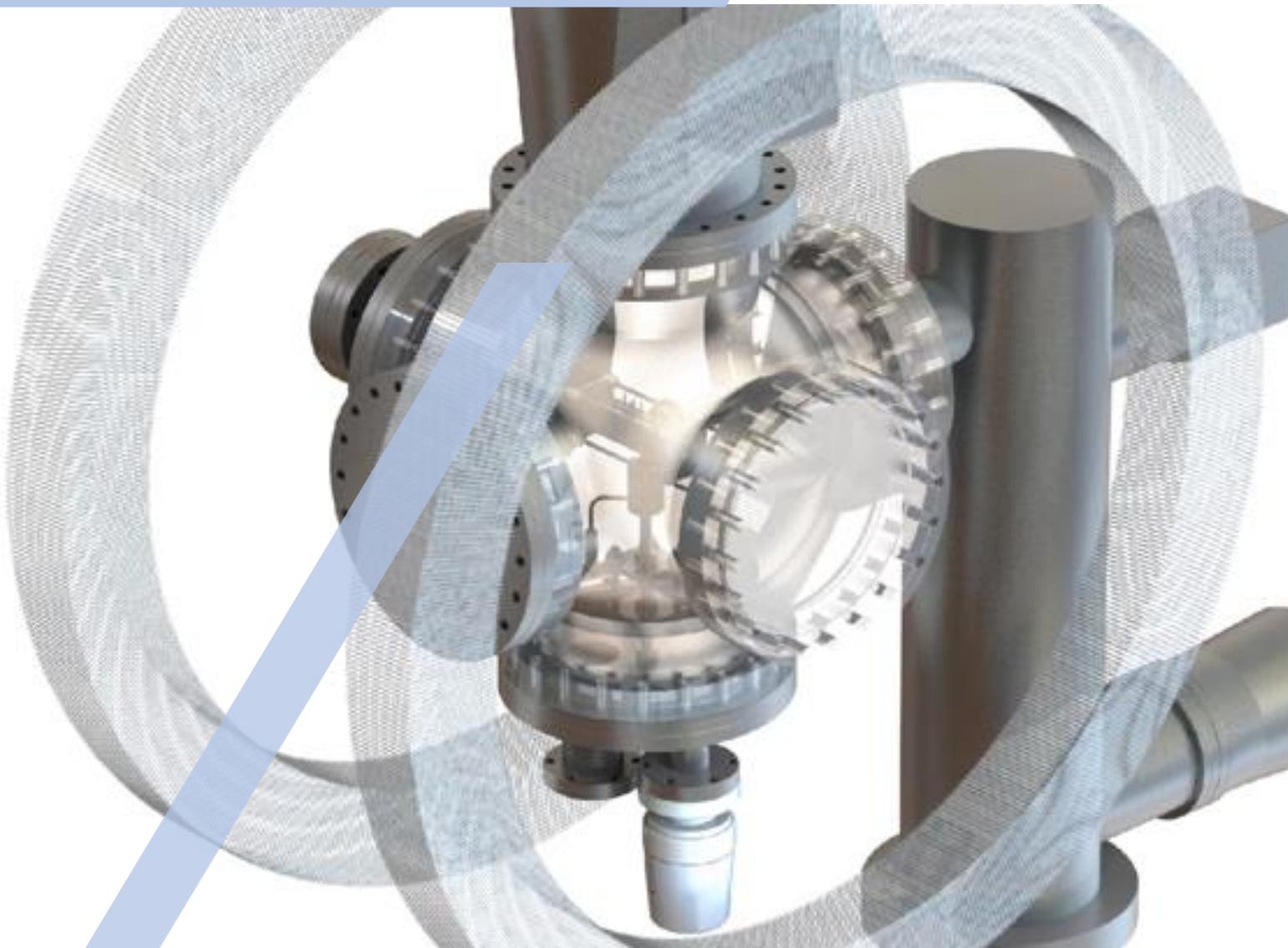


# 2020-21 Activity Report





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## Foreword

*This report summarizes the activity of CEFITEC, the Centre of Physics and Technological Research of Nova School of Science and Technology for the years 2020 and 2021. It includes not only the scientific advances achieved by our researchers, but also their engagement in advanced training, dissemination and technology transfer. It provides a quick overview of the research unit, ongoing projects, raised funding and internationalization level.*

*This report also discloses how the research carried out by CEFITEC impacts on society and what its benefits are for the community. Such impact has been reached not only through the scientific achievements, but also by advanced training of young people and close collaboration with various industrial partners.*

*The bibliometric indicators presented in this report show the high scientific level of its members and of the research unit as a whole, leaving CEFITEC at the same normalized level as the best research units of the Nova University of Lisbon and of Portugal.*

*In June 2021 CEFITEC underwent a reorganization process with some colleagues moving to another research unit. Therefore, this report only covers the activity of integrated researchers active at the end of 2021.*

*It's my great pleasure to lead this team of highly motivated students and researchers and to follow their continuous progresses in science and technology. This strong motivation is the reason for our international recognition and our success in attracting new collaborations, more funding and new talented students. It is very accomplishing to see masters and doctoral students succeeding as scientists and as engineers after developing their skills at CEFITEC along their training program in the state of the art of science and technology. It's also great to witness industrial partners seeking CEFITEC for support on specific issues or looking for specialized services.*

*The ongoing projects and the current perspectives of new projects suggest an increase in the pace of CEFITEC for the coming years, as long as the contractual instability of some researchers is resolved. We are a determined team committed to seeking excellence and to making our best contribution to the development of the country and to the progress of science and technology in general.*

*Orlando Teodoro*

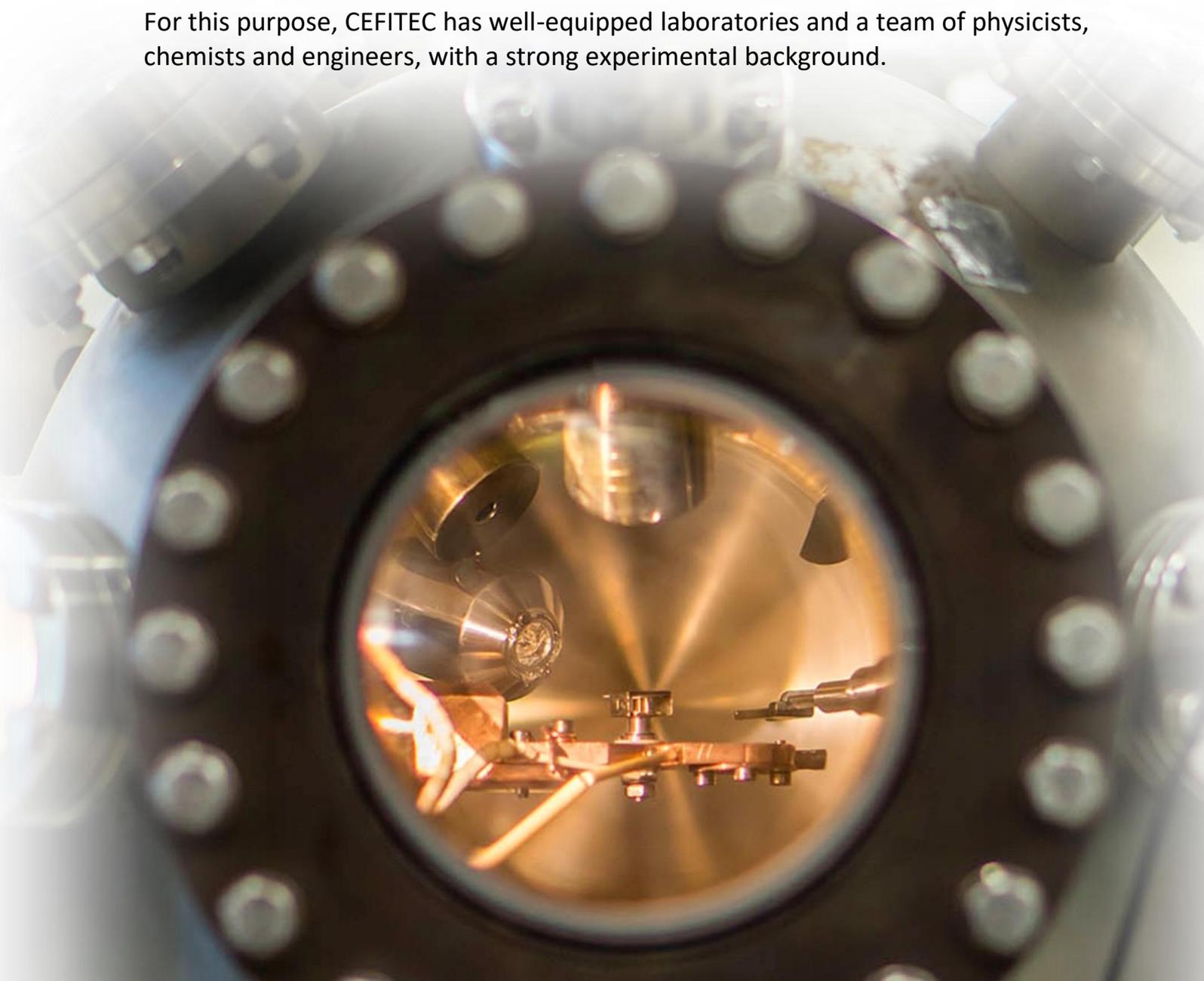




CEFITEC is devoted to exploring Engineering Physics activities, merging selected topics in Physics, Chemistry, Materials Science and Engineering. Actual CEFITEC expertise focuses on Surface Science, Vacuum Technology, Atomic and Molecular Interactions and Solar Pumped Lasers.

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.

For this purpose, CEFITEC has well-equipped laboratories and a team of physicists, chemists and engineers, with a strong experimental background.







**Publications 2020**

**33**

(14 integrated members)

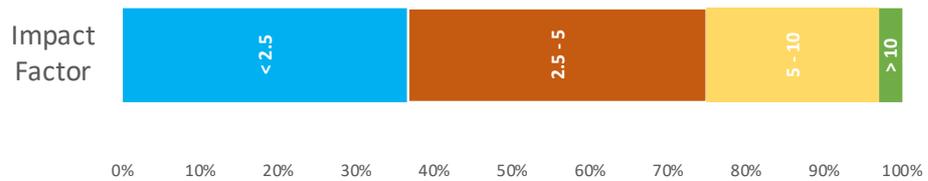
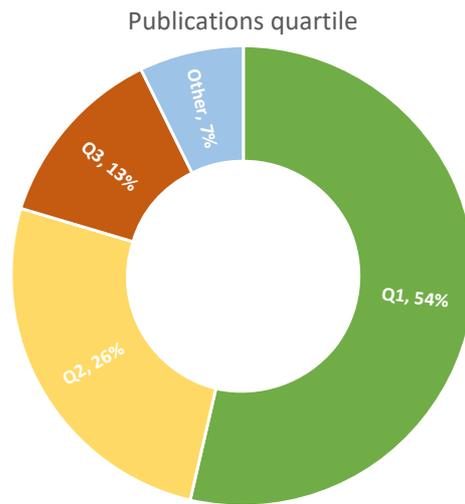
**Publications 2021**

**36**

(14 integrated members)

(Source: Scopus, WOS)

77% of all publications were produced in international collaboration



**Dawei Liang** was included in “**World’s Top 2% Scientists list**” by Stanford University in 2021.



**CERN** is funding a new project for “Improving of carbon-based low secondary electron yield coatings” in a consortium led by CEFITEC.



**Paulo Limão-Vieira** was appointed nominator by the Nobel Committee for Physics to the Nobel Prize in Physics 2021.

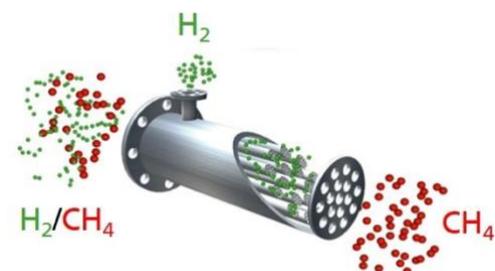


Professor Paulo Manuel Assis Loureiro Limão-Vieira

On behalf of the Royal Swedish Academy of Sciences, the Nobel Committee for Physics has the honour of inviting you to nominate for

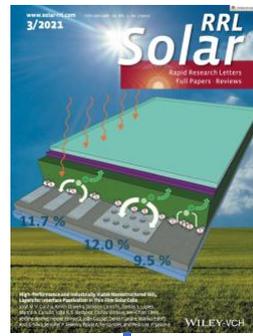
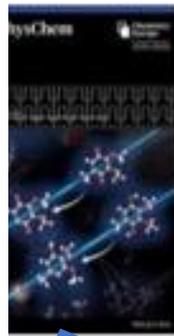
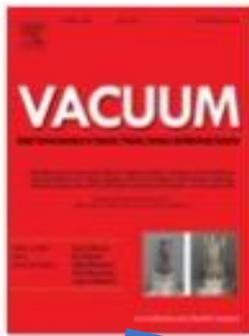
The Nobel Prize in Physics for 2021

CEFITEC is in the European consortium “Metrology for decarbonising the gas grid” which will support the **transition from natural gas to hydrogen** in the European gas networks.

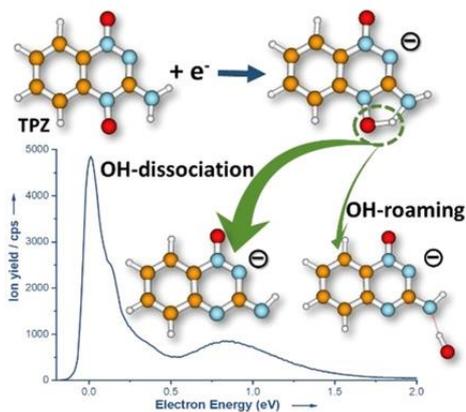




New **cork stopper** branded “Naturity” was released in 2021 by the world’s largest manufacturer of cork stoppers after a **technology license** issued by FCT NOVA and CEFITEC.



CEFITEC researchers authored four cover page publications

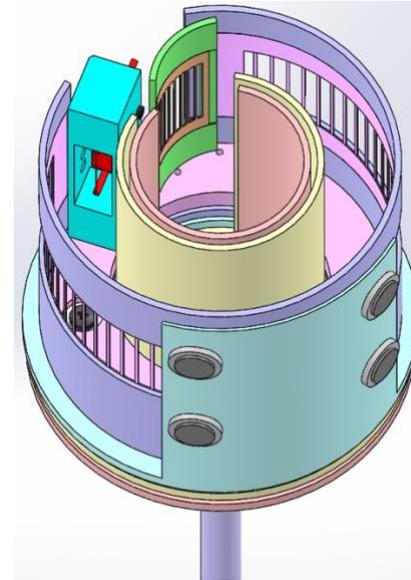


Low-energy electrons make a choice

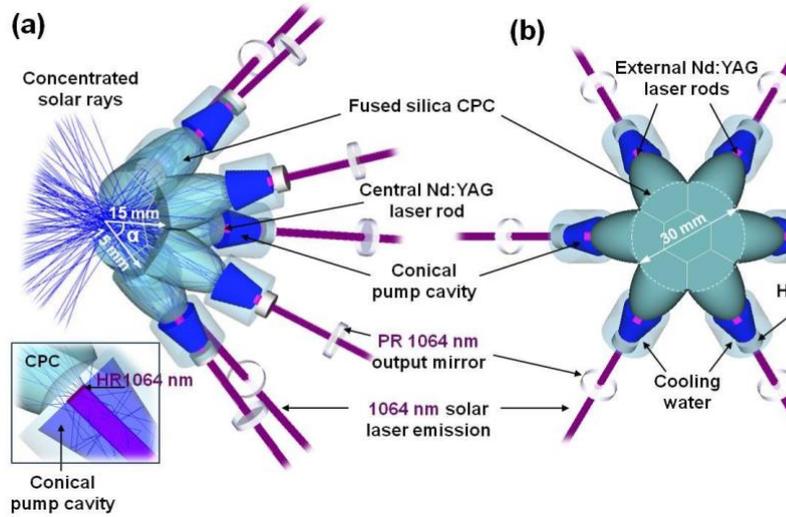
“Hot article” published in *Angewandte Chemie* (IF=15.336):

Arthur-Baidoo, E. | Ameixa, J. | Ziegler, P. | Ferreira da Silva, F. | Ončák, M. | Denifl, S.; Reactions in Tirapazamine Induced by the Attachment of Low-Energy Electrons: Dissociation Versus Roaming of OH. *Angewandte Chemie - International Edition*, 59(39) 17177-17181, 2020

Preliminary tests show that the **new device** developed at CEFITEC to measure pressures  $10^9$  times below atmosphere is a progress beyond the state of the art in **vacuum metrology**.



The **multirod pumping configuration** is the latest advance in collection and conversion efficiency in **solar lasers** attained by CEFITEC researchers.



Advances in collection efficiency





## Roadmap on dynamics of molecules and clusters in the gas phase

Henning Zettergren<sup>1,8</sup>, Alicja Domaracka<sup>2</sup>, Thomas Schlathöfer<sup>3</sup>, Paola Bolognesi<sup>4</sup>, Sergio Díaz-Tendero<sup>5,6,7</sup>, Marta Labuda<sup>8</sup>, Sanja Tosic<sup>9</sup>, Sylvain Maclot<sup>10,11</sup>, Per Johansson<sup>10</sup>, Amanda Steber<sup>12,13</sup>, Denis Tikhonov<sup>12,13</sup>, Marta Carmen Castrovill<sup>14</sup>, Lorenzo Avallini<sup>15</sup>, Sadiq Bari<sup>16</sup>, Aleksandar R. Mikosavljevic<sup>17</sup>, Alicia Palacios<sup>17</sup>, Shirin Parajji<sup>18</sup>, Dariusz G. Plekarski<sup>19</sup>, Patrick Rousseau<sup>20</sup>, Daniela Ascenzi<sup>21</sup>, Claire Romanzin<sup>22</sup>, Ewa Erdmann<sup>2,5</sup>, Manuel Alcam<sup>2,7,18</sup>, Janina Kopyra<sup>19</sup>, Paulo Limão-Vieira<sup>20</sup>, Jaroslav Kotiček<sup>21</sup>, Juraj Fedor<sup>21</sup>, Simon Albertini<sup>22</sup>, Michael Gatchell<sup>22,1</sup>, Henrik Cederquist<sup>1</sup>, Henning T. Schmidt<sup>1</sup>, Elisabeth Gruber<sup>23</sup>, Lars H. Andersen<sup>24</sup>, Odel Heber<sup>24</sup>, Yoni Tokar<sup>25</sup>, Klavs Hansen<sup>26</sup>, Jennifer A. Noble<sup>27</sup>, Christophe Jouve<sup>27</sup>, Christina Kjaer<sup>28</sup>, Steen Brøndsted Nielsen<sup>28</sup>, Eduardo Carrascosa<sup>29</sup>, James Bull<sup>29</sup>, Alessandra Candian<sup>30</sup>, and Annemieke Petrigiani<sup>30</sup>

Vacuum 179 (2020) 109545

Contents lists available at ScienceDirect

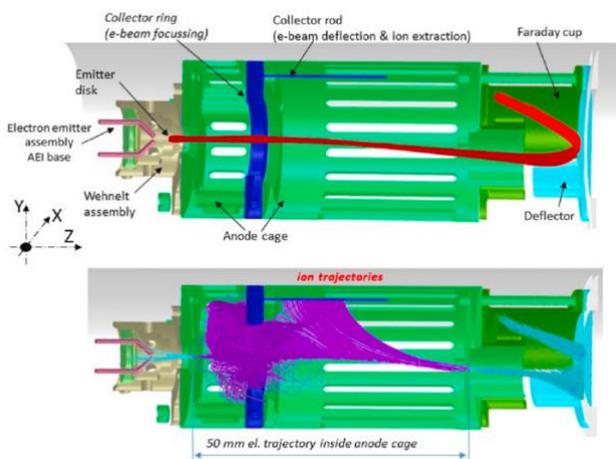
Vacuum

journal homepage: <http://www.elsevier.com/locate/vacuum>

A review on hot cathode ionisation gauges with focus on a suitable design for measurement accuracy and stability

Karl Jousten<sup>1\*</sup>, Frederic Boineau<sup>2</sup>, Nenad Bundaleski<sup>3</sup>, Claus Illgen<sup>4</sup>, Janez Setina<sup>5</sup>, Orlando M.N.D. Teodoro<sup>6</sup>, Martin Vicar<sup>7</sup>, Martin Wüest<sup>1</sup>

<sup>1</sup>Physikalisches Institut (PI), Albert-Ludwigs-Universität (ALU), Albertstr. 11, 78056, Tübingen, Germany  
<sup>2</sup>Unité de Chimie Industrielle (UCI), Université de Caen, 14050, Caen, France  
<sup>3</sup>CEITEC, Department of Physics, Faculty of Science and Technology, Nova University of Lisbon, 2829-515, Caporita, Portugal  
<sup>4</sup>IMP, Institute of Materials and Technology, Kopce 811, 1000, Ljubljana, Slovenia  
<sup>5</sup>Czech Metrology Institute (CMI), Opatov 772-71, 638 06, Brno, Czech Republic  
<sup>6</sup>INPC/INAC, Av. Landelino 6, 11-9496, Belfora, Lachemiro, Brazil



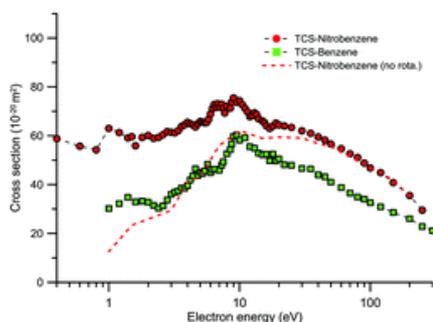
CEFITEC members co-authored two relevant **review articles**.

The **high measurement accuracy** showed by the **novel ionization gauge** designed in the frame of a European consortium led to the submission of a new ISO standard.

This new design was the outcome of a work package entitled “Fundamental physics for the design of ionisation gauges” coordinated by a CEFITEC member.

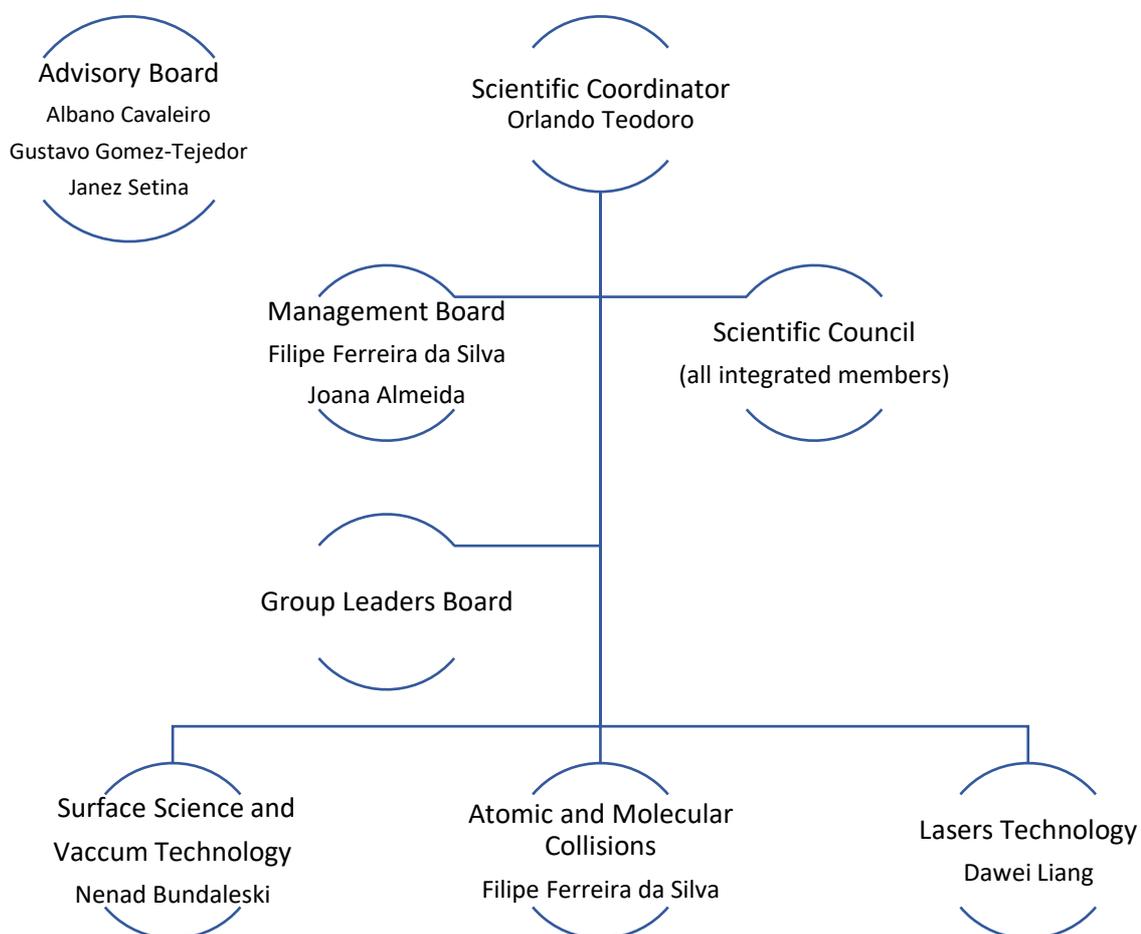
“Hot article” published in *Physical Chemistry Chemical Physics* (IF=3.945):

L. Álvarez, F. Costa, A. I. Lozano, J. C. Oller, A. Muñoz, F. Blanco, P. Limão-Vieira, R. D. White, M. J. Brunger and G. García; Electron scattering cross sections from nitrobenzene in the energy range 0.4–1000 eV: the role of dipole interactions in measurements and calculations. *Phys Chem Chem Phys* (20), 13505-13515, 2020

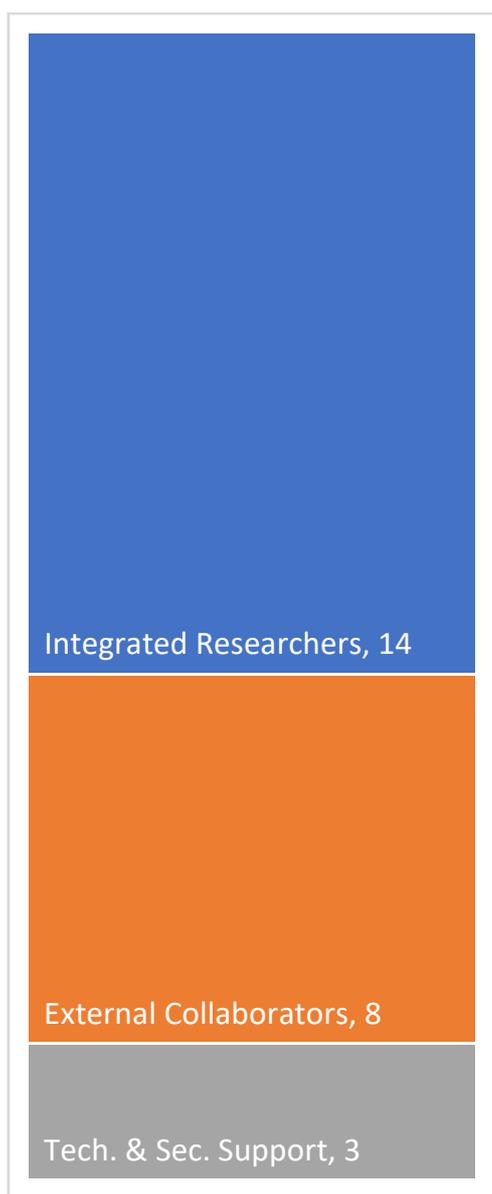




## CEFITEC after June 2021



# Research team



Active members in 31/12/2021

## Integrated members

Ana Gomes Silva  
 Ana Lozano Martinez  
 Ana Luísa Fonseca  
 Augusto Moutinho  
 Cláudia Vistas  
 Dawei Liang  
 Filipe Ferreira da Silva  
 Joana Almeida  
 João Ameixa  
 Mónica Mendes  
 Nenad Bundaleski  
 Orlando Teodoro  
 Paulo Limão-Vieira  
 Pedro Pereira

## External collaborators (RaBBiT)

Alessandra de Souza Barbosa, Department of Physics, Universidade Federal do Paraná, Brazil  
 Alexander Tolstoguzov, Utkin Ryazan State Radio Engineering University, Russian Federation  
 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

### **Surface Science and Vacuum Technology**

Early in the 90s, this group started to emerge as a branch of the Centre of Molecular Physics of the Universities of Lisbon. A new lab was equipped with modern surface analysis techniques pursuing ion interactions with surfaces in the keV energy region, including sputtering, scattering and charge exchange.

The large background in high and ultra-high vacuum led to the creation of a new lab targeting an approach to the national industry via the calibration of vacuum gauges and consultancy. METROVAC was officially recognized as an accredited calibration laboratory in 2002. Soon this laboratory broadened its accreditation scope to include the metrology of ultra-low flows, including reference leaks and leak detection. These new skills gave the motivation to start a new area of research studying the transport of gases and vapors through cork and desorption of contaminants. Achievements on this subject quickly attracted the attention of cork stopper manufacturers and fruitful collaborations have started.

Meanwhile, the surface science lab underwent in a collaboration with CERN regarding the study of secondary electron emission from carbon coatings, which are used in the accelerator walls to mitigate the formation of the electron cloud. This cloud is one of the major limitations to increase the beam luminosity in particle accelerators, but also introduces major technological problems in telecommunication satellites and spacecrafts in general. Nowadays the surface science lab has two fully operational XPS (X-Ray Photoelectron Spectroscopy) systems and one ToF-SIMS (Time-of-flight Secondary Ion Mass Spectrometer). In recent years, great experience has been accumulated in the emission of secondary electrons from surfaces and in the chemical characterization of nanostructured surfaces.

Recently the two labs fully merged their capabilities to design a high accuracy ionization gauge where the problems induced by the secondary electron emission from the ion collector were carefully addressed.



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.

## Atomic and Molecular Collisions

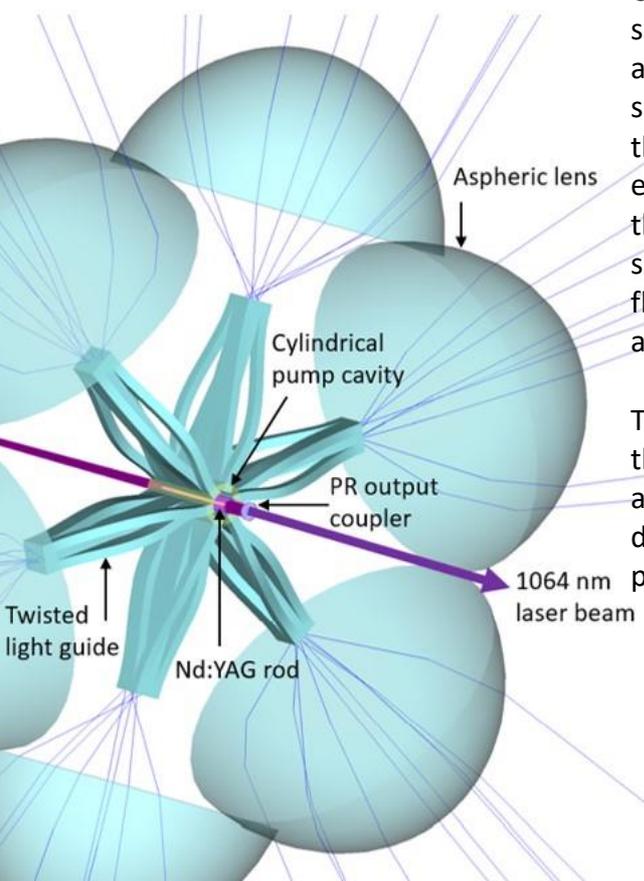


## Laser Technology

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  $41.3 \text{ W/m}^2$  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 and 2016, and Journal of Photonics for Energy in 2019 and 2020. A book publishing contract on “Solar-Pumped Lasers” with Springer Nature has also been signed in January 2020. 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.

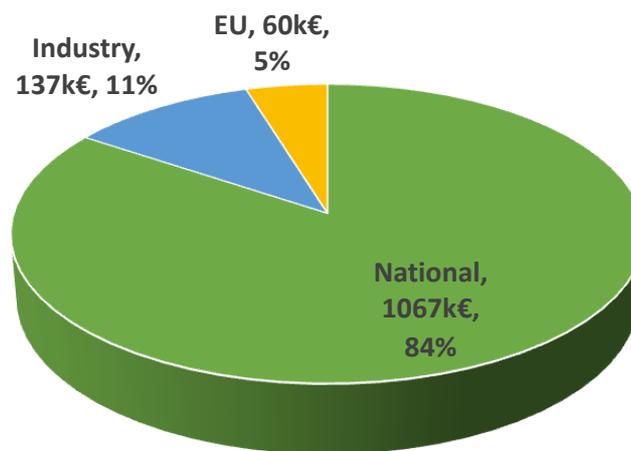
Currently, the laser technology group is seeking for high solar laser performance through the development of alternative prototypes for the simultaneous pumping of several laser crystals with broader absorption spectrum in the visible region. The goal is to enable the simultaneous emission of multiple renewable beams with enhanced thermal performance and efficiency. The study of innovative solar concentrators to substantially improve the solar energy flux and, consequently, the solar pumping efficiency, has 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.

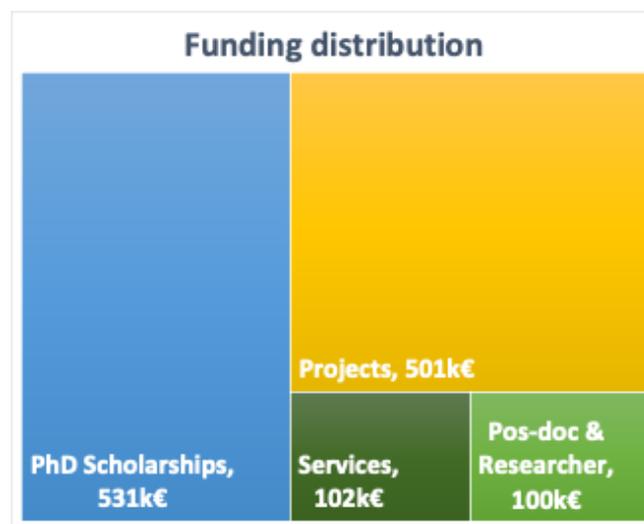




## Funding source



## Funding distribution



Only funds expended in 2020 and 2021: **1 145 k€**.

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

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

## Funded projects

Projects running during the reporting period of 2020-21, others than 'base' and 'programmatic':

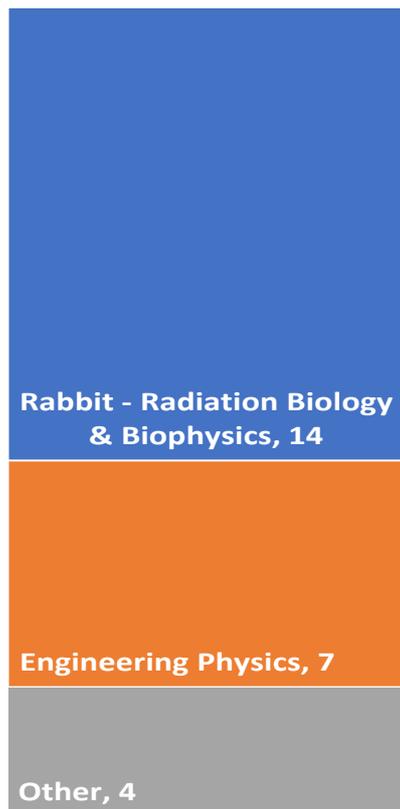
Title	Funding agency	Reference	PI (in CEFITEC)	Period
Towards a documentary standard for an ionisation vacuum gauge	EMPIR, EURAMET	16NRM05_Ion Gauge	Orlando Teodoro	2017-2020
Industrialization of the process of thermal extraction of TCA from natural cork stoppers	Amorim Cork	License agreement under the contract dated from 18/07/2017	Orlando Teodoro	2017-2021
Decomposition of biological molecular targets by electron transfer experiments	FCT, IP	PTDC/FIS-AQM/31281/2017	Paulo Limão-Vieira	2018-2021
Boron-containing compounds chemical reactions triggered by low energy electron interactions	FCT, IP	PTDC/FIS-AQM/31215/2017	Filipe Ferreira da Silva	2018-2021
Efficient fundamental mode multi-beam solar laser emissions	SPERA-III, Horizon 2020	MULTI-BEAM-LASER	Dawei Liang	2020-2021
Low energy electrons interactions: from fundamentals to applications	Bilateral agreement with University of Iceland	FBR_OC1_058 CEFITEC_FCT-UNL	Filipe Ferreira da Silva	2020
Erasmus mobility	Erasmus + 2020 University of Potsdam	Erasmus + 2020	Filipe Ferreira da Silva	2020

Improving of carbon-based low secondary electron yield coatings	FCT, IP	CERN/FIS-TEC/0039/2019	Nenad Bundaleski	2021-2023
Exploring the electronic structure of ether derivative molecules in photoabsorption experiments	EU Framework Programme for Research and Innovation HORIZON 2020 CALIPSOplus	Grant Agreement 730872	Paulo Limão-Vieira	2021
Identifying the electronic excited states of cyano containing molecules detected in the interstellar medium	EU Framework Programme for Research and Innovation HORIZON 2020 CALIPSOplus	Grant Agreement 730872	Mónica Mendes	2021
Electronic Excited States of Naphthalene and Halogenated Derivative	EU Framework Programme for Research and Innovation HORIZON 2020 CALIPSOplus	Grant Agreement 730872	Ana Lozano Martinez	2021
Metrology for decarbonizing the gas grid	EMPIR, EURAMET	20IND10_Decarb	Orlando Teodoro	2021-2023
PRIOR-low energy Particle and Radical Interactions in biomedical applications of Radiation	Ministerio de Economia y Competitividad, Spain	SPID201600X080458IV0	Paulo Limão-Vieira	2021



CEFITEC pursued an active scheme on advanced scientific and technological training allowing students and members on their early stage careers to be taught along side with the most recent developments a par with international standards. CEFITEC was engaged in 5 doctoral programs. Most students were awarded with scholarships by the national funding agency FCT IP in competitive calls.

Of special relevance is its engagement in the coordination of the international doctoral program RaBBiT - Radiation Biology and Biophysics Doctoral Training Program.



**Pos-Doc**

**4**

**PhD students**

**25**

**PhD theses**

**6**

**Master theses**

**8**

**Finished PhD theses:**

	<b>Year, Program</b>	<b>Title</b>	<b>Student</b>	<b>Supervisor(s)</b>
1.	2020, RABBIT, Radiation Biology & Biophysics Doctoral Training Programme	Low-Energy Electron Interactions with Radiosensitisers and Hydrated Biomolecular Clusters	Rebecca Meißner	Stephan Denifl and Paulo Limão-Vieira, (co-tutored with University of Innsbruck, AT)
2.	2020, RABBIT, Radiation Biology & Biophysics Doctoral Training Programme	Electron–Molecule Reactions: Computational Study of Methods and their Applications	Alexandra Loupas	Jimena Diaz Gorfinkiel and Paulo Limão-Vieira, co-tutored with The Open University, UK)
3.	2020, RABBIT, Radiation Biology & Biophysics Doctoral Training Programme	Collision studies with electrosprayed biomolecules	João Ameixa	Stephan Denifl and Filipe Ferreira da Silva, (co-tutored with University of Innsbruck, AT)
4.	2021, Belgrade University), Physical Chemistry	Investigation of the electronic structure and composition of the surfaces of multicomponent semiconductors $Cd(Zn)_{1-x}Mn(Fe)_xTe_{1-y}(Se,S)_y$	Mirjana Medić-Ilić	Nenad Bundaleski, Ivana Radisavljević (co-tutored with Belgrade University, SER)
5.	2021, RABBIT, Radiation Biology & Biophysics Doctoral Training Programme	Dissociative processes induced by electron and radical impact with biologically relevant molecules	Filipe Costa	Gustavo García, (CSIC Spain), Paulo Limão-Vieira
6.	2021, RABBIT, Radiation Biology & Biophysics Doctoral Training Programme	Investigating conformation-dependence in radiation-induced reactions in isolated biomolecules and clusters	André Rebelo	Samuel Eden (Open University), Paulo Limão-Vieira

**Finished master theses:**

<b>Year, Master Course</b>	<b>Title</b>	<b>Student</b>	<b>Supervisor(s)</b>
1 2020, Engineering Physics	Avaliação da Permeabilidade da Cortiça	Maria Inês Bento	Orlando Teodoro, Ana Fonseca
2 2020, Engineering Physics	Projeto de equipamento industrial para extração de TCA de rolhas de cortiça natural	Miguel Rossa	Orlando Teodoro
3 2020, Engineering Physics	Heating of Atomic Force Microscopy (AFM) cantilevers operating in liquid media under intense optical illumination	Frederico Henriques Antão Mendes Tremoço	Ana Gomes Silva, Pieter de Beule
4 2020, Engineering Physics	Simulation of Tunnel Junctions in Silicon/Perovskite Tandem Solar Cells	Hugo Filipe Nunes Onderwater	Ana Gomes Silva, Guilherme Gaspar (FCUL)
5 2021, Engineering Physics	Dielectric materials as new approach for Cu(In,Ga)Se <sub>2</sub> front passivation	Margarida Monteiro	Ana Gomes Silva, Jennifer Teixeira
6 2021, Biomedical Engineering	Avaliação da temozolomida como agente radiosensibilizador em estudos de interação de eletrões de baixa energia	Ana Margarida Oleiro Nunes	Mónica Mendes, Filipe Ferreira da Silva
7 2021, Engineering Physics	Implementação de espectrómetro de massa do tipo tempo de voo reflectrão	João Miguel Esteves Ramos	Filipe Ferreira da Silva



### Process for extraction of TCA from natural cork stoppers

After 5 years of intense collaboration with Amorim Cork the new process of thermal extraction of TCA (2,4,6-trichloroanisole, chemical structure below) from natural cork stoppers was fully industrialized **achieving TRL 8** (Technology Readiness Level). About 40 large machines were designed and built to process more than 700 million stoppers per year.

This technology was protected by national and international **patents** by CEFITEC researchers. A license was granted to Amorim Cork for the exclusive use of this technology.

The new technology was branded **®Naturity**.



2,4,6- trichloroanisole molecule  
(green - chlorine, red - oxygen, dark grey - carbon, white - hydrogen)



### 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  $\pm 1\%$  for a known gas. This project had the collaboration of INFICON and VACOM, two leading manufacturers of vacuum equipment. This new gauge should be commercially available soon.

A draft for an **ISO standard** was submitted.



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 conformity 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:

- Permeation tests.
- Leak testing.
- Surface analysis by XPS and SIMS.
- Consultancy in vacuum technology.

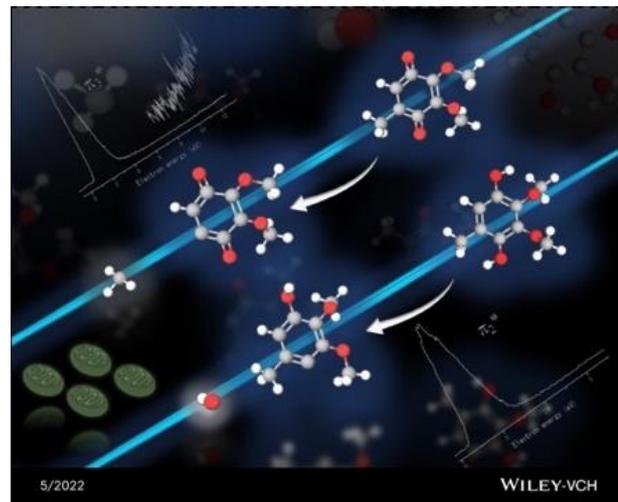
METROVAC is engaged in **research** in topics related to vacuum metrology and ultra-low flow measurements. This includes health & safety aspects related to the introduction of **hydrogen** in the gas grid, the transport of gases through **cork** and development of **new instruments** to measure low pressures.



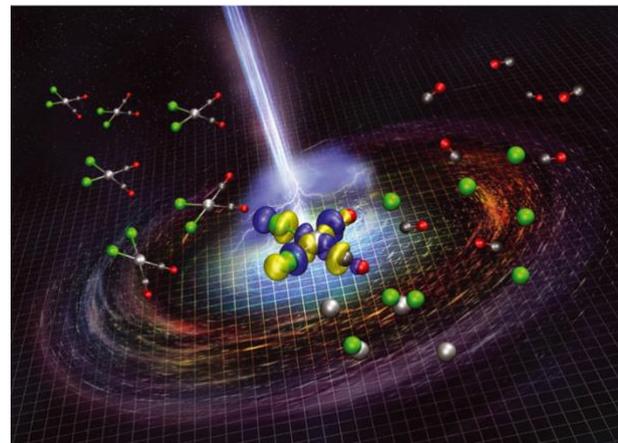


## Do you know that...

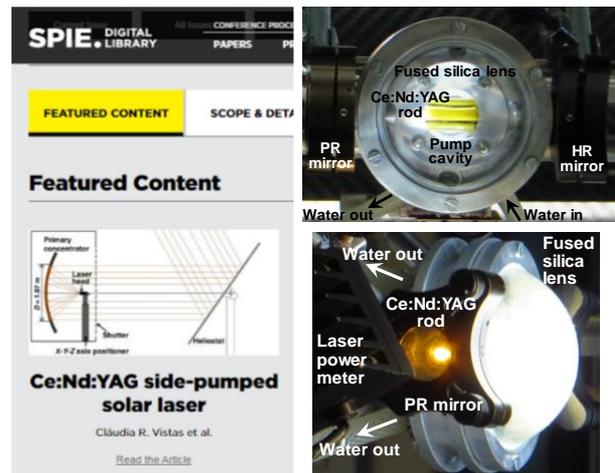
Researchers at CEFITEC showed that **electrons with extremely low energy may induce damage in biological molecules** which allows to understand some molecular mechanisms related to degenerative disorders.



**Nanotechnology** benefits from advances made by molecular physicists at CEFITEC on the comprehension and optimization of electron-beam-induced deposition technique.

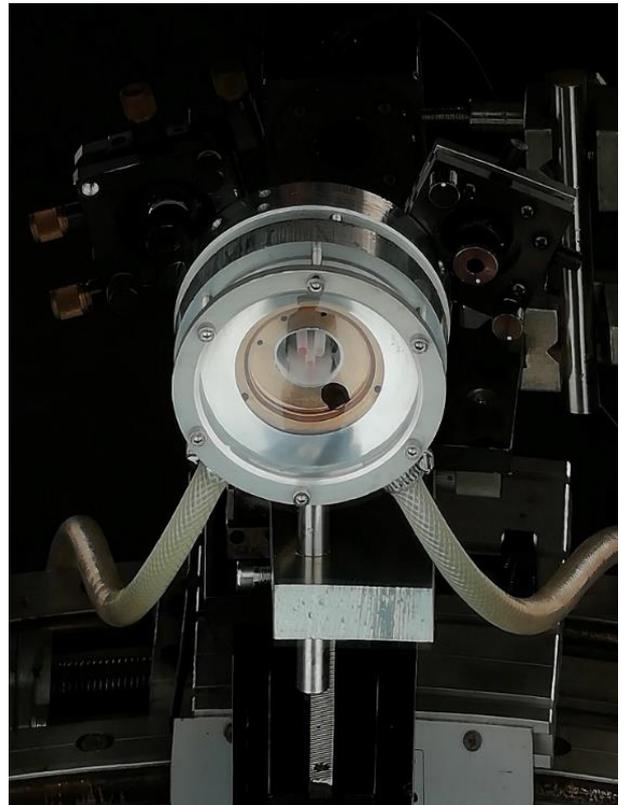


Solar lasers do not require electric energy to generate a laser beam.



Solar lasers bring an important **economic advantage** for countries with **high solar availability** and for the future development of sustainable industrialization, either on **Earth or in Space**.

CEFITEC holds the world record in efficiency of solar lasers.



CEFITEC researchers have **invented** a process to **remove from cork the major off-flavor found in wine**, commonly known as **TCA** (2,4,6-trichloroanisole).



The valorization of **cork** products **fight climate change**, since cork oaks retain more CO<sub>2</sub> than what is released during the manufacture of stoppers, leading to a **negative carbon footprint**.

In this way, **replacement of cork stoppers by plastic stoppers is avoided**.



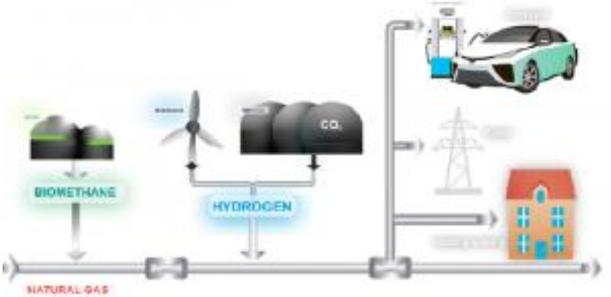
CEFITEC holds an **accredited laboratory** for **20 years**, offering its unique expertise in vacuum technology to the industry.



**METROVAC**



Forthcoming introduction of **hydrogen in the European gas network** brings new challenges in **health & safety requirements** and CEFITEC researchers are part of the international team tackling this problem.









## Science dissemination

CEFITEC was actively engaged in several activities promoting public awareness and understanding of its ongoing research. These activities included:

- “EXPO FCT”, the annual open day of Nova School of Science and Technology.
- “Encontro com a Ciência e Tecnologia” sponsored by FCT IP.
- “90 segundos de ciência”, radio Broadcast series.
- Summer schools for secondary school students.
- Newspaper and television interviews.



# CEFITEC in media



segundos de ciência

HOME SOBRE 90 SEG EPISÓDIOS CONTACTO

**EP. 1049 JOANA ALMEIDA – GRUPO DE INVESTIGAÇÃO DESENVOLVE LASER BOMBEADO A LUZ SOLAR**

MARÇO 18, 2021

00:00 / 02:12



Estes lasers podem ser usados no espaço para a transmissão de energia entre satélites, para telecomunicações, e até mesmo para desviar asteróides que apresentem um perigo de colisão com o nosso planeta.

Joana Almeida, investigadora no Laboratório de Laser Solar do CEFITEC – Centro de Física e Investigação Tecnológica da Nova School of Science and Technology (FCT NOVA), está a desenvolver lasers bombeados a luz solar concentrada, uma alternativa sustentável aos lasers convencionais.

CISION

Diário de Notícias

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25-02-2021

Melo: Imprensa

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Pág: 14

Cores: Cor

Área: 25,50 x 30,10 cm<sup>2</sup>

Corte: 1 de 1



# Vinho sem sabor a rolha. A tecnologia revolucionária para a indústria corticeira

**INOVAÇÃO** O novo processo criado pela equipa de investigadores liderada por Orlando Teodoro, do Centro de Física e Investigação Tecnológica, permite eliminar a componente química que contamina as rolhas de vinho.

TEXTO FRANCISCO DE ALMEIDA FERNANDES



Un lungo viaggio di ricerca verso un obiettivo:  
ottenere un vino senza il sapore di sughero.

## NATURITY®

Come è nata la tecnologia più rivoluzionaria per l'industria  
del sughero senza alcuna aggiunta di elementi artificiali



**Orlando M.N.D. Teodoro**  
Professore e ricercatore presso il  
Centro de Física e Investigação  
Tecnológica - Nova School of  
Science and Technology,  
Physics Department Portugal

**CARTAS DESDE EL MUNDO**

**PORTUGAL**

**El corcho luso goza de buena salud**

La industria portuguesa, líder mundial en este sector, ha descubierto cómo quitar en el vino el sabor y el aroma que este tipo de tapones dejan impregnado en las botellas

**Degoña Higuera**  
Lisboa

Portugal es desde hace décadas el mayor productor y exportador mundial de corcho, y el principal fabricante de tapones de botellas de vino y cara de esta prensa da materia prima. El país es responsable de más del 90% del corcho del planeta y de casi el 60% de su exportación y distribución. Los extensos campos de alcornoques, los denominados montados, de donde se extrae cada nueve años la preciosa materia prima, giran protagonista a su vez en la región del Alentejo, al sur de Lisboa. «La pandemia no ha afectado de mucho a este negocio que da empleo directo a más de 8.300 personas, son muchas las familias que viven del corcho, de su extracción, transformación y distribución en todo el país», explica el ingeniero de montes, Carlos Alberto, técnico del Observatorio del Alentejo y del Corcho que se explota en 27 municipios luso.

El observatorio está ubicado en el aguntamiento de Cortiça, la capital portuguesa del corcho, donde funcionan cuatro empresas de transformación del corcho y de distribución que dan empleo directo a más de 300 personas. Allí se encuentran también los montados más importantes y espectaculares del país. «Que son árboles no solo de este corcho único que tenemos vino de una gran riqueza y diversidad patológica y animal», recuerda el ingeniero. «Cada día se fabrican en Portugal de cinco a seis millones de tapones 100% naturales de roble, muchos paneles aislantes y otros productos». Cualquier persona en España, en EEUU o en el Reino Unido, por ejemplo, al desconchar una botella de vino debe ser consciente del trabajo que hay detrás, desde que se caca el corcho del árbol hasta la fabricación del tapón, y de que

**AL MARGEN DE LA PANDEMIA.** Carlos Alberto, ingeniero de montes, es técnico del Observatorio del Alentejo y del Corcho que se explota en 27 municipios luso. Según explica, la crisis del covid apenas ha afectado a la fabricación del sector, con un ligero descenso en la producción de tapones de corcho para botellas de vino.



probablemente provenga de Portugal. En plena pandemia ha nacido y se ha implantado una técnica pionera, descubierta por unos investigadores luso, para hacer de nuevo totalmente el sabor a corcho que se impregna en el vino por el momento del taponado. El artículo del descubrimiento es de João Trindade, investigador de Física de la Universidade Nova de Lisboa, y director del Centro de Física e Investigação Tecnológica de dicha universidad. La patente ya ha sido comprada por el grupo por-

tuqués Amorim, líder mundial del sector y ha sido más de cinco años de investigación con un pequeño equipo y numerosas pruebas hasta llegar, por fin, al resultado final», precisa João de Trindade. Según explica, la originalidad del proceso es no utilizar ningún tipo de solventes o aditivos para eliminar el componente químico que sale de los tapones de corcho y que habitualmente contamina el vino. «La casuística de dicha contaminación es la molécula TCA», detalla Trinda-

de. Hasta ahora había otras técnicas que utilizaban aditivos para eliminarla, pero el equipo de este investigador la ha conseguido con un proceso seco y 100% natural que, llegando directamente al punto débil de unión de la TCA al corcho, lo elimina previamente de los tapones para evitar la contaminación una vez embotellado el vino», afirma este físico, quien admite orgulloso de que esta año el grupo Amorim venderá 700 millones de tapones que incorporan esta técnica.

**VACUUM TECHNOLOGY**

Innovation in vacuum science, technology and engineering at CERN and beyond

APPLICATIONS | FEATURE

**Vacuum metrology: made to measure**

6 January 2021

A pan-European consortium is working towards an international standard for the commercial manufacture of ionisation vacuum gauges – an advance that promises significant upsides for research and industrial users of vacuum systems. Joe McEntee reports.



**Measurement science** 'Design for manufacturability' is a priority for the EMPIR 16NRM05 partners, such that any specialist manufacturer will be able to produce standardised, next-generation ionisation gauges at scale. Here, PTB scientists Karl Iousten (right)

Absence, it seems, can sometimes manifest as a ubiquitous presence. High and ultrahigh vacuum – broadly the “nothingness” defined by the pressure range spanning 0.1 Pa (0.001 mbar) through 10<sup>-9</sup> Pa – is a case in point. HV/UHV environments are, after all, indispensable features of all manner of scientific endeavours – from particle accelerators and fusion research to electron microscopy and surface analysis – as well as a fixture of diverse multibillion-dollar industries, including semiconductors, computing, solar cells and optical coatings.

For context, the ionisation vacuum gauge is the only instrument able to make pressure





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Peer reviewed publications co-authored by the 14 integrated members

2020 (Scopus, WOS)

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## Editorial activity

CEFITEC integrated members were engaged in the following editorial activities:

Journal	Assignment	Member
European Physical Journal D (Springer-Nature)	Guest editor to topical issue "Molecular collisions, photoionization and dynamics; honouring Professor Vincent McKoy"	Paulo Limão-Vieira
Web of Conferences (EDP sciences)	Editorial board member	Paulo Limão-Vieira
European Physical Journal D (Springer-Nature)	Editorial board member	Filipe Ferreira da Silva
Energies (MDPI)	Guest Editor of the Special Issue "Challenge and Research Trends of Solar Concentrators"	Dawei Liang
International Journal of Molecular Sciences (MDPI)	Guest Editor of Sepcial Issue "Electron and Photon Interactions with Bio(related)Molecules"	Filipe Ferreira da Silva

Peer reviewed journals that invited CEFITEC members to review manuscripts:

Journal	Publisher
Applied Surface Science	Elsevier
Energies	MDPI
Eng	MDPI
European Physical Journal D	Springer-Nature
Holzforschung - International Journal of the Biology, Chemistry, Physics and Technology of Wood	De Gruyter
International Journal of Mass Spectrometry	Elsevier

Journal of Advanced Engineering Materials	Wiley
Journal of Alloys and Compounds	Elsevier
Journal of Cleaner Production	Elsevier
Journal of Crystal Growth	Elsevier
Journal of Crystal Research and Technology	Wiley
Journal of Food Engineering	Elsevier
Journal of Materials Chemistry	Royal Society of Chemistry
Journal of Nanotechnology	Hindawi
Journal of Photonics for Energy	SPIE
Journal of Physics B: Atomic, Molecular and Optical Physics	Institute of Physics
Journal of Physics D, Applied Physics	Institute of Physics
Journal of the American Society for Mass Spectrometry	American Chemical Society
Materials Research Bulletin	Elsevier
Measurement	Elsevier
Microelectronics Engineering	Elsevier
Modern Physics Letters B	World Scient
Nuclear Science and Techniques	Springer
Optics & Laser Technology	Elsevier
Optics Communication	Elsevier
Physical Chemistry Chemical Physics	Royal Society of Chemistry
Plasma Sources Science and Technology	Institute of Physics
Sensors and Actuators: A. Physical	Elsevier
The Journal of Chemical Physics	American Institute of Physics
The Journal of Physical Chemistry A	American Chemical Society
Thin Solid Films	Elsevier
Vacuum	Elsevier

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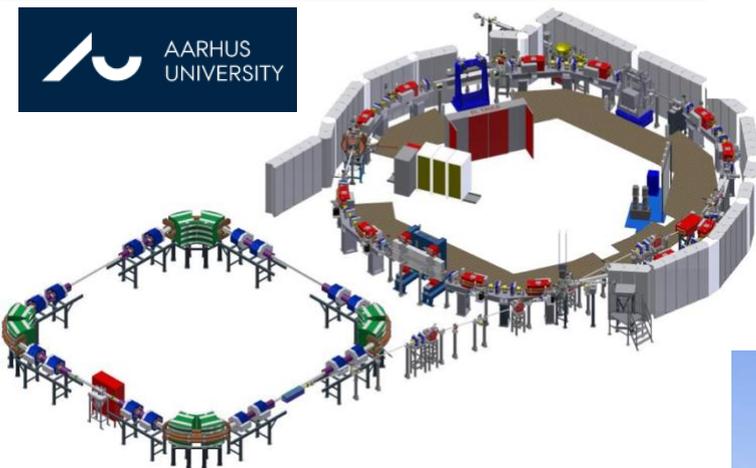
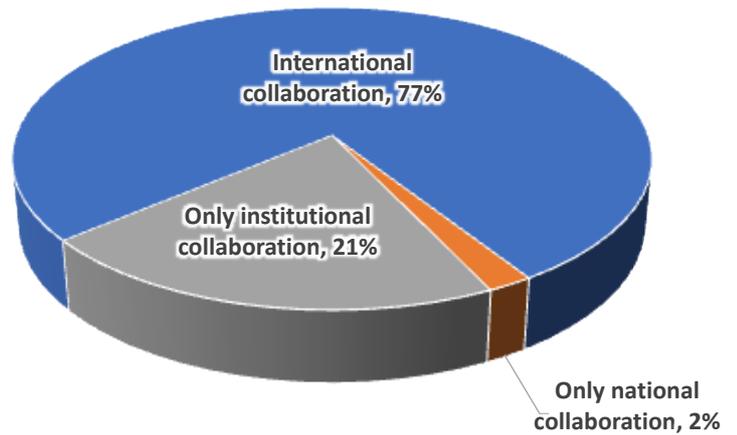


The majority of CEFITEC's publications are the result of international collaborations. The top 6 collaborating institutions are:

1. CNRS, France.
2. CSIC, Spain.
3. University of Innsbruck, Austria.
4. Aarhus University, Denmark.
5. Complutense University, Spain.
6. Flinders University, Australia.

CEFITEC has also active collaborations with several National Metrology Institutes in Europe and with CERN.

### Publications





## Participation in conferences

*RIVA 2021 Iberian Vacuum meeting, 4th-6th October 2021*

Secondary electron emission in accelerator technologies and vacuum metrology, Nenad Bundaleski, invited lecture

Comparison of the influence of stray magnetic fields on the operation of Bayard-Alpert and extractor ionisation gauges, R. Silva, N. Bundaleski, O.M.N.D. Teodoro, oral presentation

*International Symposium on Nanoscale Research, Montanuniversität, Leoben, Austria, September 2021*

Controlled Growth of High Current Functional Semiconductor Systems, Ana G Silva, invited lecture

*Conferência CBRAVIC21, Congresso Brasileiro de Aplicações de Vácuo, 1-3 December 2021*

Ultrafast nonlinear nano-optics: from fundamentals to basic research and applications, Ana G Silva, plenary invited lecture

*67<sup>th</sup> American Vacuum Society Symposium, USA, October 25-28, 2021*

Laser induced thermal emission from nickel nanowires, A.G. Silva, K. Pedersen, oral presentation

*16<sup>th</sup> European Vacuum Congress, Marseille, France November 2021*

On laser induced emission from nickel nanowires, A.G. Silva, K. Pedersen, oral presentation

*2<sup>nd</sup> Molecular Dynamics in the GAS-phase COST Action General Meeting, October (2021)*

Methanol negative ions fragmentation probed in electron transfer experiments, Paulo Limão-Vieira, oral presentation

*Autumn Meeting of the Brazilian Physics Society, Brazil (2021)*

Formation of negative ions in atom-molecule collision experiments, Paulo Limão-Vieira, oral presentation

Collision induced dissociation of halothane in electron transfer experiments, Ana Lozano Martinez, oral presentation

*32nd International Conference on Photonic, Electronic and Atomic Collisions (VicPEAC 2021) July 2021*

Low energy electron interactions with 5-aminoimidazole-4-carboxamide, Mónica Mendes, oral presentation

*POSMOL 2021 - XXII International Symposium on Electron-Molecule Collisions and Swarms , July 2021*

Electron interactions with the coenzyme Q0: molecular anion observation and its subsequent fragmentation reactions, João Ameixa, oral presentation

*MD-GAS WG1 & WG2 Conference 2021, March 2021*

Electron attachment to OTfU: a potential radiosensitizer, João Ameixa, oral presentation

*COST Action Molecular dynamics in the GAS phase – Early Career Investigators (ECI) webinars 29 June 2022*

Revealing physico-chemical mechanisms of DNA damage upon low-energy electron attachment through DNA origami studies, João Ameixa, oral presentation

*J. Heyrovski Institute of Physical Chemistry 25 October 2022*

Low energy electron attachment to biomolecules, João Ameixa, oral presentation

*1st Annual Multiscale Irradiation and Chemistry Driven Processes and Related Technologies COST Action Meeting (MultiChem 2022), May 2022*

DNA radiation damage studies using DNA origami nanostructures, João Ameixa, oral presentation

*11<sup>th</sup> International Meeting on Atomic and Molecular Physics and Chemistry, Prague (2022)*

Bound electron enhanced radiosensitisation of nimorazole upon charge transfer, S Kumar, B. Kerkeni, G García and P Limão-Vieira, poster contribution

*eSENSE-EMMC Meeting, Multiscale Modeling of Materials and Molecules, Uppsala, Sweden (2022) 52*

Electronic Structure and Reactivity of Tirapazamine as a Radiosensitizer, J Romero T Maihom, P Limão-Vieira, poster contribution

Electron-impact ionization cross sections of small molecules containing Fe and Cr, J Romero, P Limão-Vieira, M Probst, poster contribution

## Organization of conferences

<i>RIVA 2021 Iberian Vacuum meeting, 4th-6th October 2021</i>	Member of the Scientific Committee, Orlando Teodoro, Ana Gomes Silva
<i>International Symposium of Molecular Beams</i>	Member of the Scientific Committee, F Ferreira da Silva
<i>EMS, Symposium on Electron-Molecule Collisions and Swarms</i>	Chairman of the international scientific and advisory committee 2019 – 2021, Paulo Limão-Vieira
<i>DEEP-GAS 2022 - Dynamics of Energetic &amp; Electronic Processes in molecules and clusters in the GAS phase, 4-7 October 2022 in Madrid, Spain</i>	Member of the Organizing Committee, Ana Lozano
<i>The 1st Training School of the COST Action MultiChem, Instituto Superior Técnico (Lisbon, Portugal) October 03-07, 2022</i>	Member of the Local Organizing Committee, Filipe Ferreira da Silva

## Participation in scientific societies

<i>Chair of the Nanometer Structures Scientific Division of IUVESTA</i>	Ana Gomes Silva
<i>Vice-Chair of the Education Committee of IUVESTA</i>	Ana Gomes Silva
<i>Member of the Officers Board of IUVESTA and Recording Secretary</i>	Ana Gomes Silva
<i>Vice-Chair of the Portuguese Vacuum Society SOPORVAC</i>	Orlando Teodoro
<i>Portuguese Councilor in IUVESTA</i>	Orlando Teodoro

(IUVESTA 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.)





