G. Silva, poster contribution
MD-Gas General Meeting, Dubrovnik, Croatia (2023) 53.	Efficient molecular oxidation in collisions with superoxide anions. S Díaz-Tendero, C Guerra, S Kumar, F Aguilar-Galindo, A I Lozano, M Mendes, P Limão-Vieira, J C Oller, and G García, poster contribution

Organization of conferences

RIVA XII - Iberian Vacuum Conference, Braga, Portugal - May 16-17 2022	Scientific committee member, Orlando Teodoro, Ana Gomes Silva
The 22nd International Vacuum Congress, September 11-16th 2022, Sapporo, Japan	International program committee member, Ana Gomes Silva
POSMOL 2023, XXI International Workshop on Low-Energy Positron and Positronium Physics & the XXIII International Symposium on Electron-Molecule Collisions and Swarms, Notre Dame, USA, 03 – 06 August 2023	International scientific committee member, Paulo Limão-Vieira
19th International Conference on Thin Films, September 26-29th 2023, Burgos, Spain	Local program committee member, Ana Gomes Silva
5th International Conference on Power and Energy Technology (ICPET 2023)	Technical committee member, Dawei Liang, Joana Almeida, Cláudia Vistas
90 IUVSTA WORKSHOP TEMTEM 2023, 18th-21st December 2023, Valencia, SPAIN	*Co-Chair,* Ana Gomes Silva

Participation in scientific societies

Society	*Position*	CEFITEC member
IUVSTA	Member of Executive Officers Board and Recording Secretary	Ana Gomes Silva
IUVSTA	Vice-Chair of Statutes Committee	Ana Gomes Silva
IUVSTA	Member of the Education Committee	Ana Gomes Silva
EU COST–CA18212 MD-GAS	Member of the International Scientific and Steering Committees	Paulo Limão-Vieira
SOPORVAC	Vice-Chair	Orlando Teodoro
IUVSTA	Portuguese Councilor	Orlando Teodoro

- COST - European Cooperation in Science and Technology.
  The cost action CA18212 – Molecular Dynamics in the GAS phase (MD-GAS) aims to develop a new physical and chemical toolbox to significantly advance the understanding of gas phase molecular dynamics induced in interactions between molecules or clusters and photons, electrons, or heavy particles, and its consequences for a broad range of applications in e.g. astrochemical and atmospheric sciences, and molecular radiation damage.

- IUVSTA is the international Union for Vacuum Science Application and Technique, an international federation of thirty national vacuum organizations. It represents nearly 15000 physicists, chemists, materials scientists, engineers and technologists who are active in basic and applied research, development, manufacturing, sales and education.

- SOPORVAC is the Portuguese Vacuum Society.

Back cover: The most efficient Ce:Nd:YAG solar laser ever was developed at CEFITEC.