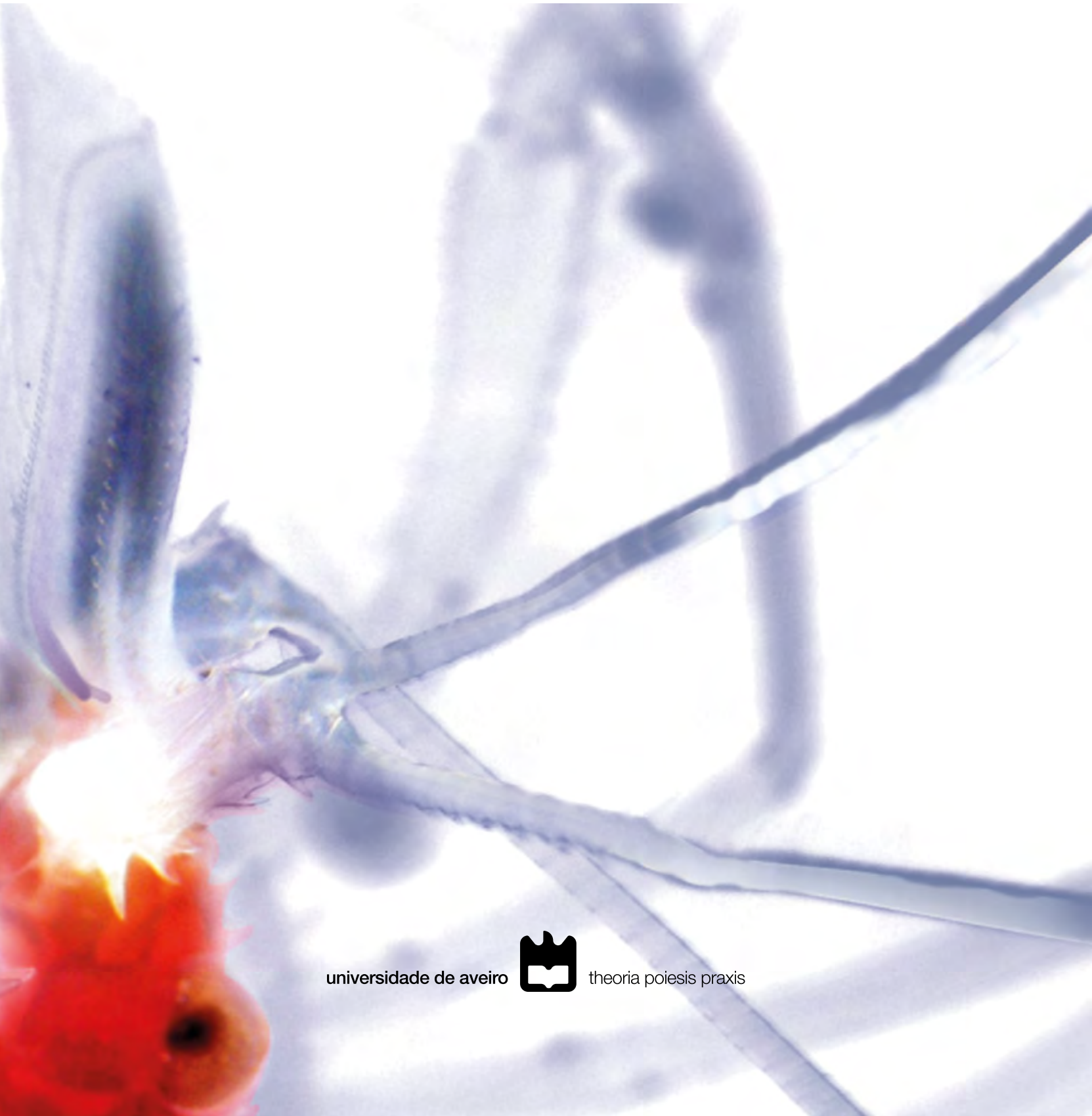
research@ua

2014



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research@ua

edition and property
Universidade de Aveiro
Campus Universitário de Santiago
3810-193 Aveiro
Portugal

phone [+ 351] 234 372 571
fax [+ 351] 234 370 004

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MANUEL ANTÓNIO ASSUNÇÃO
University of Aveiro

A WORD FROM THE RECTOR

“ Research is a key strategic element, facilitating the mission of the University of Aveiro. Firstly, because the quality of research is an indicator of the installed capacity and potential to produce new knowledge; secondly because a strong research workforce potentiates a greater demand for collaboration by industry and a better accomplishment in raising national and international projects and, thirdly, because high-level researchers and infrastructures also help attracting students for all teaching levels.
High-level research facilitates, thus, the continued success of the University of Aveiro.”

JOSÉ FERNANDO MENDES
University of Aveiro

MESSAGE FROM VICE-RECTOR FOR RESEARCH AND DOCTORAL SCHOOL

A strategy with an international focus: a perspective by the Vice-rector José Fernando Mendes

Bearing in mind the need of a stronger and united European Research Area (ERA), it is utterly important that institutions participate more and more in international activities, either in the form of R&D projects, collaboration networks, staff exchange or other instruments / forms of fostering ERA outputs.

Portuguese and foreign institutions are striving for excellence. By pursuing joint research agendas, institutions benefit from competitive funding and are therefore able to invest efficiently in world-class facilities, potentiating the attraction of the best resources and reinforcing installed capacity.

However, in order to become international and compete at that level, attention must be drawn primarily to regional development and be aligned with the strategy for the region and country. The University of Aveiro integrates 11 of the research infrastructures (RI) identified by the Portuguese Foundation for Science and Technology. These research infrastructures of strategic interest aim at underpinning scientific and technological advances and reinforcing the capacity of the R&D community in Portugal to be an active member of European and international projects.

International collaborative research is significantly more highly cited than individual work, so scientific missions to foreign universities have become a fundamental instrument to strengthen collaboration with foreign institutions.

The notion of 'excellence' in ERA and its strict connection with research, development and innovation has become extremely popular across Europe and at the University of Aveiro, one must be aware of that notion. Researchers at our units have to work their way towards a culture of creativity and follow the trend of a research-driven university.

Our achievements in Science and Technology over the last 4 decades are inspiring and the proof is that we continue to hold a good position among the best Portuguese and one of the best Southern European Universities, with less than 50 years, according to the Times Higher Education ranking system of the world Universities. Our success is based on a unique interdisciplinary environment and a sophisticated shared research infrastructure. Following the strategic evaluation and restructuration of R&D laboratories in Portugal, research at our campuses is now conducted under the umbrella of 19 Research Units, mostly classified with Excellent or Very Good by international panels, under the sponsorship of the Portuguese National Science Foundation.

As Vice-Rector for Research and Doctoral School, I am aware of the need to maximise research achievements. Strategies are designed to achieve and sustain research excellence.

With the mission of coordinating third cycle activities internally and externally and responsible for developing new innovative courses and admitting candidates, the Doctoral School has focused in creating/reviewing doctoral programs of excellence, including national and international joint ventures, while implementing specific measures to enhance the employability of holders of its doctoral degrees based on training needs and market requirements. It is, to this respect, important to seize opportunities available as the European Joint Doctorates within the Marie Curie Actions or Erasmus+ potentiality.

Invited chairs or catedras are a powerful instrument of internationalization and upgrade of research capacity. In order to promote the area of health sciences in Aveiro, the catedra in neurosciences has been launched and two major scientists in the field of immunology, Phillipe Pierre and Evelyn Gatti, have been hired for 5 years through funds provided by the Foundation Ilídio Pinho. Also fundraising schemes are being planned to provide additional private funds for iBiMED, the Aveiro Institute for Biomedicine, a new initiative of the University of Aveiro to tackle biomedical and clinical challenges of ageing through research.

Some research questions may not be answered at solo, even for the strongest and best-resourced institutions. International collaboration is fundamental in some fields and may be achieved with the help of Horizon 2020 or other EC funding instruments. The participation of the University of Aveiro in EC networking and R&D funding calls is absolutely mandatory to achieving international recognition. During 2014, 110 projects were submitted to EC project calls. Within Horizon 2020, 6 projects have been approved and are running, including two coordinated by UA. To this respect, the research support office maintained its mission of helping researchers in the preparation and submission of project applications and of screening and scanning national and international calls of interest for our researchers.

It is my understanding that universities must be ambitious and researchers must be aware of the importance of promoting high quality research and publishing results in high quality journals, whereas providing the highest level of training to young researchers. Also vital is the capacity to capitalize the interdisciplinary character of our campus and research. The Research Day and the Research@UA magazine are initiatives that aim at fostering this complex environment of scientific fields at a single campus.

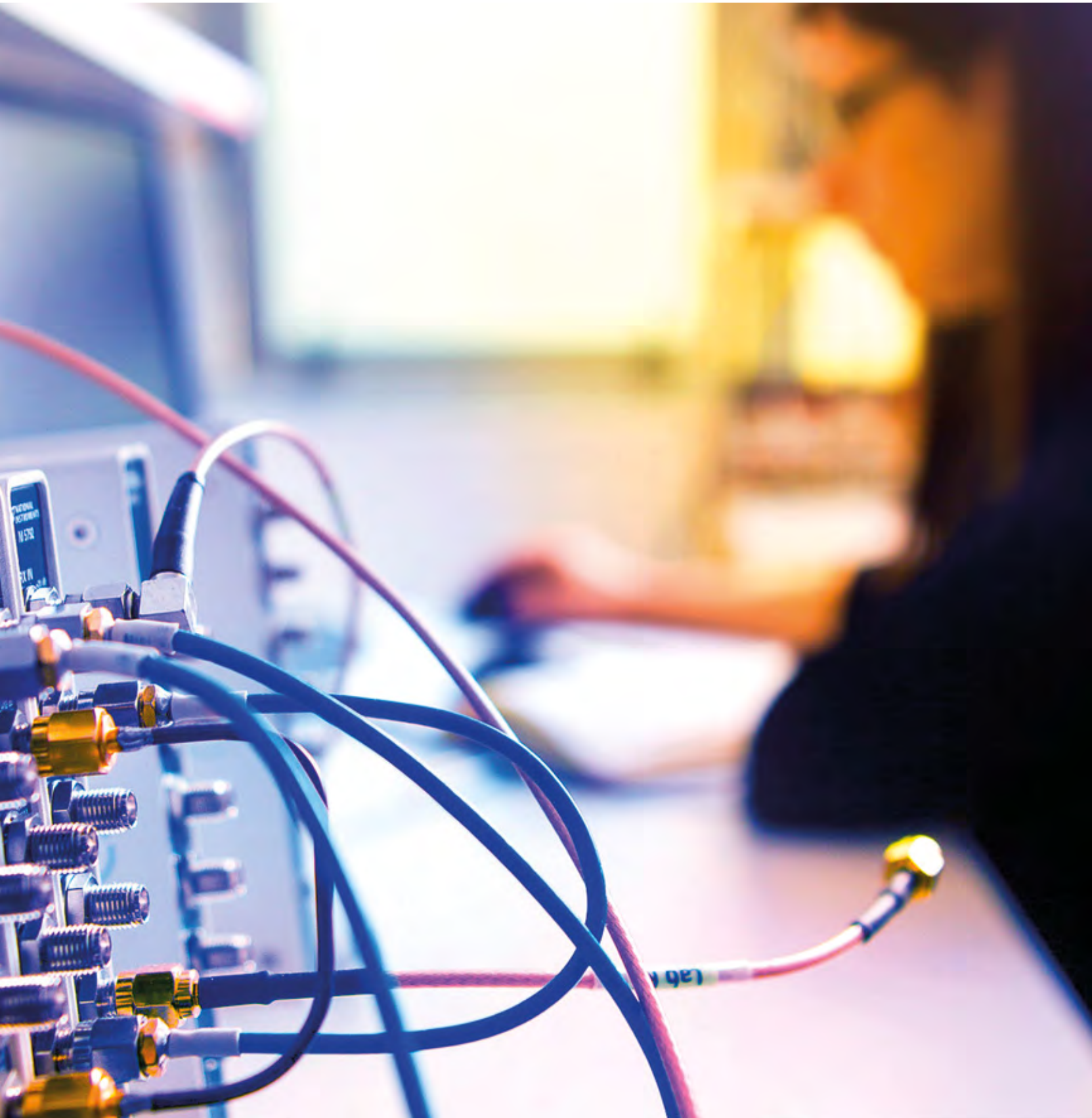
It is also my belief that world-class research is crucial to the sustainability of research-led institutions, so researchers should be able make use of their results, envision novel patents and the creation of research spin-offs, following the trend of a 21st century university. It is hoped in 2015 that UA maximizes the impact of competitive funding by combining European, national and regional funds within strategic research fields, fulfilling Europe 2020 objectives.

I hope that Research@UA 2014 may contribute to disseminate the research developed at our campus and bring about future collaborations.


3


RESEARCH
UNIVERSE

Interdisciplinary research centres and facilities



The University of Aveiro (UA) is a highly regarded institution of research led education, constituted by departments, research centres, polytechnic schools, interface units and a vocational education network. Its integrated structure permits the articulation and harmonization of the teaching and research environments, as well as the association with innovative science outreach activities.

Excellence in research is one of the hallmarks of the University, where the pursuit of diverse scientific topics of an interdisciplinary nature promotes a closer integration and collaboration of the different disciplines and scientific areas, such as Engineering, the Natural Sciences, the Arts and Humanities, Business and Economics, Life Sciences and Medicine, among others.

Dealing with pioneering emerging research areas of global and societal relevance enhances the need of a truly integrated interdisciplinary research-oriented strategy, not only at local, but also at national level. To this matter, FCT organises regular reviews of national R&D institutions, following the most rigorous international standards, with the final aim of gauging the quality of the activity conducted in the Portuguese research bodies.

Results from the strategic review of national R&D Units launched by FCT in 2013 were revealed in 2014, with very positive results to the University of Aveiro. This review was based on periodic assessments by an international panel of experts, based on the R&D institutions' activity reports and proposed strategic plans as well as on direct contacts with researchers and institutions, through site visits and/or interviews by the reviewers.

Within the review, all R&D institutions had to rethink strategies and elaborate on future actions and trends in the respective research area or field. This action led to some changes in the research universe at UA and, eventually, to the creation of iBiMED and RISCO, two new research centres at the campus, in the field of biomedicine and civil engineering, respectively.

iBiMED, the Aveiro Institute for Research in Biomedicine, is organized as a multidisciplinary research team, involving biologists, biochemists, chemists, physicists, mathematicians and clinicians and is fully equipped to carry out research in biomedical sciences. It is housed in the new building of the Health Sciences Department and has modern and sophisticated research laboratories, including state of the art Genomics, Proteomics, Metabolomics, confocal microscopy, computing, NMR and animal cell culture facilities. A new biobank and animal house will become fully available in the Summer 2015. iBiMED is organized for tackling biomedical questions from basic computational and molecular levels to clinical studies and to translate knowledge into clinical application.

RISCO, the Aveiro research centre of RIsks and Sustainability in COnstruction aims at gathering researchers whose scientific and technological work is focused on subjects related to the study and evaluation of risks and sustainability in construction, including built heritage conservation and restoration. Centred in the Civil Engineering domain, it can also comprise researchers from frontier areas such as mechanical, materials or environmental engineering as well as architecture, promoting again interdisciplinarity to achieve excellence of scientific production and technology transfer, in the fields of Risks in the Built Environment; Construction Sustainability and Built Heritage Conservation and Restoration.

High-level researchers, postdoc and PhD students, from a wide range of disciplines and scientific areas, populate our campus. The existence of 19 research centres, from which 7 are poles, sharing infrastructures and know-how at the campus and country, fortifies this vision and confirms the interdisciplinary and collaborative strategy. This reality of such a multidisciplinary research empowers academic, public and private sector organizations together in a mutually beneficial collaborative environment.

RESEARCH CENTRES AT THE CAMPUS:

CESAM – Centre for Environmental and Marine Studies
Research areas: Atmospheric Processes and Modelling, Environment Processes and Pollutants, Functional Biodiversity, Ecotoxicology, Stress Biology, Adaptation Biology and Ecological Processes, Marine and Estuarine Ecology, Oceanography and Marine Geology, Coastal Zone Planning and Management

Unit coordinator: Casimiro Pio

http://www.cesam.ua.pt/

CIC.DIGITAL – Center for Research in Communication, Information and Digital Culture
Research areas: Media and Technology, Society, Culture and Arts, Information and Communication

Pole coordinator: Lídia Silva

http://www.cicdigital.org/

CICECO – Aveiro Institute of Materials
Research areas: Inorganic Functional Nanomaterials and Organic-Inorganic Hybrids, Multifunctional Ferroic Ceramics and Nanostructures, Materials for Energy and Functional Surfaces, Biorefineries, Biobased Materials and Recycling and Biomedical and Biomimetic Materials

Unit coordinator: João Rocha

http://www.ciceco.ua.pt/

CIDMA – Center for Research and Development in Mathematics and Applications
Research areas: Algebra and Geometry, Complex and Hypercomplex Analysis, Functional Analysis and Applications, Gravitational Geometry and Dynamics, History of Mathematics, Optimization, Graph Theory and Combinatorics, Probability and Statistics, and Systems and Control

Unit coordinator: Luís Castro

http://cidma.mat.ua.pt/ma/home.php

CIDTFF – Research Centre for Didatics and Technology in Teacher Education
Research areas: Education, Didatics, Supervision, Evaluation, Society and Training

Unit coordinator: Nilza Costa

https://www.ua.pt/cidtff/

CLLC – Centre for Languages, Literatures and Cultures
Research areas: Literary and Cultural Studies (Poetics of Mobility in Literature and Culture; Cultural Flows and Literary Mediations); Language Sciences (Linguistic Variation; Translation and Terminology)

Unit coordinator: Otília Martins

https://www.ua.pt/cllc/

CINTESIS – Center for Health technology and Services Research
Research areas: Clinical & Health Services Research, Ageing & Neurosciences Research, Diagnosis, Disease & Therapeutics Research and Data & Methods Research

Pole coordinator: Carlos Silva

http://www.cintesis.eu/

CIPES – Center for Research in Higher Education Policies
Research areas: Higher Education, System Level Policies, Institutional and Organisational Analysis and Resources, Performance and Human Capital

Pole coordinator: Rui Santiago

http://www.ua.pt/cipes/

GEOBIOTEC – GeoBioSciences, GeoTechnologies and GeoEngineering
Research areas: Lithospheric Evolution, Complex Environmental Systems, Georessources, Geotechnics and Geomaterials

Unit coordinator: Fernando Rocha

http://www.ua.pt/geo/PageText.aspx?id=17534

GOVCOPP – Governance, Competitiveness and Public Policies
Research areas: Public Policies, Competitiveness, Local and Regional Innovation Systems, Territory, Development and Tourism

Unit coordinator: Eduardo Castro

http://www.ua.pt/govcopp/

IBIMED – Institute of Biomedicine
Research areas: Human ageing, protein aggregation, epigenome, ageing related diseases, systems biomedicine, clinical studies

Unit coordinator: Manuel Santos

http://www.ua.pt/ibimed/

Research Institute for Design, Media and Culture [ID+]
Research areas: Design, Art, Media and Culture

Pole coordinator: Vasco Branco

http://www.idmais.org/pt-pt/

IEETA – Institute of Electronics and Informatics Engineering of Aveiro
Research area: Information Processing, Information Systems, Biomedical Informatics, Biomedical Tecnologies, Intelligent Robotics, Intelligent Systems

Unit coordinator: Armando Pinho

www.ieeta.pt/

INET-Md – Institute of Ethnomusicology - Research Centre on Music and Dance
Research areas: Ethnomusicology and Popular Music Studies, Historical and Cultural Studies in Music, Dance Studies, Creation, Theory and Music Technologies, Performance Studies and performance as Artistic Research, Education and Music in Community

Pole coordinator: Susana Sardo

http://www.fcsh.unl.pt/inet/

I3N – FSCOSD – Institute for Nanostructures, Nanomodelling and Nanofabrication – Physics of Semicondutors, Optoelectronics and Disordered Systems
Research areas: Modelling of materials behaviour, Nanofabrication and micro-technologies, Nano and microstructured polymer-based systems and Physical characterization of self-assembled nanostructures

Pole coordinator: Armando Neves

http://www.i3n.org/

IT – Telecommunications Institute
Research areas: Wireless Communications, Optical Communications, Networks and Multimedia and Basic Sciences and Enabling Technologies

Pole coordinator: José Neves

http://www.it.pt/

QOPNA – Organic Chemistry, Natural Products and Agro-food Stuffs
Research areas: Organic Chemistry, Natural Products, Food Science /Biochemistry and Mass Spectometry

Unit coordinator: José Cavaleiro

https://www.ua.pt/qopna/

RISCO – Aveiro Research Centre of Risks and Sustainability in Construction
Research areas: Risks in the Built Environment, Construction Sustainability, Built Heritage Conservation and Restoration

Unit coordinator: Paulo Vila Real

http://www.ua.pt/risco/

TEMA – Centre for Mechanical Technology and Automation
Research areas: Advanced Mechanical Engineering and Fracture Mechanics, Applied Energy, Biomechanics, Nanoengineering, Transportation Technology and Simulation Software Research and Development

Unit coordinator: António Bastos

https://www.ua.pt/tema/

Chair Ilídio Pinho – Neurosciences

Research in the health sciences domain is, these days, one of the most transversal activities at the University of Aveiro, having the contribution of several departments, schools and research units that translates itself in knowledge creation and technology transfer from the university to the society. In line with this and as a strategic approach in order to further promote health sciences research, iBiMED, a new multidisciplinary and interdepartmental research unit that brings together biologists, biochemists, physicists, mathematicians and medical doctors was created in 2014. But the bet on health sciences research started years before, in 2012, with the signature of a protocol between UA and the Foundation Ilídio Pinho aiming to fund neuroscience research at UA. This financial support resulted in the launch of a new chair – chair Ilídio Pinho – Neurosciences.

The chair was officially presented to the community during the 41st University anniversary ceremony, which took place on December 15th 2014. The ceremony counted with the presence of Philippe Pierre, immunologist, currently director of research at the Centre Nationale de la Recherche Scientifique (CNRS) – Centre d'Immunologie de Marseille-Luminy and the main holder of the chair. The chair will also count with the contribution of Evelina Gatti, research coordinator in the same institution.

In Marseille, these scientists coordinate a team of 15 scientists, which is focused on the dendritic cell biology particularly in the alterations that occur in the activation of these cells of the immune system by pathogenic organisms.

Philippe Pierre concluded is PhD in 1994, at EMBL, Heidelberg (Ger) and Université de Genevé (CH). He then moved to Yale University School of Medicine (USA) where he did his post-doctoral studies and stayed as associate research scientist until 2000, when joined Centre d'Immunologie de Marseille-Luminy as group leader, where later he become director. During his career, Pierre has published more than 60 papers in international high impact peer reviewed journals, such as Nature, Cell, Nature Methods, Immunity, Journal of Cell Biology, PNAS, EMBO Journal and Plos Pathogens, some of which as joint publications with Manuel Santos – director of SACS and iBiMED - team, as result of more than 10 years of collaboration. He developed an innovative technology (SUnSET) a nonradioactive method to monitor protein synthesis. He was awarded with a prize from the Fondation Schlumberger pour l'Éducation et la Recherche (2000) and also with the EMBO Young Investigator Award (2003).

Evelina Gatti concluded her PhD in Biology and Biotechnology at Università degli Studi di Milano. She did her post-doctoral training at Yale University and in 2000 she co-founded the Dendritic Cell Biology Lab, at Centre d'Immunologie de Marseille-Luminy, together with Pierre. She as over 45 publications in international peer high impact journals, related to the molecular mechanisms regulating antigen processing and presentation in human and murine antigen presenting cells and the role of ubiquitination in the cell biology of dendritic cells as well as of non-professional antigen presenting cells.

In the frame of the neurosciences chair, these experts intend to expand their research interests, relating it to the subjects that are studied by the iBiMED team, namely the relationship of the biochemical stress response mechanisms that are activated during cellular decay (e.g. during ageing) and the induction of innate immunological responses. Furthermore, this will provide a strong input in what UA internationalization is concerned and will strengthen the French-Portuguese alliance, in articulation between CNRS and the Université of Aix-Marseille.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SPOTLIGHT ON RESEARCH DISSEMINATION

Research Day 2014

The University of Aveiro (UA) undertakes world-leading science and engineering research and teaching, which allows us to sustain and develop the skills needed to underpin world changing developments. The aim of the Research Day is to offer an opportunity to learn about this research performed at UA, celebrating its achievements, promoting collaboration and reinforcing the interdisciplinarity among researchers and departments.

Last year's edition was held in June 03 and was attended by more than 700 researchers, mostly postgrad students, researchers and professors. 12 in-house lectures and 204 posters revealed the high-quality research that is performed at our campus, in the fields of Arts & Humanities, Sciences and Engineering.

Since the first edition in 2011, the presence of invited keynote speakers contributed to the quality of the program. Núria Gales, Professor at the University Pompeu Fabra, Barcelona, Spain and Vice-President of the ERC, enlightened attendees about the European Research Council basics and detailed about the ERC Funding Schemes and how it fits under Horizon 2020 structure. Jürgen Rödel, Vice-President of Research at the Technische Universität Darmstadt, introduced the profile of TU Darmstadt as one of the leading German universities of technology with high international visibility. Its main focus is on engineering and technology is at the heart of all its disciplines: natural sciences, social sciences and engineering.

The perspectives of the 2014 invited speakers have, indeed, enriched the program and contributed greatly to this stimulating research day. It celebrated the research performed by its community, but also enabled to capitalize the collaborative research panorama among the departments and research centres at the campus.

Researchers of the Month 2014

MILTON RODRIGUES DOS SANTOS
Health School
mrs@ua.pt

1. What are your personal perspectives as a researcher?

The ultimate goal of my research is to contribute to the health care continuous improvement namely through the appropriate use of medical imaging resources. This includes DICOM data mining, secondary use of radiology data and radiology continuous quality improvement in terms of focus on the patients, radiation protection and processes optimization.

2. In your opinion, what are the biggest challenges in your area of research?

The biggest challenge is the development of translational and clinical research supported in partnerships between the scientific community and the health care providers. This requires trust relationships and political willing to translate the knowledge and expertise added value of research units such as the Institute of Electronics and Telematics Engineering of Aveiro (IEETA). This can promote opportunities and synergies to improve health care delivery.

On the other hand, it seems necessary to establish a strategy for medical imaging at University of Aveiro (UA), where the M.Sc. in Medical Imaging could be the cornerstone. For that is important to promote and activate partnerships such as the one that existed in the past with Siemens Medical Solutions, which was fundamental for the prestige of the Health Sciences School of the University of Aveiro. By doing this, the University of Aveiro could aspire to be recognized for its excellence in medical imaging. International recognition will be therefore more attainable both in research and teaching at post-graduate levels.

3. Where are the strengths of the UA in your opinion?

One of the main strengths of UA is its organizational matrix, were, in the case of Medical Imaging, promotes the skills integration from different areas of expertise, which can have a huge potential.

4. Could you give one idea to improve research in the UA?

As someone who has worked most of his life in a hospital environment, I think that is necessary to create stronger links with the community in which University of Aveiro operates (UA should go out more often), namely through the assertive dissemination of the existing resources in the clinical research arena.

CARLOS FERNANDES DA SILVA
Department of Education
csilva@ua.pt

1. What are your personal perspectives as a researcher?

My first commitment as a researcher of the University of Aveiro (UA), and as a member of the Department of Education (scientific area of Psychology), is to improve the Behavioral Sciences in a lab and field experimental perspective. In the last two decades, Psychology at the University of Aveiro has been widely recognized both at the national and international levels, with experimental psychology as the tenet of the work developed both in basic and applied psychology domains.

From the standpoint of the philosophy of knowledge, "subjectivity" relates to the properties of a subject who knows. On the contrary, "objectivity" relates to the properties of an object of knowledge. In the field of subjectivity there are individual differences, while in the field of objectivity there is an intersubjective agreement. However, when there is intersubjective agreement about a property of a subject (e.g., a preference), this property (subjective) becomes objective. Therefore, psychology can be a science in its own right since researchers are conceptually and methodologically rigorous (precise concepts, universal terms, validated measurements, experimental paradigms, and adequate mathematical analysis). Psychology has to be clearly distinguished from common sense and, therefore, must be empirically validated (evidence based psychological practice). On the other hand, psychological phenomena (e.g., consciousness) have an epistemological and ontological status that is distinguishable (but not separates) from the physical, chemical, biological and social phenomena.

So, as researcher in this area, I think that it is vital to perform robust behavioral experiments in the real world and in the laboratories (e.g., cognitive and affective neuroscience, biofeedback, and so on), to build mathematical models and theories (not only statistical models), to run randomized clinical trials, follow-up studies, and to test hypotheses about the relationships between psychological phenomena and social and biological (not only neuroscience) phenomena – social psychology and psychobiology. My conviction is that we should not restrict our research and practice to applied settings. The investigation of basic psychological phenomena is critical to the extent that there is not a good practice without a solid theory.

To ensure that psychology is a science in its own right and useful to the mankind, we have to supervise research projects (including PhD theses), we have to strive for competitively funded projects, we have to publish our studies in scientific journals with blind peer review and international metrics (impact factors, number of citations, H-index, etc.), preferably in a teamwork context and framed in a research center evaluated by independent international panels (...)

2. In your opinion, what are the biggest challenges in your area of research?

From the perspective of the entities that fund scientific research, as well as the Portuguese Agency for Evaluation and Accreditation of Higher Education (A3ES), Psychology is a social science and with little relevance, compared to the exact, life, health sciences, and engineering.

Thus, under the current economic situation of the country, with increasing budget cuts, the sustainability of psychology at UA (teaching and research) is at risk. However, the problem may be overcome if the UA explores its matrix structure. The scientific production of the psychology group of UA has been increasing, as well as the capture of funded projects.

3. Where are the strengths of the UA in your opinion?

The main strength of the University of Aveiro is its matrix structure, which enables an efficient management of resources and a rapid resolution of the problems of all kinds. Furthermore, UA is a new University and the structure of the campus facilitates communication between teachers and non-teaching employees, as well as students and visitors.

4. Could you give one idea to improve research in the UA?

The departments of the University of Aveiro should collaborate more to jointly organize meetings with internal referees (monthly?), where researchers of different areas present their projects and results. The UA could also have a proof-reading to help researchers to publish their papers and to submit research proposals. Many universities nowadays have this type of service, considering the current context in which internationalization is increasing.

JOÃO PAULO DAVIM
Department of Mechanical Engineering
pdavim@ua.pt

1. What are your personal perspectives as a researcher?

Do better research and the industry field. Continue and reinforce the ability not only to produce, but also, and with a special emphasis, to transfer the obtained knowledge to other generations of researchers and practitioners.

2. In your opinion, what are the biggest challenges in your area of research?

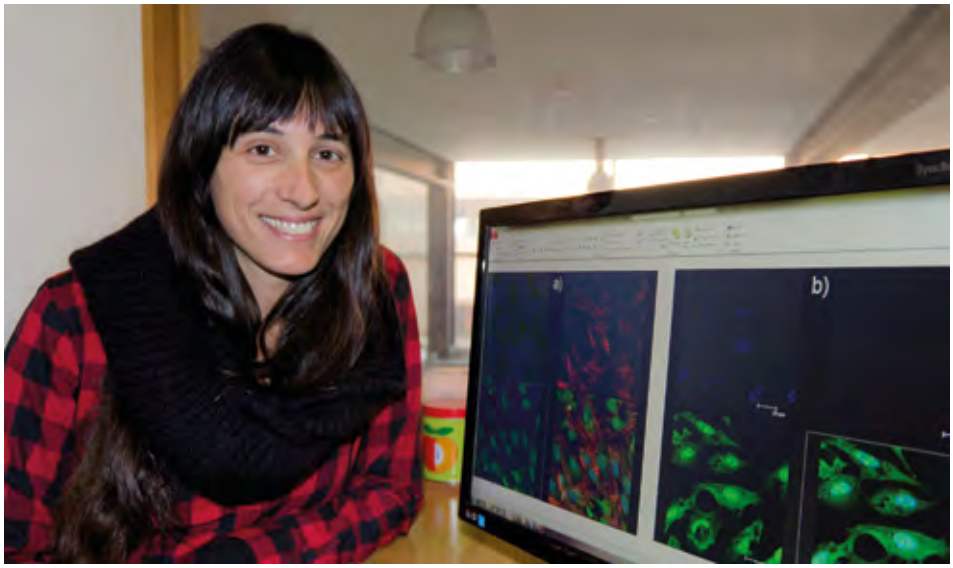
The re-industrialization of Europe and Portugal is at the present political agenda due to its crucial importance to the economic development. Manufacturing has a huge importance in the re-industrialization process, given its applicability in the production of components to the automotive, aeronautics and aerospace industry as well as other advanced industries. As a consequence, the development of modern manufacturing needs to incorporate more and deeper scientific knowledge through the findings of a deep laboratory experiment, related with modeling, simulation and optimization, using complex and sophisticated computational and statistical methods. It is a great challenge to achieve lean manufacturing. The development and implementation of methods and sustainable manufacturing technologies (taking into account environmental, economic and social issues) also constitute a major challenge to this research area.

3. Where are the strengths of the UA in your opinion?

The university dynamics, the quality and scientific and professional abilities of its human resources, its innovative campus as well as the strategic location of Aveiro city (with excellent communication and transport infrastructures between the North and South of Portugal), are strengths of UA. The good position of UA in the major international "rankings" is another relevant and very positive issue with a great importance for all those who are seeking to the university as a place where they can develop their studies and research.

4. Could you give one idea to improve research in the UA?

Valuing researchers and research results in an objective way, is crucial to maintain the motivation and improve performance of all those that are involved and committed in the research area.



MERCEDES VILA JUÁREZ
Department of Mechanical Engineering
mvila@ua.pt

1. What are your personal perspectives as a researcher?

Throughout my scientific career, I have sought to successfully join interdisciplinary knowledge, from physics to biology, by actively pursuing complementary formation, including 10 years of mobility experience in different European laboratories in order to work with high level biomedicine and materials experts to acquire new and mandatory knowledge for my scientific aims (...) Following this strategy, my current priorities as a researcher, are to make use of this acquired knowledge to establish a multidisciplinary team favoring national and international synergies, while initiating collaboration among expert groups in Europe through membership of excellence networks in bioengineering. Such activities will, ultimately, strengthen the individual position and generate professional stability. The research team I am building up will promote cooperation and will boost European Science and technology in an emergent state-of-the art area such as Nanomedicine.

2. In your opinion, what are the biggest challenges in your area of research?

The application of engineered nanomaterials in research, development, and commercial products is widespread and has been growing rapidly. Nevertheless, there is currently no information or legislationt, regarding the safety and toxicity requirements for nanoparticles. Every nanosystem has different features concerning size, shape and surface properties, and needs to be investigated for achieving an optimized prototype that could be used in therapies without human body accumulation risks or any environmental impact.

Moreover, the application of these nanosystems for fighting against cancer is a potential future strategy to revolution the therapies that we accept as common, but which are mostly inefficient and carry more adverse effects than beneficial. Therefore, the design and understanding of how these nanosystems could be used in an innovative manner to control human tumoral processes, is one of the main keys to create new efficient therapies. Nevertheless, we cannot forget that although academic institutions, governments, and industrial facilities are expending significant resources in the pursuit of nanomaterial technologies to be applied in Medicine, there is still a limitation concerning the number of new products that are successfully introduced into the marketplace. So academic-industry links must be created and strengthened in order to successfully transfer the knowledge from universities to real applications.

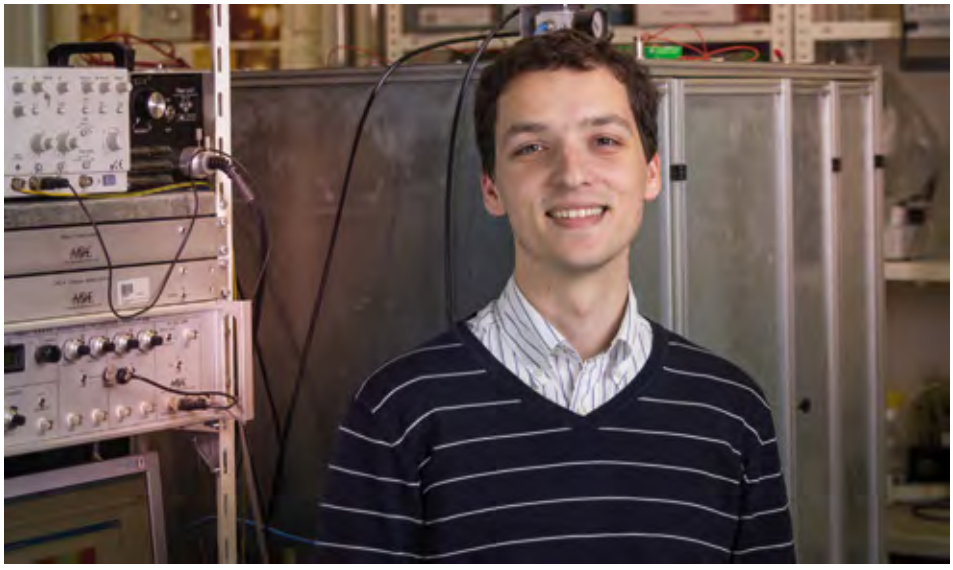
3. Where are the strengths of the UA in your opinion?

That is question I have been asked several times when I decided to move back here for creating a new research team and a new laboratory. The University of Aveiro has always supported me from the very beginning of my scientific career and I have always found here, a young and innovative environment that supports young researchers to develop their talents. The University of Aveiro offers a highly internationally oriented and interdisciplinary platform that facilitates multidisciplinary science. Moreover, it is a very active University in terms of scientific dissemination, so creating internal collaborations is highly accessible. The entire university infrastructure, scientific and administrative, that surrounds and supports us as researchers, is perfect for helping us to develop science.

4. Could you give one idea to improve research in the UA?

One of the most important ways of supporting science is taking care of the scientific researchers (...) Frequently, researchers that have invested huge efforts in creating new research lines and supporting them during many years end up leaving because of their precarious future without permanent or long-term contracts. This fact is a serious issue and it is stopping the faster and continued development of science.

Moreover, now that we are confronting an economic crisis which directly affects us and our opportunity of getting funding for performing our research, we have to, more than ever, get conscious that money should be attracted from European funding. The University of Aveiro is doing a good effort on spreading information, and is helping us in all administrative matters very efficiently. But we are competing with European universities that have specific professional offices for assisting researchers in writing projects and analyzing future failures. As a suggestion, the UA should create a strong European office with scientific qualified personnel able to assist all researchers interested in writing projects, without having to depend on the FCT contact points which have to assist all Portugal.



JOÃO TEDIM
Department of Materials and Ceramic Engineering
joao.tedim@ua.pt

1. What are your personal perspectives as a researcher?

As a researcher working on the Surface Engineering and Corrosion Protection group, SECOP (CICECO-DEMaC) one of my main goals is to continue well-established activities in the field of smart coatings for high performance applications, a field of high interest among materials scientists as well as industry, for which I have been contributing in recent years as a researcher of UA. Currently, our group is internationally recognized by the work in self-healing coatings for corrosion protection, as well as impact-and corrosion-sensitive coatings for vehicle applications. Furthermore, the development of nanostructured materials for controlled release of active substances is a topic transversal to different areas of science and engineering. As a result, I am leading activities in collaborative projects (FP7, QREN) within fields that go from sensors for food packaging to development of multifunctional paper. Personally, my aim is to strengthen networking with groups, nationally and internationally, through participation in several H2020 and industrial-based projects so that these recent R&D activities find a sustainable growth in the forthcoming years. Together with "materials-based" objectives I find of the utmost importance that design of new materials takes into account the use sustainable resources, and at the same time the toxicity of generated nanomaterials when released in the environment is investigated. This integrative vision is already being applied in our activities in collaboration with other groups from UA as well as in the frame of international partnerships. Within our group, one of my goals is to assist the formation of highly motivated MSc, PhD and Post-Doc researchers to work in this challenging area, retaining enough critical mass to keep high-level research in the group. Ultimately, this generated knowledge will be accessible to students that would like to take a post-graduate degree in our university.

2. In your opinion, what are the biggest challenges in your area of research?

In the field of smart coatings for protective applications the main challenge is to be able to adapt lab-designed systems for industrial testing and validation. There are hundreds of works reporting remarkable responses under controlled conditions but in the majority of cases serious validation cannot be done because several points are not considered, namely:

- lack of integrated vision on the conditions that a coating must withstand under service life;
- correlation between (lab) electrochemical testing and accelerated standard tests;
- feasibility of the upscaling of promising nanomaterials;
- compatibility between new functional nanoadditives and conventional coating technologies;

3. Where are the strengths of the UA in your opinion?

UA combines high level scientific staff with young and motivated researchers. These are, in my opinion, the main ingredients to achieve a balanced and sustainable growth of the institution on its main objectives: education and research.

4. Could you give one idea to improve research in the UA?

Researchers and professors are quite often overloaded with financial and administrative issues, in addition to their scientific and academic responsibilities. One simple suggestion is to consider hours of managerial/administrative staff in the budget of projects. That would allow the hiring of people to closely monitor a set of projects, in order to increase the level of support to researchers and facilitate the role of administrative personnel in the central services. In some cases this could maximize the level of project execution (and income), without significantly compromising the budget of the institution.

JOÃO ROCHA
Department of Chemistry
rocha@ua.pt

1. What are your personal perspectives as a researcher?

It is an enormous privilege to do what one likes while being paid for that. This is how I picture my research. I was 7 years old when I saw men walking on the moon. Mesmerized by this event I decided to be a scientist, an unlikely endeavour being in a poor country estranged from Europe. I took a degree in Physics and Chemistry that included a lot of maths, philosophy, psychology and sociology as it was aimed at high-school teachers. This was a blessing because it gave me a room with a very broad view over the World. Eventually, in 1985, I got a position at the Chemistry Department, University of Aveiro, and started giving lab classes and tutorials. Those days, there were no lab facilities to do decent research towards a Ph.D. (in Aveiro or almost anywhere else in the country). This is how, in 1988 by the hand of Prof. Júlio Pedrosa, I turned out in the University of Cambridge (UK) to meet Jacek Klinowski my Ph.D. mentor and life's personal trainer. Nothing would be the same after, for me. Coming down from Cambridge I was committed to show that excellent research might be done even in obscure places. I was successful enough in getting a European project to finance my group and the solid-state NMR spectrometer Aveiro had bought in the frame of CIENCIA programme. In 1994, I co-authored a Nature paper and came out of obscurity. Until 2002 it was just hard work and the sheer pleasure of doing research, day after day, building up my group. But for some reason this did not seem enough to me. I wanted to put Aveiro on the map of Science and for that I needed to gain critical mass. This is when my group and others in Aveiro came together and started a Materials Science and Engineering institute known as CICECO, initially with over two hundred people (now four hundred). We got the special status of 'Associated Laboratory' and could hire researchers, buy equipment and start spinning our wheels. Twelve years have passed and CICECO is now one of the main European institutes of its kind.

In summary, the small step for a man on the moon lead to my personal giant leap of creating CICECO. However, what really excites me is doing research and learning. I used to be a chemist or a physicist but now I do not know anymore what I am as so many other fields attract my attention. This, in the end, is the joy of Science.

2. In your opinion, what are the biggest challenges in your area of research?

Here are some of the challenges of my present research. As I often turn to nature (particularly minerals) to conceive new solids, can I make materials that outperform natural ones, and how? Can understanding of how water clusters form (and their nature) in simple solids provide clues as to how clusters of water molecules influence the reactivity of proteins or enzymes? How do we engineer light-emitting metal centres (lanthanides) in order to obtain efficient materials, for example, for optical communications or for sensing temperature, pH and molecules? How do we engineer nanosystems capable of (simultaneously) working as contrast agents for magnetic resonance, optics and thermal imaging? The structure and dynamics of some very important materials are difficult to characterise because of poor crystallinity, disorder and defects. How do we combine various experimental tools (NMR, diffractions) with computer modelling in order to accomplish that?

3. Where are the strengths of the UA in your opinion?

Very low bureaucracy, swift action, easy flow of information and a pragmatic attitude to solving problems, mixed with a vision for the future, have been the main strengths of UA. These assets are not for ever and we must be vigilant not to kill the chicken and loose to our competitors. Particularly in times of crisis, it is very tempting to find (cold) comfort in the greasy hands of bureaucracy. I am afraid some among us are giving in.

4. Could you give one idea to improve research in the UA?

There is only one way of improving UA's research: hire the best possible people; and because we are not rich, hire the most promising young people around. Give them some seeding money and a lot of freedom to act. Assess their work after a decent period of time (4-5 years) and keep the best. We already do this, to a certain extent, but we are not doing nearly enough and our agenda must be clearer and bolder. This is not easy. What really matters is never easy.

UWE KÄHLER
Department of Mathematics
ukaehler@ua.pt

1. What are your personal perspectives as a researcher?

Like any mathematician I would like to found my own mathematical school, i.e. getting students and fellow researchers to understand and follow my approach to Mathematics. I also would like to find the right balance between „Pure“ and „Applied“ research. This means on one hand creating a method in terms of an abstract theory while on the other hand looking into the practical implementation. Usually, mathematical algorithms have the problem that they are either too theoretical (work only with academic examples) or that they have no theoretical justification (seems to work if one looks at examples, case studies). Getting both sides right, i.e. developing a method which is justified by a mathematical theory and works well in practical cases happens not that often.

2. In your opinion, what are the biggest challenges in your area of research?

There are several. Probably the biggest challenge is the large gap between the increasingly sophisticated methods used by the specialists and the standard methods normal researchers know from their mathematical education. This leads to a lack of communication and dissemination of ideas as well as increasingly hard efforts of young researchers to catch up with the experts.

Apart from that there is the curse of dimensionality (anything being done in 3D and higher requires very high computational costs) and the focus on algebraisation in favor of geometric calculations. This leads to an unhealthy imbalance between the two approaches.

From a pure scientific point of view the biggest challenge looks to me the construction of a function theory over higher non-commutative structures. Nowadays, it is well known how to do it for simple symmetries, like SU(2), but other cases remain difficult. This has connections with many problems, for instance, in extending Hörmander's principal symbol calculus to a full symbol calculus.

3. Where are the strengths of the UA in your opinion?

In the first place we have many young researchers with high motivation. At least in the Department of Mathematics there are no pre-determined areas of Science which allows our researchers to look out for new areas and explore new opportunities. There is a large support from colleagues and administration which allows researchers to pursue top-level research within the constrains of a „small“ university with limited resources. It also has a beautiful campus and a nice ambience which makes it easier to invite top-level researchers for short research stays.

4. Could you give one idea to improve research in the UA?

At the research day one should not only speak about results, but also about problems. Presenting a kind of „collection“ of problems which are currently considered hard problems or problems in „standby“ from each research center could lead to a bigger interaction between researchers from different areas.

ISABEL DUARTE
Department of Mechanical Engineering
isabel.duarte@ua.pt

1. What are your personal perspectives as a researcher?

As a researcher, my main personal perspective is that the results of my research contribute to increase the scientific knowledge that should be used to develop new products designed to make people's lives easier and safer. This way, I always keep in mind that working in the lab must be performed for developing cost-effective solutions to implement a new processing method, or insert a new product (materials/components) in the industry in a short or long term, taking in account questions such as minimizing the scrap/waste and ensuring the worker's safety. Furthermore, the research in a specific field should be carried out in collaboration with multidisciplinary teams, experts in the field or in other research topics from around the world. My career has been conducted following these principles. I started to work as a research fellow in the metal porous and metallic foams field, my main specialisation, in the well-renowned Fraunhofer-Institut in Bremen, guided by the most expert Scientist in this field, Prof. Dr. John Banhart. Together, we started a pioneer research work on laboratory studies about kinetics of the metallic foaming process, achieving my doctoral degree with the thesis entitled "Metallic Foams: Production, Characterisation and Numerical Simulation". Since this pioneer laboratory work, my research has mainly focused on the development of structural components based on Al-alloy foams and their manufacturing methods including the design of efficient equipment and tools for industrialising the process. Some successful cases are the outcome of the collaboration with an industrial Portuguese company (MJAmaral) and international RTD entities (e.g. University of Maribor and Technical University of Berlin). One example of this is an efficient automated continuous production line (7 m x 1.5 m x 1 m) for manufacturing components based on metal foams (...).

2. In your opinion, what are the biggest challenges in your area of research?

My main research field is in the metallic foams, which are light-weight, recyclable, non-inflammable materials having an excellent energy absorption and a good sound absorption used in different industrial sectors (e.g. transport industry and building construction). The development of light metallic foams started in the 90s. Nowadays, a number of processing techniques is available that allow us to produce a variety of metallic foams. Also, there is clearly a commercial and military interest of the companies, funding agencies and research institutes. However, the main reason that such materials are not used in large-scale is due to their high price. The challenge of future process development is not only to improve the foam properties but also to further reduce costs to make them competitive in relation with the alternative products (...) One of the biggest challenges is the development of new processes to join the foams with the other materials promoting a strong chemical bonding during the foam formation to produce structures based on foams with a stable and predictable mechanical performance, as well as to eliminate the additional joining step which is one of the main cost drivers of multi-material-design in the automotive industry. Another challenge is to develop graded foam-filled thin-wall structures aiming towards a better crashworthiness performance.

3. Where are the strengths of the UA in your opinion?

The University of Aveiro has several strengths which is a blend of education, research, scholarship, and professional accomplishment. The main strength of the UA is the people which are energized, dynamic and enthusiastic people comprised by excellent professors, scholars, researchers and professionals. Another strength is the wide offer of courses in areas ranging from music to sciences and engineering, as well as a friendly alumni, a powerful business model which promotes innovation by exploiting the knowledge produced at UA and its transfer to the business sector and/or by supporting the protection of intellectual property and its respective commercial exploitation or by supporting the establishment of technology-based companies. Furthermore, the way that the campus was constructed, concentrating all the department buildings together, allows for easier communication, collaboration and cooperation between all staff. Also, the UA is integrated in a very nice city (Portuguese Venice) located in the centre (middle) of Portugal with very good roads and railway accesses, with one of the most important Portuguese business frames around. The UA offers high-quality graduate programs.

4. Could you give one idea to improve research in the UA?

The improving of the research in the UA is to promote the research career offering more permanent posts instead of short fixed-term research contracts, also ensuring the career progression.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Academia de Verão

"ACADEMIA DE VERÃO" IN AN OPEN CAMPUS LIKE A REAL STUDENT

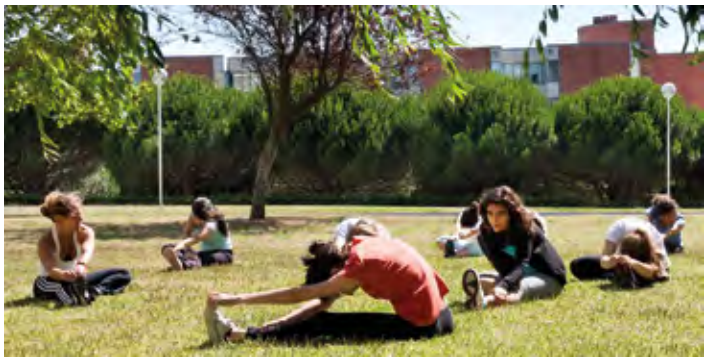
The Summer Academy (Academia de Verão) is the most intense outreach activity for young people promoted by the University of Aveiro. In 2014, 363 young students from all over the country (aged between 10 and 19 years old) participated in this programme. During two weeks of July, the departments and schools organized 24 thematic programmes in different scientific areas, to fulfill the interests and expectations of the young participants.

Either during one or two weeks, the university provided these young participants the opportunity to explore interesting scientific projects, integrate a handful of projects totally organized by the departments that accepted this annual challenge. Some municipalities and companies have sponsored the participation of the best students in the Academy, with a total of 60 scholarships.

Besides the laboratory experiments, the exciting field work and the pleasant field visits outside the Campus, students also had the privilege of being in contact with the real university lifestyle - they were accommodated in the students' residences, had their meals in the campus canteens and performed sports activities in the gymnasium and on the university lanes in the afternoon. Of extreme importance was the close relationship with the university students and researchers that monitored their stay on Campus and coordinated the cultural, sports and lab activities.

Children and young people are welcome to visit the campus and join the scientific and cultural activities, promoted especially for them, throughout the year. In 2014, more than 3000 visitors were in the university campus. In the Science and Technology Open Week, which takes place in November, over 8000 students joined the university students and researchers in 324 activities specially designed for them.

As its motto states, the University of Aveiro is a true "campus with ideas".




5

RESEARCH HIGHLIGHTS

Transboundary Ocean Planning and Governance in the European Atlantic Space: lessons from the TPEA project

Fátima Lopes Alves[1], Maria da Luz Fernandes[1], Catarina Fonseca[1], Ana Isabel Lillebø[2], Lisa Pinto de Sousa[1], Inês Crespo Antunes[1], Cláudia Pimentel[1], Tanya Esteves[1], Amadeu Soares[2], Celeste Coelho[1], Carlos Borrego[1], Kira Gee[3], Stephen Jay[3]

1 — Department of Environment and Planning & CESAM, University of Aveiro
2 — Department of Biology & CESAM, University of Aveiro
3 — University of Liverpool, United Kingdom

Transboundary Planning in the European Atlantic (TPEA) was co-funded by the European Commission (DG Mare), coordinated by University of Liverpool and ran from December 2012 to May 2014. The aim of the project was to demonstrate commonly-agreed approaches to transboundary maritime spatial planning (MSP) in the European Atlantic region. In this context, it explored the opportunities and challenges of carrying out cross-border MSP in Europe's regional seas, making connections with integrated coastal management. TPEA focused on two pilot areas: one involving Portugal and Spain and the other Ireland and the United Kingdom.

Major outputs of the project were:
Good Practice Guide with key lessons and principles emerging from the project. The guide is intended to assist authorities responsible for MSP, agencies and other institutions supporting the implementation of MSP, coastal and marine stakeholders and other parties with an interest in the outcomes of MSP, and the scientific MSP community.

Geoportal web-based viewer designed to facilitate all aspects of data management (e.g. spatial analysis, communication, harmonization and scenario testing). Info is available in a mobile App (fig 1).
Pilot Areas Report with comprehensive details of TPEA approach and presenting the key findings for the pilot areas of the European Atlantic.

The project was conducted during the preparation of EU legislation requiring Member States to conduct MSP (Directive 2014/89/EU). The project experience is intended to assist Member States in fulfilling their responsibilities under EU and national legislation in regard to cooperation with each other on planning and management of adjoining waters and coastal zones. TPEA will demonstrate the potential for cross-border MSP not just as a means of fulfilling regulatory requirements, but as a valuable contribution to MSP efforts with healthy and sustainable use of the seas and oceans.

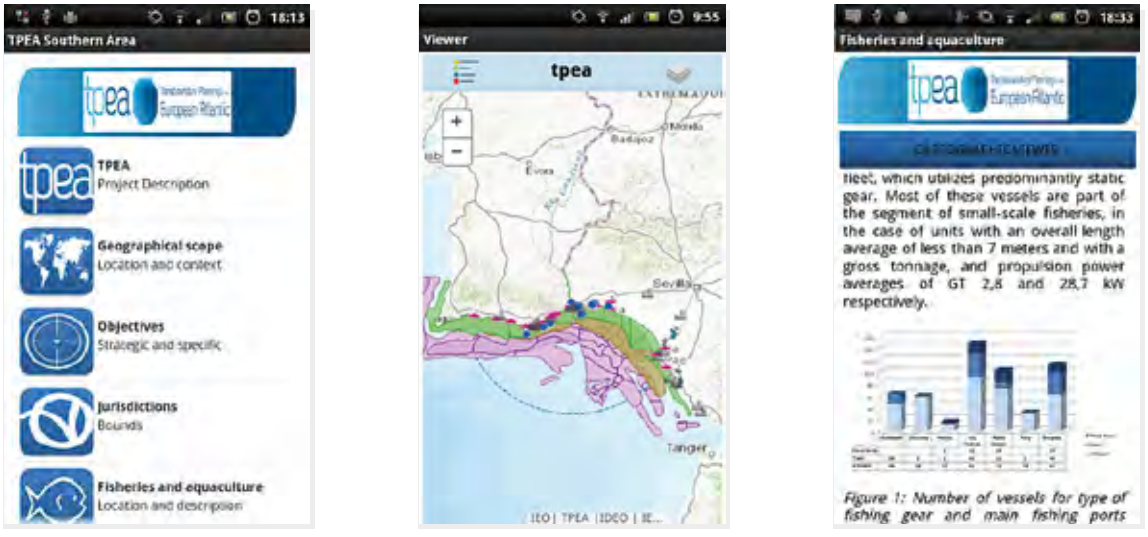


FIGURE 1
TPEA SOUTHERN AREA: Mobile APP, Algarve – Gulf of Cádis.

Integrated System for Managing Fish Farm Effluents

Ricardo Calado[1], Ana I. Lillebø[1*], Bruna Marques[1], Valter Fernandes[1], Pedro Seixas[2], Renata Serradeiro[3]

Recirculating aquaculture systems (RAS) are currently considered one of the paradigms of the Blue Revolution, as they allow to "grow fish anywhere". Enterprises employing RAS to grow marine fish in super intensive production still face several challenges to expand their activity. One of such constraints is the load of organic rich suspended particulate matter (SPM) present in the effluents generated (circa 5-10% of the circulating water). Due to their salt content SPM cannot be readily disposed in the environment, as it is still considered as a dangerous waste. Therefore, their collection and disposal presents an economic burden to enterprises.

The present project (STEP) evaluated for the first time in Portugal the performance of polychaete assisted sand filters (using the ragworm Hediste diversicolor) and constructed wetlands (using the autochthonous halophyte Halimione portulacoides) in the reduction of SPM in the effluent of a super-intensive fish farm using RAS to grow Senegalese sole (Solea senegalensis). After 5 months of operation, a reduction in 55% of SPM was recorded in tanks colonized with ragworms in comparison with non-colonized sand filters. Sand filters initially stocked with 180 large sized ragworms (LSR) per square meter exhibited an average density of 6750 LSR per square meter at the end of the trial, representing an average market value if traded as sports fishing bait of 2250 euros. Concerning the halophyte H. portulacoides, the initial biomass (wet weight) averaging 1.5 Kg per square meter increased 13 fold reaching 19 Kg per square meter at the end of the trial. This increase in halophytes biomass corresponded to a production of 5 Kg (dry weight) per square meter per year, which accounts for a stock of 1.4 Kg of C, 0.09 Kg of N and 0.02 Kg of P uptaken from the fish farm effluent. Overall, the STEP project opened a new window for innovative approaches towards integrated multi-trophic aquaculture.

1 — Department of Biology & CESAM, University of Aveiro
2 — Aqualgae, C/ de la Reina 66, Ático, 04002 - Almeria, España
3 — Aquacria Piscicolas & Sea8, Cova da Junça, Quintas do Sul, Torreira, Portugal

FIGURE 1
Overview of STEP integrated multi-trophic bioremediation system.

Lost fishing gears and litter found at Gorringe Bank: a call for conservation

Rui Pedro Vieira[1], Katherine L.C. Bell[2], Marina R. Cunha[1]

1 — Department of biology & CESAM, University of Aveiro
2 — Ocean Exploration Trust, USA

Evidence of human impact on deep sea confirms the significant threat to its biodiversity that requires urgent action. The most relevant seamounts in the NE Atlantic are within the Portuguese EEZ (and extended continental shelf). These prominent structures, rise from bathyal depths to near surface, and harbour fish stocks with high economic value.

The Gorringe Bank is characterized by an intense maritime traffic from the Mediterranean and Atlantic and threatened by fishing activities. Longlines are commonly used in Portuguese multi-specific fisheries in a wide depth range. The catch composition on Gorringe Bank accounts for a total of 61 fish species and several crustaceans typically associated with rocky outcrops where the risk of losing or damaging the fishing gear is highest. Marine litter was analysed from photo and video imagery obtained during ROV surveys carried out down to 3015 m depth. The high fishing pressure in Gorringe Bank is confirmed by the frequency of lost or discarded fishing gear (cables, longlines and nets), whose effects are direct and immediate (e.g. damaging corals, by-catch), persist over time (e.g. ghost-fishing), but have poorly known long-term impacts.

Data provided by the Portuguese Directorate of Marine Resources (DGRM) showed an intense longline fishery activity in recent years in the Gorringe area, which almost stopped with the economic downturn in 2012. Due to the high value of the fisheries at these seamounts one can expect that, in the absence of further protective legislation, the economic improvement will resume the fishing pressure and subsequent habitat degradation on Gorringe Bank.

Large rocky outcrops on Gorringe Bank support vulnerable marine ecosystems (VMEs) such as coral gardens and sponge aggregations at bathyal depths and coralligenous algae and kelp beds at the summit.

Protection of these seamounts is expected to maintain healthy ecosystems, contributing to fisheries productivity in the region. Under this scope, our work is a powerful tool to support VMEs conservation actions in Gorringe Bank.

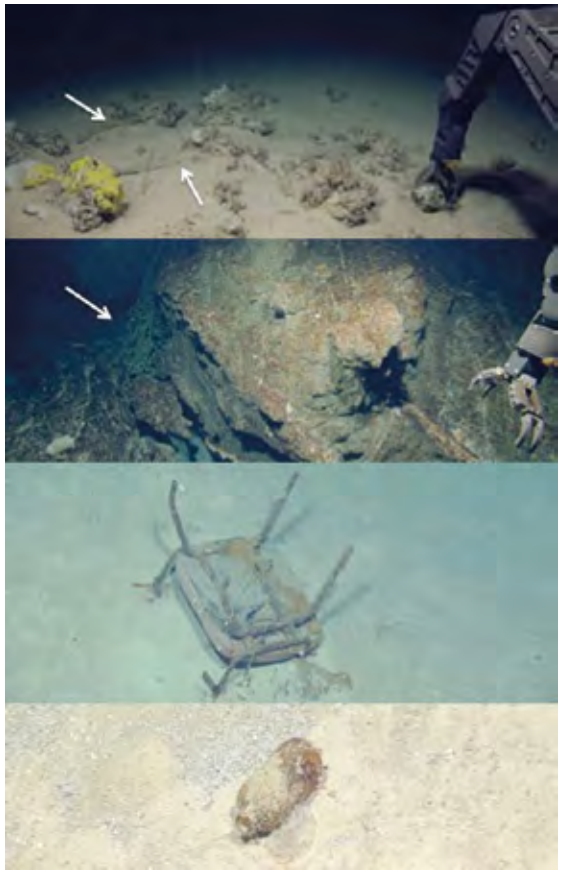


FIGURE 1
Examples of lost fishing gears found in the Gorringe Bank.

FIGURE 2
Deep-sea fauna observed during the ROV dives.

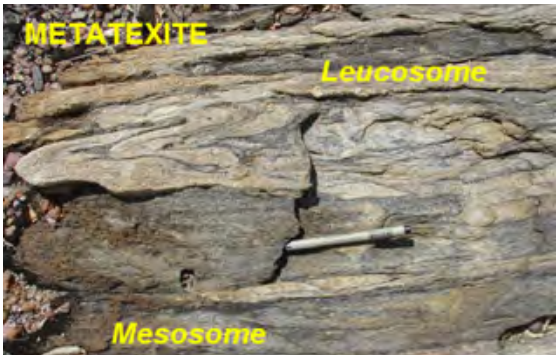
Evidence of crustal melting: insights from the Banabuiú gneiss-migmatitic complex (Central Ceará, Brasil)

F. Martins[1], M.R. Azevedo[1], B. Valle Aguado[1]

Migmatites are highly heterogeneous partially molten crustal rocks, typically found in continental terranes where the roots of ancient mountain belts (orogens) are exposed. In the deep parts of orogenic belts formed in response to plate convergence, the metamorphic conditions (P and T) may be high enough to melt the crust and generate migmatites. At low degrees of partial melting, melt-residuum separation produces metatexite migmatites, characterized by a conspicuous, centimeter-to decimeter-scale, compositional layering. The melted portion is light coloured (leucosome) and may constitute patches, layers and/or veins within the darker unmelted material (mesosome). As the temperature rises and melting becomes more extensive, the physical nature of the partially molten rock changes from solid-dominated to melt-dominated, magma flow occurs and pre-migmatization structures are destroyed leading to the formation of diatexite migmatites. Diatexite migmatites have a granitic appearance and enclose, in some cases, disrupted fragments of the host rock.

The Banabuiú region, located in Central Ceará (Brasil), represents a segment of the Brasiliano /Pan-African orogen, a deeply eroded mountain belt formed during the Late Neoproterozoic amalgamation of the West Gondwana supercontinent (ca. 600 million years ago) through the collision of the Congo-São Francisco and São Luís-West African cratons.

Spectacular outcrops of metatexites and diatexites occur in the area providing a unique opportunity to study the relationships between deformation, metamorphism and crustal melting processes. Field, structural, petrographic and geochemical evidence show that the large amounts of melts hosted in these terrains were produced at mid-crustal levels by partial melting of fertile metasediments, over a temperature range of 700-800°C, at the peak of Brasiliano contractional deformation and high-grade metamorphism. Migration and multiple injection of melts into the present exposure level was a deformation-assisted process, linked to the development of a structurally controlled network of conduits in the last stages of the Brasiliano /Pan-African Orogeny.



1 — Department of Geosciences & GEOBIOTEC, University of Aveiro

FIGURE 1
Assembly of the West Gondwana supercontinent at c.a. 600 Ma.

FIGURE 2
Metatexite showing veins of leucosome (melted fraction) within unmelted material (mesosome).

FIGURE3
Diatexite migmatite produced by high degrees of partial melting, enclosing disrupted fragments of the host rock.

Occupational and environmental exposure to manganese and the occurrence of Manganism and Parkinson's diseases in manganese mining areas (South Portugal)

MMS Cabral Pinto[1, 2], EA Ferreira da Silva[1], PIS Moreira[2], MMVG Silva[3]

1 — Department of Geosciences & GeoBioTec, University of Aveiro
2 — CNC Centre—Centre for Neuroscience and Cell Biology, College of Medicine, University of Coimbra
3 — Department of Earth Sciences, University of Coimbra

Occupational and environmental exposure and inhalation to Mn has been suggested as a possible cause of neurodegenerative disorders. The inhalation and ingestion of Mn affects the central nervous system of rats, primates and humans. Various cases have been reported of pathological neurologies, and even deaths, induced by chronic consumption of waters containing moderate to high levels of Mn. Manganese is essential to the regular functioning of the immune system and regulates sugar levels in the blood and cellular energy. However, when present in excessive quantities it becomes toxic, giving rise to the development of neurodegenerative diseases such as manganism. Manganese exposure can also play an important role in causing Parkinsonian disturbances, possibly by potentiating ageing of the brain, which in conjunction with genetic predisposition may lead to a sub-threshold neurodegeneration in the basal ganglia in more susceptible populations generating a pre-Parkinsonian condition. Since Mn elimination from the central nervous system requires a long time, neurotoxic effects may occur later in life, increasing the frequency of Parkinsonian disturbances in elderly individuals. In Baixo Alentejo region there are several abandoned Mn mines (Fig. 1), related with the Fe-Cu-Zn-Pb massive sulphydes deposits and close to the mines there are abandoned tailings deposits, freely exposed to weathering. This study presents the preliminary results of the neuropsychological assessment of inhabitants of Baixo Alentejo Mn mines areas and analyze the statistical significant differences with the control participants at level of the global cognitive status and the cognitive domains such as memory, executive functions, visuospatial skills, language, orientation and attention. The neuropsychological assessment of a pre-selected population in the studied areas is being investigated and compared to the chemical contents of select metals on human biological samples of urine, hair and nails.

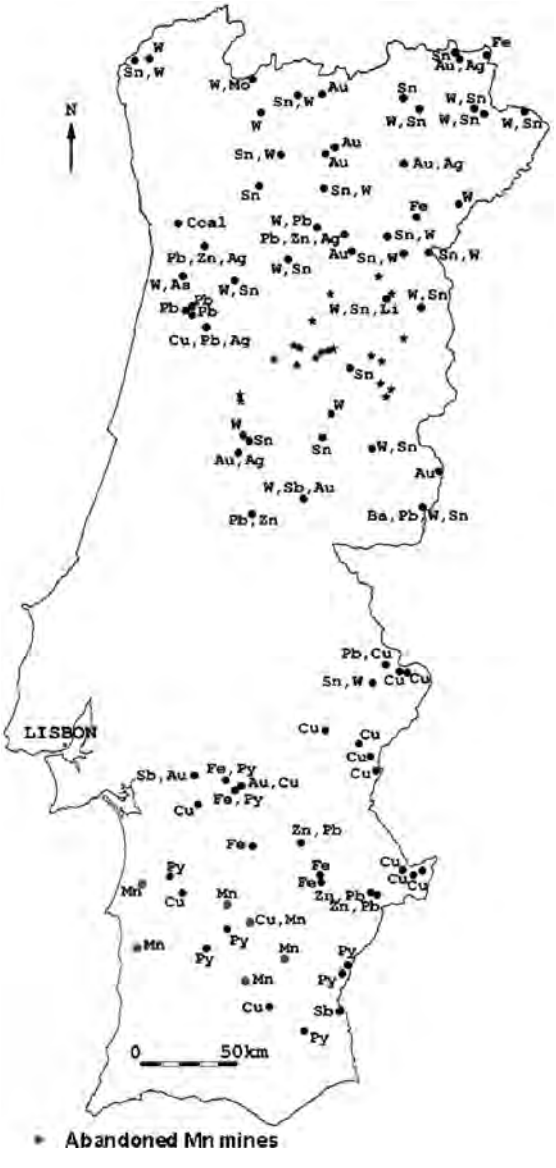


FIGURE 1
Major explored mines in Portugal.
* - Uranium mines.

"Black holes with hair"

Carlos A. R. Herdeiro[1], Eugen Radu[1]

The influential XXth century physicist John Wheeler, created the mantra "black holes have no hair", to stress the remarkable simplicity of these objects. Indeed, according to general relativity, the most general astrophysically interesting black hole has only 2 degrees of freedom: its total mass M and angular momentum J, and is described by an elegant solution of the Einstein equations, called the Kerr metric. This simplicity contrasts with what is known for ordinary stars – or any other known object – which, for the same M, J, may differ considerably, as M, J may be differently distributed throughout the star.

The "no-hair idea" idea is anchored on rigorous mathematical theorems, dubbed uniqueness black hole theorems, which have been proven in the 1970s for gravitational collapse in the presence of specific matter sources. But it extrapolates from these theorems by assuming that a similar statement holds for any matter source, a fact that has only partial mathematical support. Hence it is a conjecture.

In a paper published in Physical Review Letters (PRL 112(2014)221101), a team from the University of Aveiro has explicitly constructed a family of black hole solutions with 'hair' by exploiting a loophole in previous no-hair theorems. For these new 'Kerr black holes with scalar hair', the hair is provided by scalar matter, that can stay in equilibrium with the black hole due to a new mechanism unveiled in this work, which can, moreover, allow other more general types of matter to linger around black holes, thus setting the stage for constructing more generic 'hairy' examples.

The Aveiro team provided preliminary evidence for astrophysical signatures of these models, which could work as smoking guns for hair, and could arise by observing: black hole shadows, currently being measured by the Event Horizon Telescope; properties of accretion disks; or gravitational wave emission from perturbed black holes that will be measured by ground based interferometers such as Advanced LIGO.

1 — Department of Physics & I3N, University of Aveiro

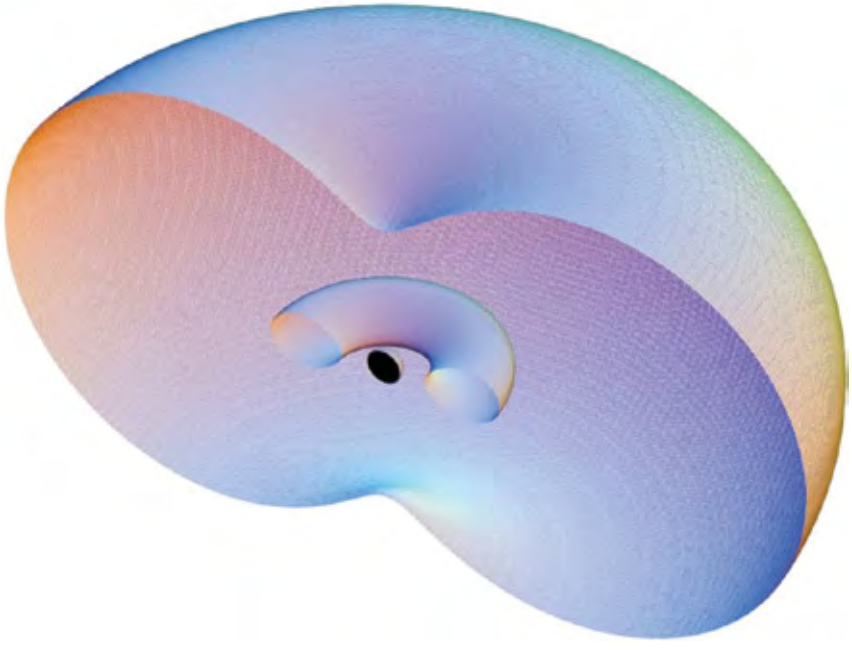


FIGURE 1

The horizon of a Kerr black hole with scalar hair (small central sphere with black top) surrounded by surfaces of constant energy density of the scalar matter, which are topologically tori near the black hole (due to the rotation) and become topologically spherical asymptotically.

Rare earth based silica-phosphate glass phosphors

Cláudio Nico[1], José Carreira[1], Teresa Esteves[1], Teresa Monteiro[1], Luís Rino[1]

1 — Department of Physics & I3N, University of Aveiro

Optical based sensor devices with remote interrogation are particularly advantageous for operation in thermally or electromagnetically harsh environments where typically electronic sensor devices fail. The fabrication of such devices requires the development of new materials and a deep knowledge of its physical properties. Hosts with high chemical durability and thermal stability as silica-phosphate glasses are among the most promising materials for the large scale production of the aforementioned low cost luminescence-based physical sensors. Being environmentally inert, nonconductive, nonmetallic, and chemically resistant, this type of sensors should be able to operate in adverse and corrosive environments. The sensor's dielectric construction, providing immunity to electric and magnetic fields, makes it ideal for applications where high DC, RF, and microwave fields or high voltages are present, as in the proximity of transmission antennas, high power lines and in electrically-noisy environments.

The presented work is focused on rare earth (RE) doped silica-phosphate glasses prepared by a wet non-conventional quenching method. The obtained results points to a high potential of these materials for the application in the mentioned optical devices.

Remote temperature sensors are technological important and these glasses present a good host for the co-doping with RE and use their emission characteristics for remote detection of temperature, based on the fluorescence intensity ratio technique. We are now start developing these type of sensors in cooperation with our I3N partners from CENIMAT (FCT, Universidade Nova de Lisboa) and, from Romania, the National Institute for Research and Development in Optoelectronics.

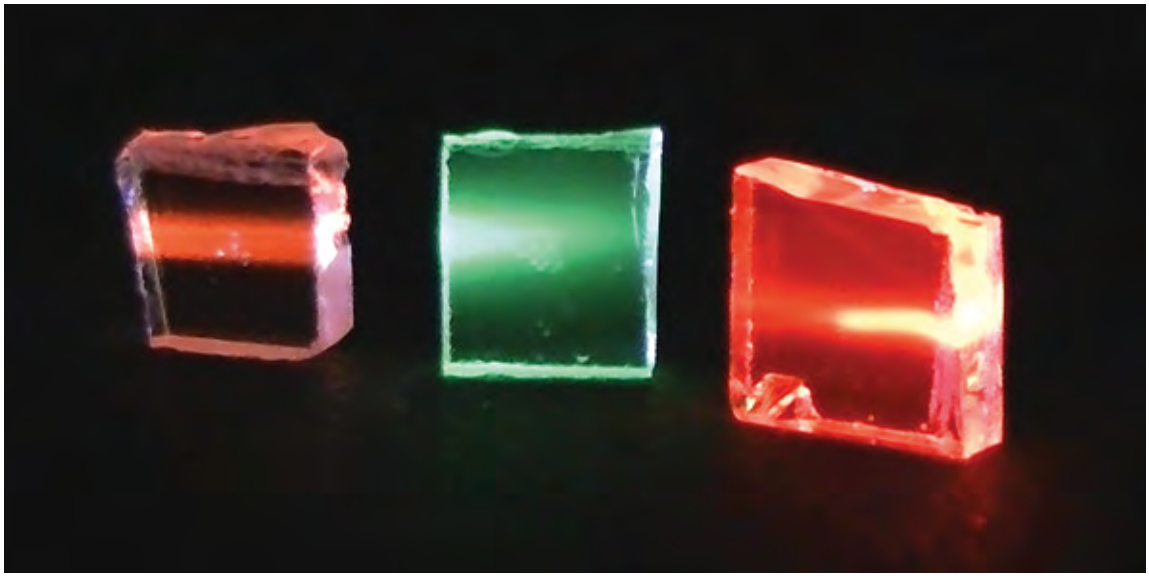


FIGURE 1
RT luminescence of the silica-phosphate glasses doped with distinct lanthanides.

1 - Optically activated Dy^{3+}/ Eu^{3+} ions in a co-doped aluminophosphate oxide host, 13th European Vacuum Conference and 7th European Topical Conference on Hard Coatings, 8-12 September 2014, Aveiro, Portugal
2 - Eu^{3+} luminescence in aluminophosphate glasses, Journal of Luminescence, 145 (2014), 582–587
3 - Effects of ultraviolet excitation on the spectroscopic properties of Sm3+and Tb^{3+} doped aluminophosphate glasses, Optical Materials, 35, 12 (2013) 2382–2388

Thin Film Solar Cells based on Earth Abundant and Non-toxic Materials: The cases of $Cu_2ZnSn(S,Se)_4$ and SnS

A.F. da Cunha[1], M.G. Sousa[1], P.A. Fernandes[1], J.P. Teixeira[1], J.P. Leitão[1]

$Cu_2ZnSn(S,Se)_4$ (CZTS) has been object of intense research worldwide for around half a decade with the main goal of replacing, the more mature, $CuIn_{1-x}Ga_x(Se_{1-y}S_y)_2$ (CIGS) as absorber layer in thin film solar cells. The advantage of this new compound is that it uses low cost and low toxicity elements. CZTS is a compound whose intrinsic point defects lead to p-type semiconductor behaviour. It presents a direct energy band gap of approximately 1.5 eV and as a result it shows a high absorption coefficient of 10^4 cm^{-1}. These properties confirmed CZTS as a good candidate for replacing CIGS. More recently, SnS has also started to emerge as an alternative to CIGS and CZTS. Even though it is an indirect band gap semiconductor it has an allowed direct transition at around 1.3 eV which leads to a high absorption coefficient around 10^4 cm^{-1} and it shows p-type conductivity derived from intrinsic defects, mostly Sn vacancies. Groups at Harvard University and MIT have recently demonstrated solar cells with 4.4% efficiency.

In our group, we are also working on the development of CZTS and SnS thin films and solar cells. We have established a growth method based on the annealing, in a rapid thermal processing furnace, of metallic and sulphide precursor stacks. The method is sketched in figure 1. We studied the influence of heating rate, maximum annealing temperature, time at maximum temperature and amount of evaporated sulphur on the properties of the films. The morphological, electrical and optical properties of the resulting layers are being optimized. These studies revealed that samples annealed at higher temperatures, shorter times and higher amount of evaporated sulphur exhibited larger grain sizes. We have, so far, produced, entirely in the University of Aveiro, functioning solar cells based on CZTS with 3.1% efficiency.

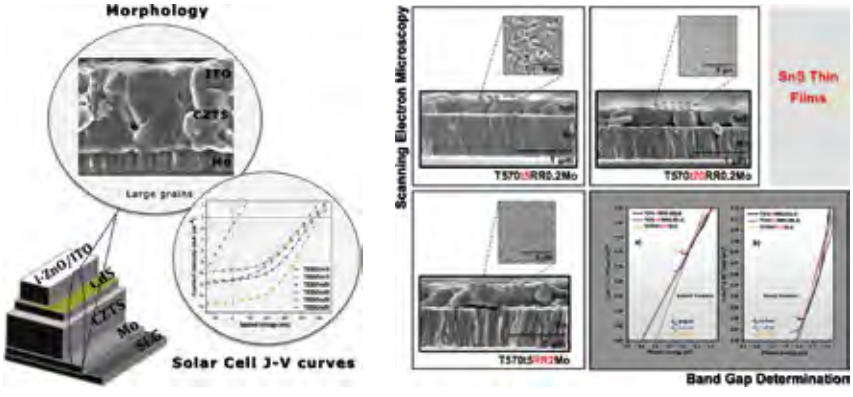
As for the work on SnS, we are working on development of a growth procedure to achieve single-phase SnS thin films. The bulk of the resulting films is formed predominantly by SnS but capped by a very thin layer of β-Sn. The results, so far, show that increasing the heating rate leads to the enhancement of the crystallinity of the SnS and decreasing the time at maximum temperature lowers the amount of the β-Sn phase detected on the film. The latter may result from the SnS decomposition at the surface. A summary of the growth method and main results is shown in figure 2.

In both cases, the growth methods under development are compatible with large-scale industrial production.

1 — Department of Physics & I3N, University of Aveiro

FIGURE 1
Cu_2ZnSnS_4 growth method and solar cell characterization results.

FIGURE 2
Some results representative of the SnS thin films optimization work.



Identification of a novel human nuclear envelope LAP1 isoform, LAP1C

Mariana Santos[1], Sara C. Domingues[1], Patrícia Costa[1], Thorsten Muller[2], Sara Galozzi[2], Katrin Marcus[2], Edgar F. da Cruz e Silva[1], Odete A. da Cruz e Silva[1], Sandra Rebelo[1]

1 — iBiMED, University of Aveiro
2 — Department of Functional Proteomics, Medical Proteome Center, Ruhr University Bochum, Germany

The eukaryotic nucleus is a complex organelle enclosed by a double membrane denoted as nuclear envelope (NE). The NE separates the cytoplasm from the nucleus and is composed by the inner nuclear membrane (INM), the outer nuclear membrane, the nuclear lamina and nuclear pore complexes. The INM contains integral proteins and most of them interact with lamins (the major component of the nuclear lamina) and/or chromatin. One of the first lamin associated proteins identified was lamina-associated polypeptide 1 (LAP1) which is a type II transmembrane protein of the INM (codified by the TOR1AIP1 gene) whose function is poorly understood but is known that it binds directly to lamins and indirectly to chromosomes. Moreover, LAP1 was found to interact with torsinA, which is a central protein of DYT1 dystonia (a human neurological movement disorder) and also with emerin that is another INM associated with human muscular dystrophies. Recent studies have indicated that in fact LAP1 is functionally associated to torsinA in neurons and with emerin in skeletal muscle.

To date of this study the only known human LAP1 isoform was LAP1B. We identified a novel human LAP1 isoform that we named LAP1C. This new isoform is N-terminal truncated, with a molecular weight of approximately 55 KDa contrasting with 68 KDa of LAP1B (Fig. 1A). The existence of this novel isoform was validated by several techniques including LAP1 knockdown, northern blot and liquid chromatography-mass spectrometry. The characterization of novel isoform was achieved by transient expression the HA-LAP1C in human neuronal cell line, SH-SY5Y cells. The results show that the exogenous expressed band corresponding to HA-LAP1C co-migrates with the endogenous LAP1C (Fig. 1B). Moreover, the immunolocalization studies confirmed that HA-LAP1C is mainly found in nuclear envelope and also in some points inside the nucleus (Fig. 1C). Additional phosphorylation assays determined that both isoforms (LAP1B and LAP1C) are post-translationally modified by protein phosphorylation in five residues and two of these were found to be dephosphorylated by Protein Phosphatase 1 (Fig. 1D).

In summary, the results presented are of paramount importance since they open new avenues for the study of DYT1 dystonia and related nuclear envelope-based diseases like muscular dystrophies, where LAP1 (LAP1B and C) and their phosphorylation represent a key regulatory mechanism across the nuclear membrane.

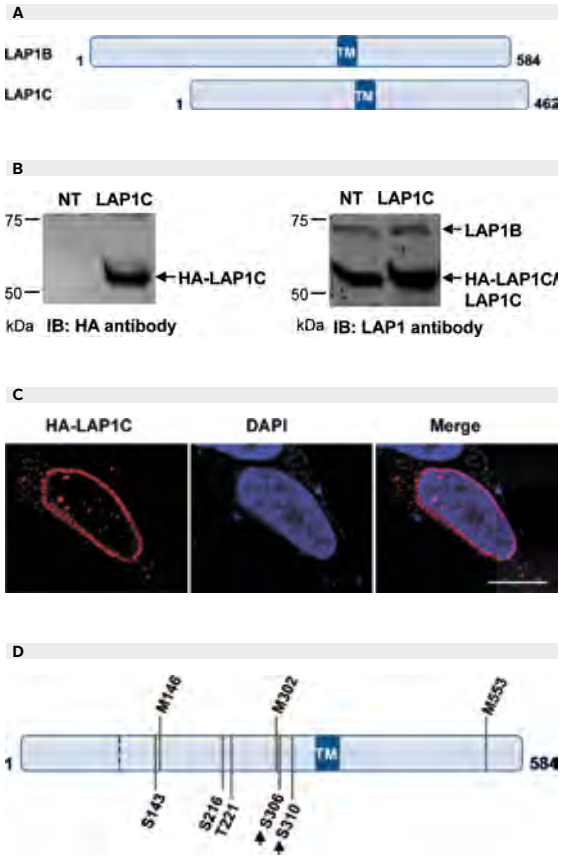


FIGURE 1
Expression, localization and post-translational modifications of LAP1C. A- A schematic representation of the differences of the two LAP1 isoforms (LAP1B and LAP1C) are presented. B- SH-SY5Y cells were transfected with HA-LAP1C and further analyzed by immunoblotting analysis using a HA antibody or using a LAP1 antibody. C- Immunolocalization of HA-LAP1C using a HA antibody and the Alexa Fluor 594-conjugated secondary antibody (red). DNA was stained with DAPI. The images were acquired using the LSM 510 confocal microscope (Zeiss). D- LAP1 isoforms are phosphorylated on Ser142, Ser216, Thr221, Ser306 and Ser310 residues being the last two dephosphorylated by Protein Phosphatase 1 (indicated by arrows). Methionine residues 146, 302 and 553 residues were found to be oxidized. The residues numeration is relative to the LAP1B sequence and the translation initiation site of LAP1C is indicated by a dashed line. TM, transmembranar domain; NT, non-transfected; IB, immunoblotting. Scale bar, 10 µm.

Luminescent organics: from isolated molecules to organized solids

Samuel Guieu[1,2], Joana Pinto[1], Vera L. M. Silva[1], Artur M. S. Silva[1], João Rocha[2]

Molecules and materials with the ability to emit light are a critical part of both fundamental science and everyday life, with applications ranging from fluorescent biological probes to sensors to lightning devices. Recently, all-organic luminescent molecules have emerged as a promising alternative to inorganic materials, avoiding the use of toxic or expensive metals, while being easily modified in order to tune their properties, particularly the emitted light color. One of the current limitations of all-organic chromophores is the loss of efficiency in concentrated solutions or in the solid state, because the interactions between the fluorophore molecules usually form non-emissive species. However, careful design of the chromophores avoids the interactions leading to emission loss, promoting the organization of the molecules into emissive solids.

We developed new all-organic molecules exhibiting different luminescent properties in solution and in the solid state. Although a family of diarylmethane derivatives (Fig. 1) is non-emissive in solution they become highly luminescent upon crystallization. This behavior was rationalized by their crystal structure, which shows that the molecules self-assemble into chains linked through hydrogen bonds, efficiently rigidifying the structure.

A series of prepared boron diketonate complexes exhibit fair luminescent properties in dilute solutions, emitting in the yellow range of the visible spectrum. When the concentration increases, the emission color disappears and is replaced by a red color (Fig. 2) attributed to the formation of dimeric species, as confirmed by the crystal structures of the compounds.

These approaches pave the way toward all-organic luminescent materials based on small molecules, which could then be used for biological imaging or in solid emitting devices.

1 — Department of Chemistry & QOPNA, University of Aveiro
2 — Department of Chemistry & CICECO, University of Aveiro

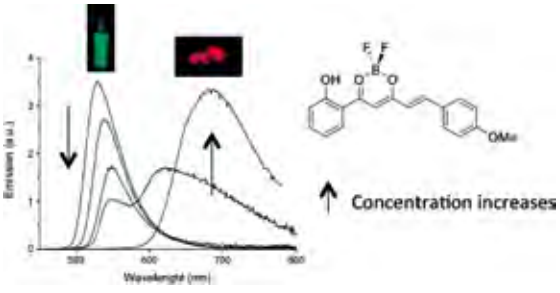


FIGURE 1
Exemple of a fluorophores with excimer formation in the solid state. The yellow luminescence observed in dilute solution disappears when the concentration increases, replaced by the red luminescence of the excimer.

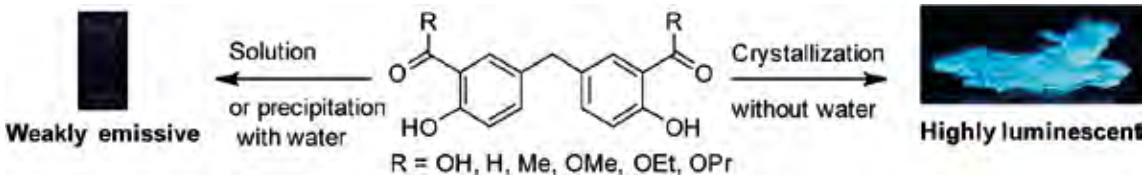


FIGURE 2
Compounds with crystallization-induced emission enhancement properties.

Newer insights on light and Reactive Oxygen Species applications: a DQ/QOPNA contribution

Sónia Pires[1], A. Mafalda Pereira[1], M. Amparo F. Faustino[1], Mário M. Q. Simões[1], M. Graça P. M. S. Neves[1], José A. S. Cavaleiro[1]

1 — Department of Chemistry & QOPNA, University of Aveiro

Advantages and drawbacks on the use of Light related with the formation of Reactive Oxygen Species (ROS) are well known. Light is unquestionably responsible for life, but long exposures to it could be threatening and several diseases can come up. So oxygen reactive species can have that dual behavior. In fact, in recent years, the Organic Chemistry group of DQ/QOPNA has carried out research pointing to the advantage of using Light and ROS.

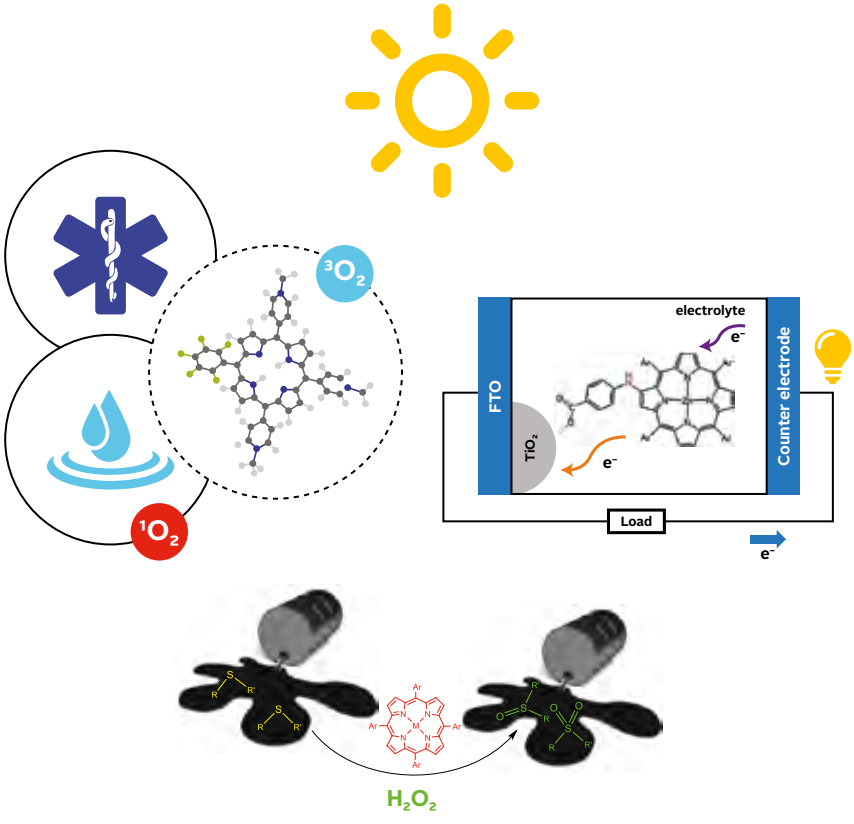


FIGURE 1
Illustration of a Dye-Sensitizer Solar Cells (DSSC), photoinactivation of microorganisms (PDI) present in hospital effluents and oxidative desulfurization (ODS) by porphyrin derivatives.

One promising research area is the development of robust organic dyes to prepare Dye-Sensitized Solar Cells (DSSCs) for harvesting and conversion of sunlight into electricity. The operation of these photovoltaic devices (Fig. 1) is based on the electron transfer from a photoexcited dye to the conduction band of a nanocrystalline semiconductor followed by a redox reaction for dye regeneration. Very recently we demonstrated that ß-(p-carboxyaminophenyl) porphyrins were efficiently incorporated as dyes in DSSC devices, in which a power conversion efficiency of about 30% of the more conventional Ru(II)-sensitizer N719 was achieved.

Another research line developed in our group combines Light and ROS to inactivate microorganisms, namely multidrug-resistant ones. Last developments with this approach highlighted that cationic porphyrins developed by us under visible light irradiations are able to destroy a large range of clinical multi-resistant bacteria either in filtrated hospital wastewaters. It is also demonstrated a synergistic effect when the inactivation of antibiotic resistant bacteria is performed in the presence of antibiotics opening good perspectives to develop efficient effluent treatments.

Our expertise leads us also to take advantage of the oxidizing properties of H^2O^2 in the presence of efficient biomimetic P450 catalytic systems to potentially decontaminate petroleum derivatives by an oxidative desulfurization (ODS) approach. Sulfur compounds are usually associated with the formation of acid rains and of the poisoning of catalysts and corrosion of combustion engines and the recent very restrictive regulations limiting the sulfur content on petroleum products highlight the interest on this environmentally sustainable methodology.

Hyperbaric storage – a novel food preservation methodology for currently refrigerated foods with quasi no energetic costs and carbon footprintless

Liliana G. Fidalgo[1], Mauro D. Santos[1], Rui P. Queirós[1], Rita S. Inácio[1], Rita P. Lopes[1], Maria J. Mota[1], Sílvia A. Moreira[1], Ricardo V. Duarte[1], Pedro A. R. Fernandes[1], Ivonne Delgadillo[1], Jorge A. Saraiva[1]

Food preservation is highly dependent on refrigeration to inhibit spoilage, requiring high energy costs and causing high carbon footprints. These issues may be overcome using a new food preservation method that arose by chance about 40 years ago with the sinking of Submarine Alvin, when well-preserved food was recovered after 10 months at a depth of ≈1540 m (≈15 MPa and 4 °C).[1] This accident opened the possibility of storing food and other biomaterials under pressure (above atmospheric pressure - 0.1 MPa), representing a potential enhancement compared to presently used refrigeration.

Recent developments in our research group (Fig. 1) revealed the possibility of storing currently refrigerated foods at naturally variable (uncontrolled) room temperature under pressure (Hyperbaric Storage - HS). This preservation method is quasi energetic costless and has low carbon footprint, since it is not necessary to control the temperature, and energy is only required to reach the desired pressure (during few minutes), but not to keep it.

HS is expected to have a significant impact on food research and has potential to be applied on food industry during the next years. Additionally, it raises relevant fundamental questions, such as: How can pressure inhibit microbial growth similarly to refrigeration? What are the molecular mechanisms behind this effect? How could this knowledge be transposed to other research areas?

It is important to mention that the industrial scale high pressure equipment of University of Aveiro (Fig. 2) was used for the first and pioneer large scale experiments of HS. Our group is actively working on this subject, with the studies conducted so far clearly indicating that HS has advantages over refrigeration, namely in terms of environmental and economical sustainability. Therefore, it is expected that HS will become a disruptive evolution on food preservation in a near future.

1 — Department of Chemistry & QOPNA, University of Aveiro

FIGURE 1
Microbial counts (total mesophiles) of watermelon juice hyperbaric stored (100 MPa, room temperature) during 60 h, compared to storage at refrigerated and room temperatures (atmospheric pressure - 0.1 MPa).

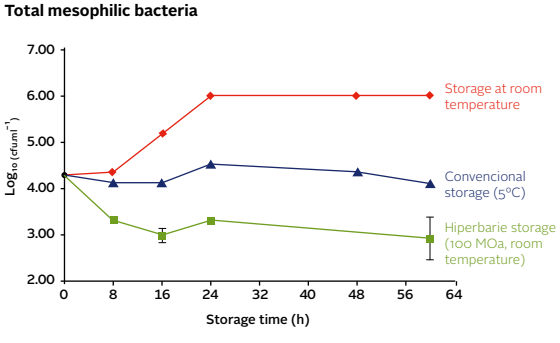


FIGURE 2
Industrial-scale high pressure equipment in Chemistry Department, University of Aveiro.

Nosewitness identification: Effects of negative emotion

Laura Alho[1], Sandra C. Soares[1], Jacqueline Ferreira[1], Marta Rocha[1], Carlos F. Silva[1], & Mats J. Olsson[3]

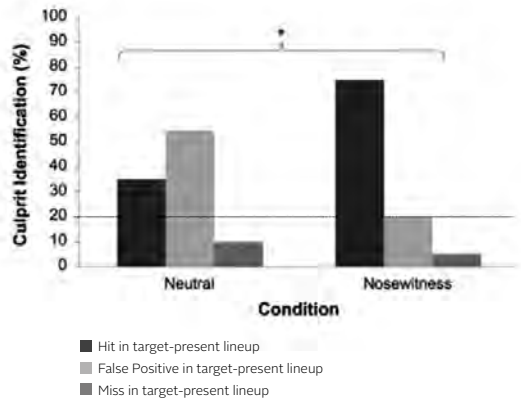
1 — Department of Education & CINTESIS, University of Aveiro
2 — Institute for Biomedical Imaging and Life Sciences (IBILI), Faculty of Medicine, University of Coimbra
3 — Department of Clinical Neuroscience, Division for Psychology, Karolinska Institutet, Stockholm, Sweden

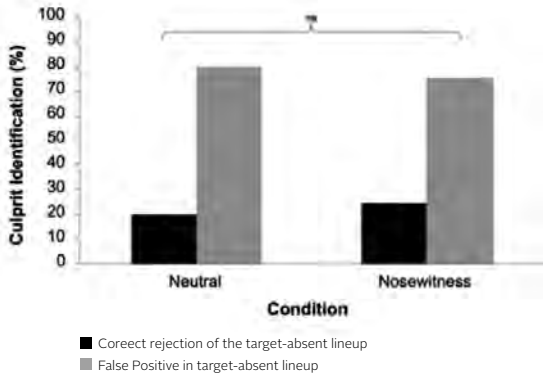
When the perpetrator and the victim are close up (e.g., crimes of sexual abuse) olfaction may provide important cues towards the identity of the body odor (BO) of the perpetrator. Each individual has a unique BO signature, as an "odorprint", that conveys genetic information and information about personal environmental variables (e.g., diet, hygiene). Furthermore, smell has been shown to be a powerful trigger for memory. However, in forensic research, identification of human BOs has been performed by trained dogs but not by humans. The possibility of identifying individuals in a forensic setting by way of odor, referred to as nosewitness identification, was investigated for the first time at the PsyLab, University of Aveiro. In two pioneer studies, we explored nosewitness identification following emotional videos of crimes. In Experiment 1 we tested an experimental model of nosewitness identification to investigate human olfactory memory for BO in a forensic setting, including emotion-evoking crimes.

Experiment 2 expanded on this issue by testing the memory effect of negative emotion using a conventional lineup identification test. Results of both experiments showed that participants who viewed a real crime, while instructed to smell the BO of the presumed perpetrator, were better than their emotionally neutral counterparts when identifying the culprit BO in a lineup with four other BOs. The results of Experiment 2 also indicated a superiority of the lineup identification for target-present trials, compared to target-absent trials (Fig. 1 and 2), which is consistent with the notion that olfactory cognition is especially prone to false alarms.

Witnessing a disturbing event, such as a crime, elicits negative emotions. Although the effects of stress in eyewitness memory have been studied, little is known regarding the effects of other emotional states in testimony for the different sensory modalities. Since our findings are contradictory to those of eyewitness studies, they may point towards different roles of negative emotion for visual and olfaction memory.

The experimental model for nosewitness presented in this study paves the way for future studies investigating the interplay between emotion and olfaction and the possible use of the sense of smell in forensic settings.



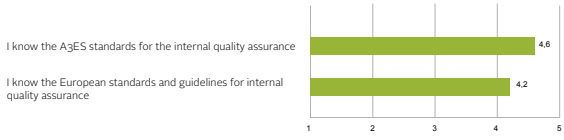


The Importance and Degree of Implementation of the A3ES guidelines for internal quality assurance in Portuguese Higher Education Institutions

Maria João Rosa[1], Cláudia S. Sarrico[2], Isabel Machado[3], Carolina Costa[3]

Similarly to what has been happening in other European countries, and much as a consequence of the Bologna process and the development of the European standards and guidelines for quality assurance in the European higher education area (ESG), we can observe in Portugal a tendency towards the development and implementation of internal quality assurance systems (IQAS) in higher education institutions (HEIs). In a more or less systematic manner, with a broader or narrower scope and with different degrees of consolidation, the truth is that a significant number of Portuguese HEIs has been designing and implementing internal systems capable of assuring their processes' quality, namely teaching and learning.

The research project described in here had as its main goals to understand the importance that the A3ES standards have for national HEIs, as a framework for the implementation of their IQAS, as well as to assess these standards' degree of implementation in Portuguese HEIs. A questionnaire was developed with a set of sentences meant to collect Portuguese academics´ perceptions on their degree of knowledge about the ESG and the A3ES standards; the importance each one of the A3ES standards has for IQAS implementation; and the degree of implementation of the A3ES standards in their institutions. Generically, the answers collected point to some unfamiliarity with the ESG and the A3ES standards. Nevertheless, most of the academics tend to consider the A3ES standards as important, or even very important, which represents a favorable environment to IQAS development within HEIs, since the implicit acceptance of the standards seems more relevant than the explicit knowledge about them. The degree of implementation of the A3ES standards in Portuguese HEIs is also quite significant, despite the fact that it tends to be lower than the importance attached to them by Portuguese academics.

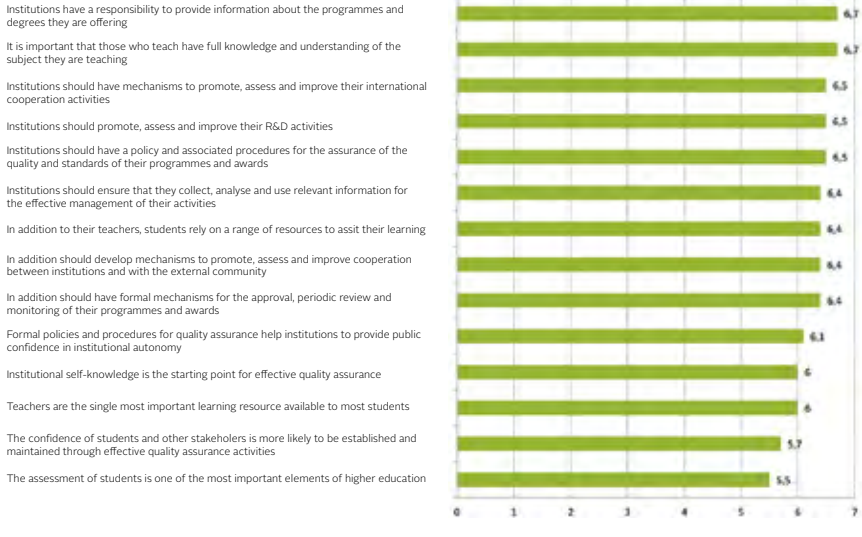


The comparisons made between the means of the answers of different groups of academics allowed for the conclusion that the higher education subsystem they work in, their age, sex, scientific area, having or not performed management functions and their degree of involvement in quality management activities are relevant for both the importance they give to the different standards and the degree of implementation they consider to exist in their institutions. These differences point to the need of developing some work along different academic groups in order to better involve them in quality management activities, mainly because those involved also know the standards better, attach more importance to them and have the perception they are more implemented.

1 — Department of Economics, Management and Industrial Engineering & CIPES, University of Aveiro
2 — ISEG Lisbon School of Economics & Management, Universidade de Lisboa and CIPES
3 — CIPES – Centre for Research in Higher Education Policies

FIGURE 1
Portuguese academics' knowledge about the ESG and the A3ES standards (mean scores of the answers).

FIGURE 2
Portuguese academics' perceptions on the degree of importance of the A3ES standards (mean scores of the answers).



Decomposition of energy-related GHG emissions in agriculture over 1995–2008 for European countries

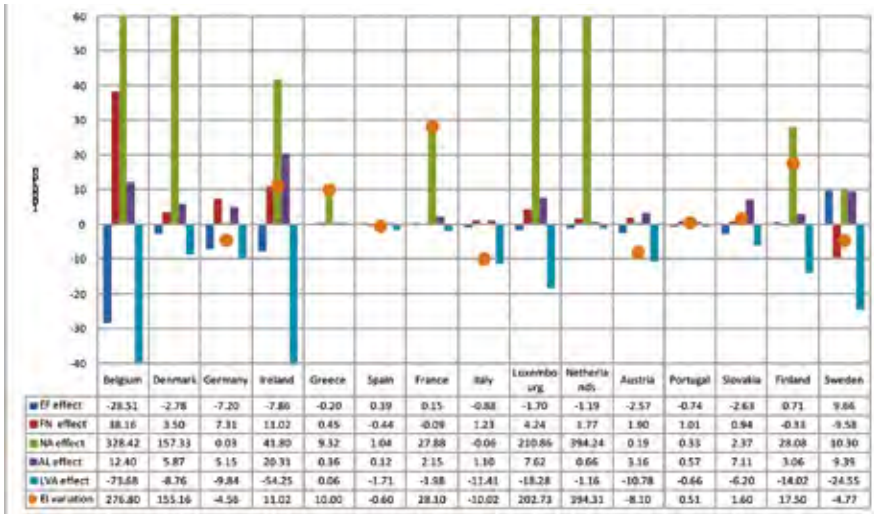
Margarita Robaina-Alves[1], Victor Moutinho[2]

1 — Department of Economics, Management and Industrial Engineering & GOVCOPP, University of Aveiro
2 — Department of Economics, Management and Industrial Engineering, University of Aveiro and CEFAGE, University of Évora

The European Union Trading Scheme does not consider the agricultural sector as part of the negotiations of carbon credits, nevertheless countries are concerned about adopting other environmental policies that aim at reducing Greenhouse Gases (GHG) emissions in the agricultural sector. For the design of a policy of this kind, it is important to understand how the intensity of GHG emissions (GHG emissions/ agricultural value added) has evolved and what factors contribute to the variation of that intensity.

The objective of this work is to identify the effects in which the intensity of GHG emissions (EI) in agriculture can be broken down and analysed, as well as their evolution and which of them has more importance in determining the intensity of emissions in agriculture. For that, we used the 'complete decomposition' technique in the 1995–2008 period, for a set of European countries. The change of EI can be decomposed into five effects: (i) changes in GHG emissions compared to the fossil fuels consumption (EF effect), (ii) changes in fossil fuels consumption compared to the use of Nitrogen in agriculture (FN effect), (iii) change in use of Nitrogen in agriculture per ha of utilized agricultural area (NA effect), (iv) change in utilized agricultural area per worker (AL effect) and the inverse of average labour productivity in agriculture (LVA effect). It is shown that in most countries studied, there was an increase in agriculture emissions intensity, and in only five countries this variable declined. The greatest decrease was seen in Italy (-0.01), while the highest raises were found in the Netherlands (+0.394), Belgium (+0.277) and Luxembourg (+0.203). NA effect and LVA effect were the ones that had a greater contribution to the variation of emissions intensity. In the countries in which the variation of EI is positive, the effect of NA is the main one responsible for this increase (for instance 100%, 118.6% and 104% for Netherlands, Belgium and Luxemburg respectively), which means that the use of Nitrogen per cultivated area is an important factor of emissions. The effect LVA proves to be the most important, specifically in the countries where the change in EI is negative (for instance 113.9% for Italy). This means that in countries where labour productivity increases (LVA decreases), emissions intensity tends to decrease.

FIGURE 1
Effects of decomposition of emissions intensity variation (1995-200) by country.



Halogen bonding in water results in enhanced anion recognition in acyclic and rotaxane hosts

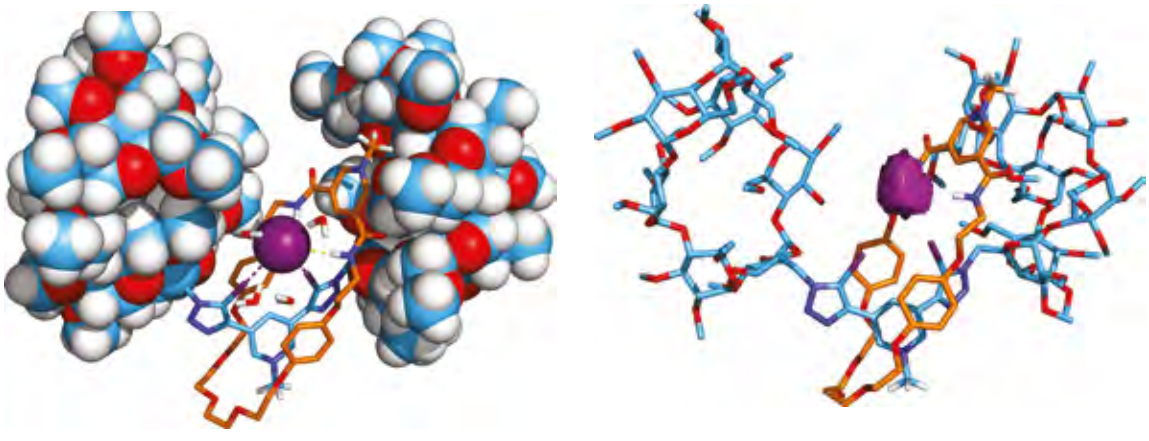
Matthew J. Langton[1], Sean W. Robinson[1],Igor Marques[2], Vítor Félix[2], Paul D. Beer[1]

Halogen bonds (XB) are the attractive interactions between electron-deficient halogen atoms and Lewis bases, an intermolecular interaction akin to hydrogen bonds (HB). However, the design of XB based receptors able to strongly and selectively recognize anions in water is not trivial due to solubility effects and the competition of solvent molecules for the binding sites. In this work these issues were solved using permethylated ß-cyclodextrins as stoppers of the rotaxane's axle component. We have demonstrated the superiority of XB over HB for strong anion binding in water (a two orders of magnitude difference), to the extent that recognition by a simple acyclic axle is achievable. Quantification of iodide binding by rotaxane hosts revealed that the strong binding by the XB-rotaxane is driven exclusively by favourable enthalpic contributions arising from the XB interactions, whereas weaker association with the HB analogous receptor is entropically driven. Further insights into the structure of the halide complexes in water were obtained through molecular dynamics (MD) simulations. The structure of the iodide complex presented in Fig. 1 shows the anion is almost within the host cavity, exposed to few water molecules. The anion binding is mediated by HB with the macrocycle and by XB with the axle components, depicted as yellow and purple dashed lines, respectively. The cooperative action of both interactions led to a confined 3D histogram built with the positions occupied by the iodide throughout the MD simulation (Fig. 2). The combination of the experimental and theoretical findings show that XB in water are a strong and selective alternative to HB, leading to a superior binding affinity for iodide over bromide and chloride. In summary, this study highlights the superiority of XB over HB as an intermolecular interaction to be exploited in several fields such as green chemistry, structural biology and drug discovery.

1 — Chemistry Research Laboratory, Department of Chemistry, University of Oxford, Mansfield Road, Oxford OX1 3TA, UK.
2 — Department of Chemistry & CICECO, University of Aveiro

FIGURE 1
Representative snapshot from the MD simulation, showing the iodide binding to the rotaxane through two XB and HB interactions, surrounded by four water molecules. The N–H···I– and C–I···I– bonding interactions are drawn as purple and yellow dashed lines, respectively. The cyclodextrin stoppers are depicted by a space-filling model. Carbon atoms are shown in cyan in the axle and in orange in the macrocycle, and oxygen, nitrogen and iodine atoms are shown in red, blue and purple, respectively. Selected hydrogen atoms are shown in white.

FIGURE 2
3D histogram built with the positions occupied by the iodide (purple) along the MD simulation. The remaining color details as given in Fig.1.



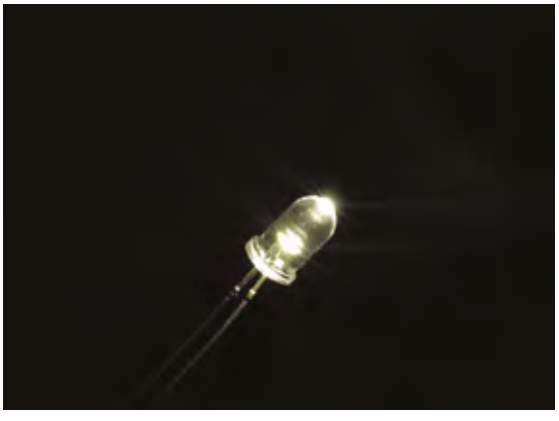
Efficient and tuneable photoluminescent boehmite hybrid nanoplates lacking metal activator centres for single-phase white LEDs

Vânia T. Freitas, Rute A.S. Ferreira[1], Xue Bai[2], Gianvito Caputo[3], Nicola Pinna[3], Zhendong Hao,Jiahua Zhang[4], Ricardo L. Longo[5], Oscar L. Malta[5]

1 — Department of Physics & CICECO, University of Aveiro
2 — Department of Chemistry & CICECO, University of Aveiro
3 — Humboldt-Universität zu Berlin, Germany
4 — State Key Laboratory of Luminescence & Applications, Changchun, China
4 — Universidade Federal de Pernambuco, Recife-PE, Brasil

White light-emitting diodes (WLEDs) are candidates to revolutionize the lighting industry towards energy efficient and environmental friendly lighting and displays. The most common WLED is a combination of a blue LED chip and YAG:Ce^{3+} yellow-emitting phosphor. The main disadvantages of such WLED are the poor colour-rendering index (CRI) and the low stability of the correlated colour temperature (CCT) that varies with the drive voltage and the phosphor coating thickness. Also, the presence of critical elements (e.g. lanthanide ions) whose scarcity and supply disruption is a noticeable concern is another drawback. Ultraviolet-pumped WLEDs gained considerable attention as an alternative due to easier manufacture process, low colour variation as a function of the forward-bias current and superior temperature stability. Moreover, as the human eyes are insensitive to ultraviolet radiation, the white colour is independent of the pumping LED and thickness of the phosphor layer.

From the materials science point of view, the main challenge is to develop a new ultraviolet down-converting metal activator-free compound with high emission quantum yield, CRI>80, and thermal stability. We developed a simple route to design high-efficient WLEDs by combining a commercial ultraviolet LED chip (InGaAsN, 390 nm) with few-nm thick boehmite nanoplates capped with in situ-formed benzoate ligands.1 The advantage of the boehmite hybrid phosphors lies in the fact that they are made of non-toxic, abundant and low-cost materials. Unusually high quantum yields (up to 58%) result from a synergic energy transfer between the boehmite-related states and the triplet states of the benzoate ligands. The produced WLED has CIE coordinates, CRI and CCT values of (0.32, 0.33), 85.5 and 6,111 K, respectively; overwhelming state-of-the-art single-phase WLEDs phosphors.

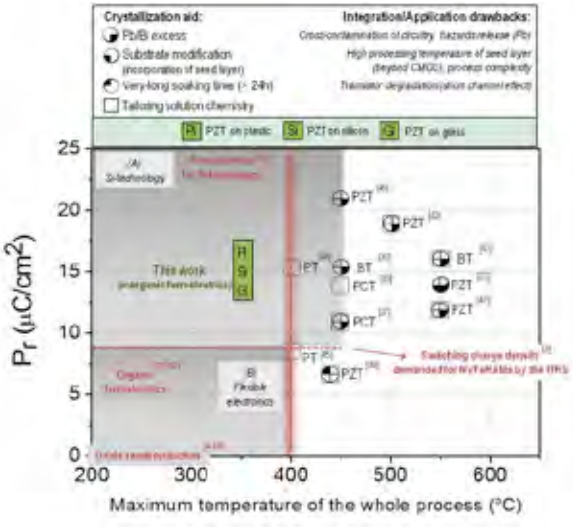


Activated Solutions Enabling Low-Temperature Processing of Functional Ferroelectric Oxides for Flexible Electronics

Iñigo Bretos[1], Ricardo Jiménez[1], Aiying Wu[2], Angus I. Kingon[3], Paula M. Vilarinho[2], M. Lourdes Calzada[1]

In the case of the most widely used inorganic materials in electronics, i.e. semiconductors, significant efforts are being devoted to their low-temperature fabrication for successful integration with flexible electronics. But now the need for direct integration of other active layers on polymers is mandatory to increase functionality of flexible devices. This is a major opportunity for ferroelectrics, since their intrinsic multifunctionality will allow diverse operations as memories, sensors, actuators, transducers making real applications not possible before (e.g. smart skin, flexible sensitive displays, photovoltaic cells, eye-type imagers). But, inorganic ferroelectrics require high temperatures to crystallise that exceeds by far the thermal stability of plastics.

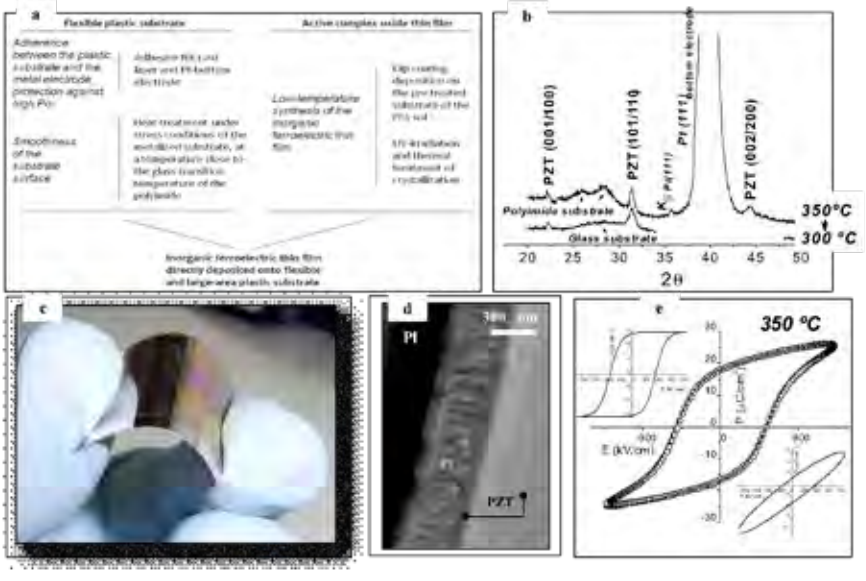
With a unique technology we proved the concept for a solution method that enables the processing of functional oxides at temperatures that direct-large-area integration of active layers with flexible electronics is turned into reality. We demonstrate the concept on the most important multifunctional oxide, lead-zirconate-titanate. Low temperature limit of crystallization of 300ºC, using a strategy that combines seeded diphasic precursors and photochemical solution deposition was reached. Based on the synergy of this strategy it is possible to overcome problems traditionally associated with low-temperature fabrication of ferroelectric oxide films, in particular absence of ferroelectric response, thereby allowing the use of these multifunctional layers in emerging electronics, as advanced devices supported on flexible polymeric substrates. We proved that properties of these ferroelectric layers on flexible plastic fulfill the major requirements demanded for devices, showing a wider temperature range of applicability and functionality than those of high-K dielectrics or organic ferroelectrics. This is a platform that can be used for many other functional oxide layers.



1 — Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Spain
2 — Department of Materials and Ceramics Engineering & CICECO, University of Aveiro
3 — School of Engineering, Brown University, Providence, USA

FIGURE 1
Key relevant challenges for the integration of ferroelectric oxide films with the Si-technology and flexible electronics.

FIGURE 2
Main features of the low-temperature solution processed inorganic PZT [Pb(Zr0.30Ti0.70)O3] ferroelectric layers on flexible plastic substrates.



Superoscillations

Paulo J. S. G. Ferreira[1], Dae Gwan Lee[2]

1 — Department of Electronics, Telecommunications and Informatics & IEETA, University of Aveiro
2 — Department of Mathematical Sciences KAIST, South Korea

Superoscillations are oscillations of a signal at a rate faster than its maximum frequency. They are a key component of Aharonov's weak measurement formalism in quantum theory with important applications in imaging, superresolution and antenna theory. A paper published in Nature (Rogers et al. 2012) argues that superoscillation-based imaging has unbeatable advantages over other technologies".

We have given a new construction of superoscillations. By taking a set of signal values as the adjustable parameters, we showed how the signal can be made to superoscillate by prescribing its values on an arbitrarily ne and possibly nonuniform grid. Surprisingly, the superoscillations can be made to occur at a large distance from the nonzero samples of the signal. We gave necessary and sufficient conditions for the problem to have a solution. Depending on the number of signal parameters, the problem can be exactly determined, underdetermined or overdetermined. We described the solutions in each of these situations and succeeded in describing the connection with oversampling and certain variational formulations. We also showed that it is possible to construct superoscillations by constraining the signal and its derivative. This allows much better control of the shape of the superoscillations. We found that for any given bandwidth, no matter how small, there exists a unique signal of minimum energy that satisfies any combination of amplitude and derivative constraints, on a sampling grid as fine as desired. We found the energy of the solution, for regular or irregular grids. The flexibility gained by having two different types of constraints makes it possible to design superoscillations based only on amplitudes, based only on derivatives, or based on both. In the last case, the amplitude and derivative sampling grids can be interleaved or aligned. We explored this flexibility to build superoscillations that cost less energy.

The paper considers a numerically difficult task: the synthesis of superoscillations. Minimum energy solutions are attractive for applications because (i) the minimum energy solution is unique (ii) it has the smallest energy cost (iii) it may yield a signal with amplitude as small as possible. On the negative side, minimum energy solutions depend heavily on cancellation and involve expressions with very large coefficients. Furthermore, these coefficients have to be found by solving equations that are very ill-conditioned. Surprisingly, shows that by dropping the minimum energy requirement practicality can be gained rather than lost. The method produces superoscillating signals with coefficients and condition numbers that are smaller by several orders of magnitude than minimum energy solutions, yet yields energies close to the minimum. The method has another important property: it yields the superoscillatory signal that maximises the energy concentration in a given set, which may or may not include the superoscillatory segment. The paper introduces translation in time by as a design parameter. We succeed in giving an explicit closed formula for the condition number of the matrix of the problem, as a function of the translation number (see the figure). This enabled us to find the best possible condition number, which is several orders of magnitude better than otherwise achievable.

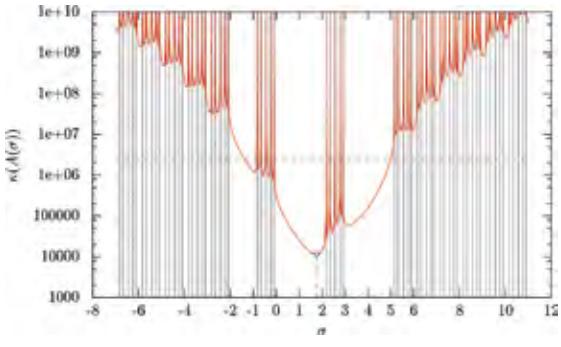


FIGURE 1
The condition number of the problem as a function of the translation . The optimum condition number is marked. Our methods yield the corresponding, enabling the design of optimally stable superoscillations.

Multimodal inverse perspective mapping

Miguel Oliveira[1], Vitor Santos[1], Angel D. Sappa[2]

Two critical components of driver assistance systems and autonomous vehicles are road and obstacle detection. Recent years have shown that Inverse Perspective Mapping (IPM) can be used as a preprocessing mechanism that significantly facilitates those components. The method consists of mapping images taken from onboard cameras to a new coordinate system where perspective effects are removed. However, in classical IPM, the presence of obstacles on the road disrupts the accuracy of the mapping.

The current paper proposes an extension to IPM in which data from a laser range finder is fused with images from the cameras, so that the mapping is not computed in the regions where obstacles are present. Tests were conducted in laboratory as well as in the field using the ATLASCAR, an autonomous vehicle research platform from UA shown in Fig. 1. The proposed approach is capable of producing mosaic images created from information of multiple cameras: Fig. 2 shows an IPM image generated from the three cameras onboard the ATLASCAR. Results show that the proposed technique considerably improves the accuracy as well as the computation time when compared with the classical IPM.

1 — IEETA, University of Aveiro
2 — Computer Vision Center, Edificio Campus UAB, Barcelona, Spain

FIGURE 1
The ATLASCAR full scale robotic platform. It is equipped with an active perception unit (A), a stereo rig (B), three LRF (C, D, H), a thermal vision camera (F), GPS (G) and an inertial measurement unit (E).

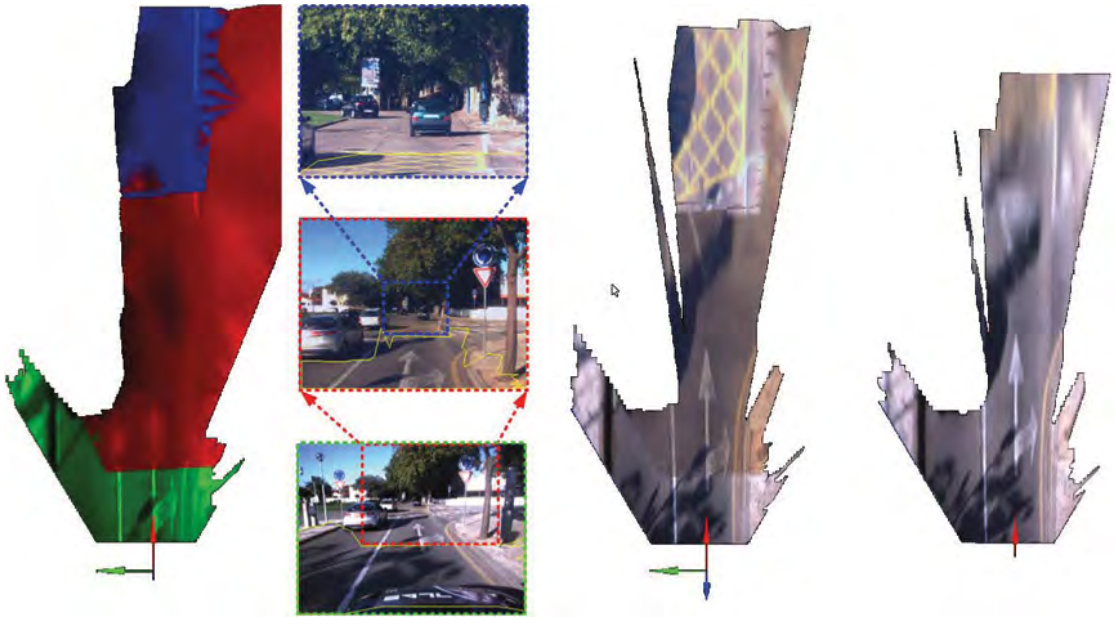


FIGURE 2
Using the proposed IPM approach in real scenarios. (a) Images of the three cameras on-board the ATLASCAR; (b) The distribution of mapping for each camera ; (c) IPM using just green camera; (d) IPM using all cameras.

Digital RF Overlay – The Future of CATV Broadcast Networks

Arnaldo S. R. Oliveira[1], Nuno B. de Carvalho[1], Rui F. Cordeiro[1], Francisco Martins[1], Nelson V. Silva[2], Paulo Jesus[2]

1 — Department of Electronics, Telecommunications and Informatics & IT, University of Aveiro
2 — PT Inovação

FIGURE 1
Global architecture of the system developed.

FIGURE 2
Laboratory prototype and final system implemented.

Current CATV broadcast systems, even those based on optical fiber transport using Radio over Fiber technology, have many limitations in terms of network range, to ensure the required quality of the signal received at the customer's equipment. For this reason, in the conventional approaches, the number of headends and stations along the network to capture, distribute and regenerate the quality of the signal is relatively high. This aspect is responsible for a substantial part of the installation, operation and maintenance costs of CATV networks currently installed.

The system developed by the Radio Systems group at Instituto de Telecomunicações – Pólo de Aveiro in collaboration with the PT Inovação, under the project Digital RF Overlay, allows the full digitalization at a single network headend of the radio frequency spectrum used by CATV systems (47- 870 MHz), its digital transmission over optical fiber, using traditional digital Ethernet connections, in the core network and the efficient reconstruction of the analog CATV signal in the desired network locations (Fig. 1), substituting in this sense a complete and very expensive headend that would be installed using current network architectures and technologies. This allows transmitting the signal to much higher distances with virtually no degradation of the signal quality, allowing a major evolution of the CATV networks in the near future, with significant advantages in terms of quality/cost ratio, distances covered, energy consumption, maintenance costs and space occupied by the equipment.

The system was developed using software defined radio concepts and techniques and implemented in high speed, state-of-the-art FPGAs, DACs and ADCs (Fig. 2). This solution for CATV signal digitalization and its transmission over fiber optic is compatible with any broadcasting system, analog or digital, and was validated in laboratory first, subsequently demonstrated successfully in the operator CATV distribution network and is ready to be deployed in large scale.

Vehicular Networks in a City-Scale: Internet Access and Internet of Things

André Cardote[1], Carlos Ameixieira[1], Filipe Neves[1], Luís Coelho[1], Diogo Lopes[1], Ricardo Matos[1], Diogo Carreira[1], Susana Sargento[1]

The University of Aveiro and Institute of Telecommunications developed a new wireless technology (WAVE/DSRC) for the communication between vehicles and between the vehicles and the Internet. This technology allows 10x the range of normal WiFi and reduces 100x the time required to start communication. With this technology we can turn any vehicle into a mobile hotspot to the Internet. The developed mobile router has several wireless interfaces, WiFi, WAVE and Cellular. Through a connection manager, the vehicles build a mesh network and are able to connect to the Internet through the best connection, being it a WiFi hotspot, another vehicle, or the cellular network if no other possibility is available (Figure 1). With this technology, the connection to the Internet can be performed through the WiFi and WAVE hotspots available in the city, being able to face the enormous traffic of passengers in the vehicles, and the large traffic volume of thousands of sensors in the city. This network of connected vehicles joins forces to offer wireless Internet access to citizens and city employees and share vital data to improve the efficiency and social value of municipal services.

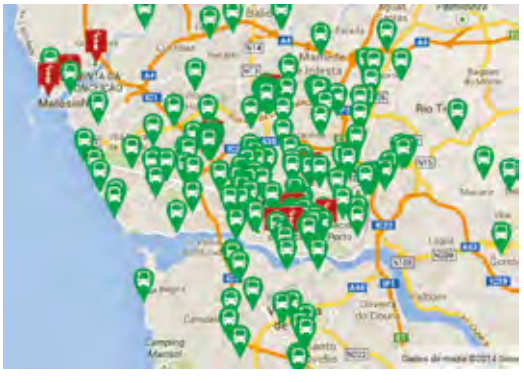
Together with the University of Porto, we developed a vehicular network in Porto, the BusNet, to provide a low-cost and large range communication support all over the city. The BusNet is a city-scale vehicular platform comprised of 400 connected buses, 25 municipality vehicles and 50 road-side units connected via WAVE/DSRC wireless vehicular technology (Figure 2), which currently provides Internet WiFi access to passengers in the buses in the city of Porto (more than 100 thousand users in 4 months, and 10000 users per day), and is able to gather large amounts of data from the transports, people and the city environment.
This work has a very high scientific level, since beyond the innovative technology, we have been building the network mechanisms required to build a moving network with optimal performance. This work has already resulted in more than 20 scientific international papers, and 20 PhD and MSc Theses.

This technology is being commercialized by a spin-off from UA/IT and UP, Veniam, which has been funded by International Venture Capitals to replicate the vehicular network in others cities in the world.

1 — Department of Electronics, Telecommunications and Informatics & IT, University of Aveiro

FIGURE 1
Mesh Network between Vehicles.

FIGURE 2
Network of Vehicles.



Planning and Dimensioning Multilayer Optical Transport Networks

Rui Manuel Morais[1,2,3], João Pedro[2,3], Paulo Monteiro[1,2], Armando Nolasco Pinto[1,2]

1 — Department of Electronics, Telecommunications and Informatics, University of Aveiro
2 — Telecommunications Institute
3 — Coriant Portugal

Network planning tools are important for both system vendors and network operators. In the budgeting and implementation stages, a planning tool offering a cost-optimized solution to the network operator can be decisive to the system vendor. After, in the operation stage, the planning tool can be used to re-optimize the available resources, bringing cost savings to network operators. Moreover, as new competing technologies are always being introduced, planning tools are also used to evaluate and compare the various alternatives before advancing to their manufacturing and market introduction. Nowadays, the manual and rule-of-thumb network planning strategies of the past are being replaced by sophisticated software tools.

Over the last few years, we have been actively involved in addressing issues related to the development of planning tools for multilayer transport networks, through a partnership with the worldwide system vendor Coriant. In the framework of this partnership, we succeeded to develop planning tools that, for the first time, take into consideration the various hardware implementation constraints.

As the first stage of the overall network planning process is the deployment of the network links, we started by proposing a genetic algorithm to design near optimal network topologies. After this initial stage, the nodes must be designed. Therefore, mathematical optimization models for the nodes dimensioning to be used in greenfield scenarios were developed. As several alternative architectures with different levels of flexibility are currently available, extensive comparative techno-economic analysis were performed focusing on the CapEx, power consumption, and footprint requirements. As a result, an optimization method for the node architecture was proposed. Simple rules and scenarios where a determined architecture brings advantage were identified. Then, when planning a network, we can quickly optimize the total network cost by selecting the architecture of each node accordingly. The last stage of the network planning process is the capacity optimization during operation. For this purpose, novel mathematical models enabling hitless re-grooming were developed. We also evaluated the savings attained by exploiting hitless re-grooming. Moreover, the traffic conditions where such savings are expected to be more substantial were highlighted. It was observed that the developed methods can assist in mitigating the impact of grooming limitations that arise when deploying more scalable architectures, bringing obvious cost savings.

The seismic vulnerability assessment of old building stocks as an effective seismic risk mitigation tool at the urban scale

Tiago Miguel Ferreira[1], Rui Maio[1], Romeu Vicente[1], Aníbal Costa[1]

The seismic risk management of old city centres is an important topic of today's societies. It is impossible to ignore the devastating effects of powerful recent earthquakes, which have affected millions of people and stressed the necessity of improving knowledge and resilience of our cities, particularly old city centres. The absence of a real risk policy limits the capacity for response and recovery after a disaster and therefore the understanding of risk factors is crucial for guaranteeing effective post-event responses.

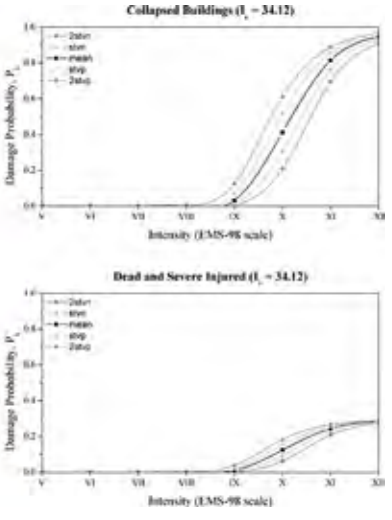
Among the many aspects that urban management and planning depend on, our research focuses on the vulnerability assessment of masonry buildings and mitigation of seismic risk in old city centres. Seismic vulnerability can be defined as an internal risk factor of a structure exposed to an earthquake and corresponds to its intrinsic predisposition to be damaged by earthquakes of defined intensity. The evaluation of structural safety conditions is often forgotten or undervalued in Portugal considered a seismic prone country, perhaps due to the absence of significant seismic activity during the recent decades, fact that has led to a lack of national risk management consciousness and preparedness.

To face this issue, a simplified seismic vulnerabi-lity assessment method has been developed and applied by this research team in several case stu-dies over the last years. The method is based on post-seismic damage observation and consists in the calculation of a vulnerability index that results from the weighted sum of 14 parameters, each of which representing a building feature that influence the seismic response of the building.

For large-scale risk assessment and management, these vulnerability results are then integrated into a geographic information system (GIS), wherein various modules can be developed for different tasks, including damage and loss estimation (such as collapsed buildings, human casualty and severely injured, unusable buildings, repair costs) for different earthquake intensities, allowing the construction of multiple damage and loss scenarios (see Fig. 1). This data, associated with GIS, can be updated periodically, revealing the utility of this type of tools and assessment methods for the management of the old building stock, allowing for both data storage and spatial analysis.

1 — Department of Civil Engineering & RISCO, University of Aveiro

FIGURE 1
Example of a damage scenario for a certain macroseismic intensity and probability curves for different loss outputs.
(a) Damage scenario spatial result using GIS.
(b) Probability of losses for different values of vulnerability.



Effective width method to account for the local buckling of steel thin plates at elevated temperatures

Carlos Couto[1], Paulo Vila Real[1], Nuno Lopes[1], Bin Zhao[2]

1 — Department of Civil Engineering & RISCO, University of Aveiro
2 — CTICM – Paris, France

Steel buildings are commonly composed of columns and beams, which constitute the structural members. Just like the skeleton of a human body these elements guarantee the stability of the whole building and therefore its safety. In the extreme event of a fire, it is fundamental that the security of the people is not compromised by evacuating them before the building collapses. For that purpose, fire safety rules exist influencing the columns and beams design. UA was one of the partners of the EU project FIDESC4 – "Fire Design of Steel Members with Welded or Hot-rolled Class 4 Cross-sections" that aimed at the development of safer and more economical design rules for steel buildings under fire situation. The authors, before studying the behaviour of columns and beams which are made of steel plates joined together to form the cross-section, focused on these smaller scale elements instead. If the ratio between the width and the thickness of the plates is high, they are considered slender (thin) plates (Class 4), and are susceptible to a local failure called local buckling and although it is a local problem it may affect the stability of the whole structure, thus justifying its investigation.

Analysing the behaviour of thin plates at high temperatures with the aid of computerized models made by the finite elements (see Fig. 1a), new analytical expressions were developed to assess their resistance against local buckling in fire. These new rules allow better prediction of the capacity of the plates at elevated temperature (see Fig. 1b), thus the structural elements and consequently the whole structure in fire. The new expressions were validated against fire tests on columns and beams, demonstrating to be accurate. The innovation on the proposed rules is that these developments allowed for a considerable gain in economic terms, demonstrating that it is possible to reduce the material needed for a steel building, with elements composed of thin plates, to resist a fire as required by regulations, replacing older methods that proved to be inadequate. The publishing of these rules in international peer-reviewed journal allowed for the scientific recognition of their merit and validity. Furthermore, in the future, it will be possible to include such rules in the European standards and legislations that govern the design of steel structures in case of fire.

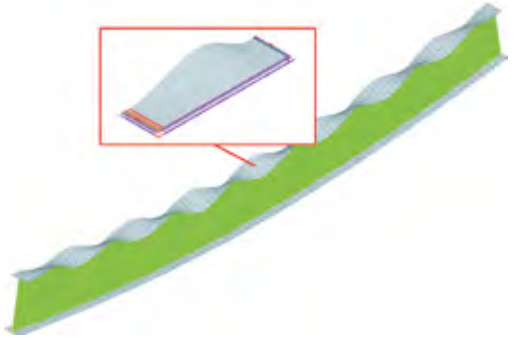


FIGURE 1
Computer model of structural member and smaller thin plate.

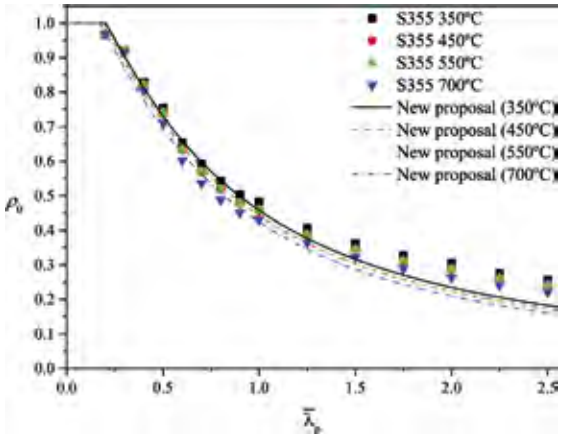


FIGURE 2
Example of the new proposal (lines) and comparison to computer results (points).

Critical analysis of the thermal conductivity models for CNT based nanofluids

Bruno Lamas[1], Bruno Abreu[1], A. Fonseca[1], N. Martins M.S.A. Oliveira[1]

Nanofluids are a new class of heat transfer fluids that use dispersed nanometre particles in conventional base fluids, with the appropriate size and volume fraction capable of inducing an anomalous enhancement in the effective heat transfer coefficient of the mixture. The literature abounds with studies on several nanoparticles to be used on nanofluids engineering. Among those, carbon nanotubes are continuously referred to as the most promising nanoparticle as to thermal properties are concerned. Despite that, these nanoparticles apparently seem to be the ones gathering less attention from researchers since little experimental and theoretical studies can be found. The latter might be explained by the difficulty encountered in modelling some of the mechanisms observed in these particular systems. In this paper, an exhaustive critical analysis to the predictive models currently available for thermal conductivity of carbon nanotubes based nanofluids is presented. To this end, a statistical analysis of the different models available was carried out and it enabled to select specific nanofluid variables as control factors namely particle geometry, volume fraction, temperature and base fluid. The statistical study undertaken highlighted a lack of confidence on the models available since there is no convergence on the results. The latter seems to occur due to poor quality data, resulting in limited generic models. Therefore, this study revealed that more parametric experimental analysis must be given to specific control factors, namely carbon nanotubes length and volume fraction (see Fig. 1), since this seems to present higher contribution to the analytical results.

1 — Department of Mechanical Engineering & TEMA, University of Aveiro

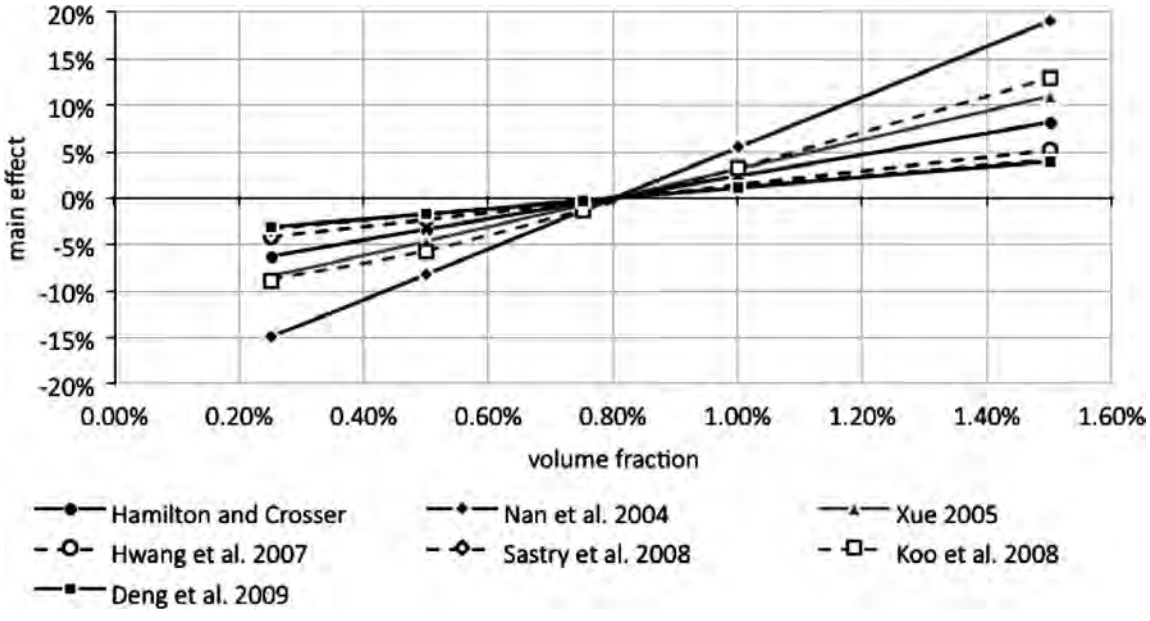


FIGURE 1
Main effect of the CNT volume fraction for the different predictive models analysed.

Can hydrogen or natural gas be alternatives for aviation? – A life cycle assessment

Sérgio R. Pereira[1], Tânia Fontes[1], Margarida C. Coelho[1]

1 — Department of Mechanical Engineering & TEMA, University of Aveiro

The main objective of this research was to evaluate promising alternative fuels in the aviation sector using Life Cycle Assessment (LCA) approach. Liquid natural gas (LNG) and liquid hydrogen ($L.H_2$) produced by different sources were compared with jet fuel A. Steam reforming (SMR) and the electrolysis with electricity from renewable sources (wind, photovoltaic and hydro energy) were considered in the $L.H_2$ production.

Energy consumption and pollutant emissions from the production of the renewable and non-renewable technologies were evaluated, which means that all stages of LCA were considered. Figure 1 presents the main steps of this methodology. In Well-to-Pump (WTP) and Pump-to-Wake (PTW) analysis the Model for Life Cycle Assessment for Hydrogen ($MACV2H_2$_v2.0) was used. This model is the second version of a numerical platform developed by Pereira and Coelho.

Figure 2 presents the energy consumption for the WTW approach for all considered aircrafts in the two flights type (short-range and long-range), also considering the aircraft capacity. Hydrogen is presented as a very competitive solution with respect to energy consumption and environmental costs. Even $L.H_2$ produced by fossil energy sources (SMR) and applied to aircrafts has 8% lower energy consumption than the same aircraft with jet fuel A. The best solution comes from renewable energy sources for hydrogen production. $L.H_2$ obtained by electrolysis with electricity from hydro energy and applied to the aircrafts allows a reduction in environmental costs between 51% and 60% (depending on the type of aircraft and flight) in relation to the same aircraft with jet fuel A. For energy consumption the reduction is 19%. Furthermore, $L.H_2$ from hydro energy presents 80% and 84% less fossil fuel consumption than jet fuel A and LNG, respectively.

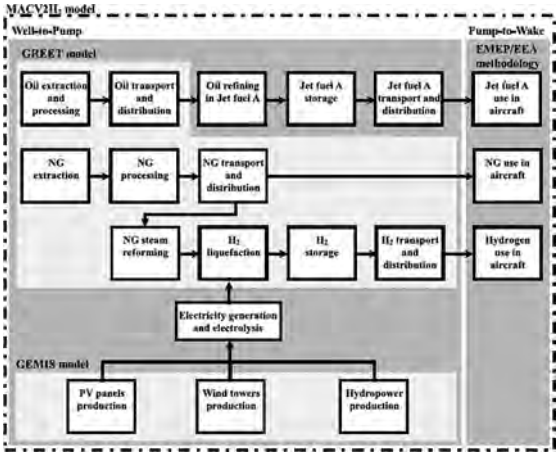


FIGURE 1
Methodological framework in the well-to-wake approach for aviation.

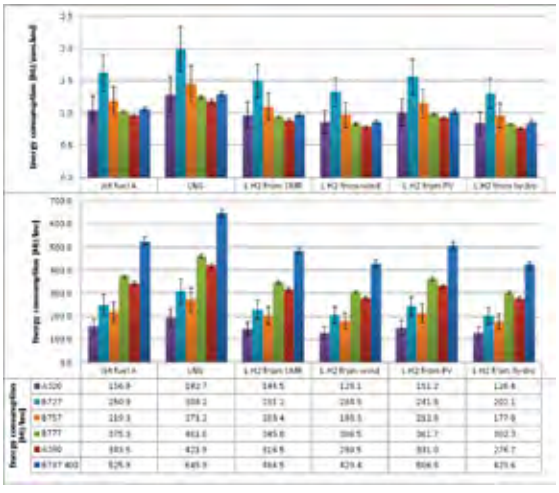
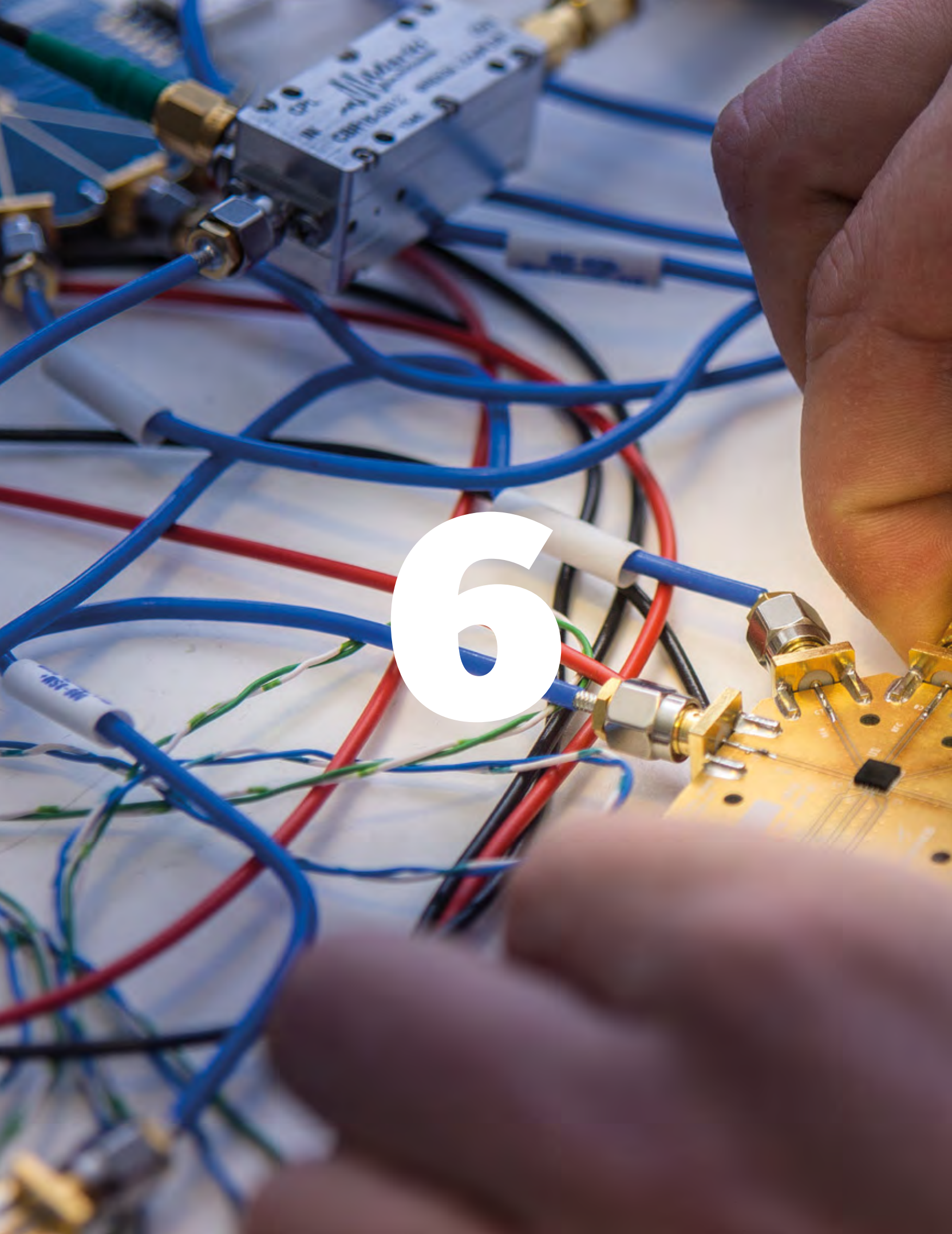


FIGURE 2
Energy consumption (MJ/km and MJ/pass.km), for short and long-range aircrafts, using WTW approach.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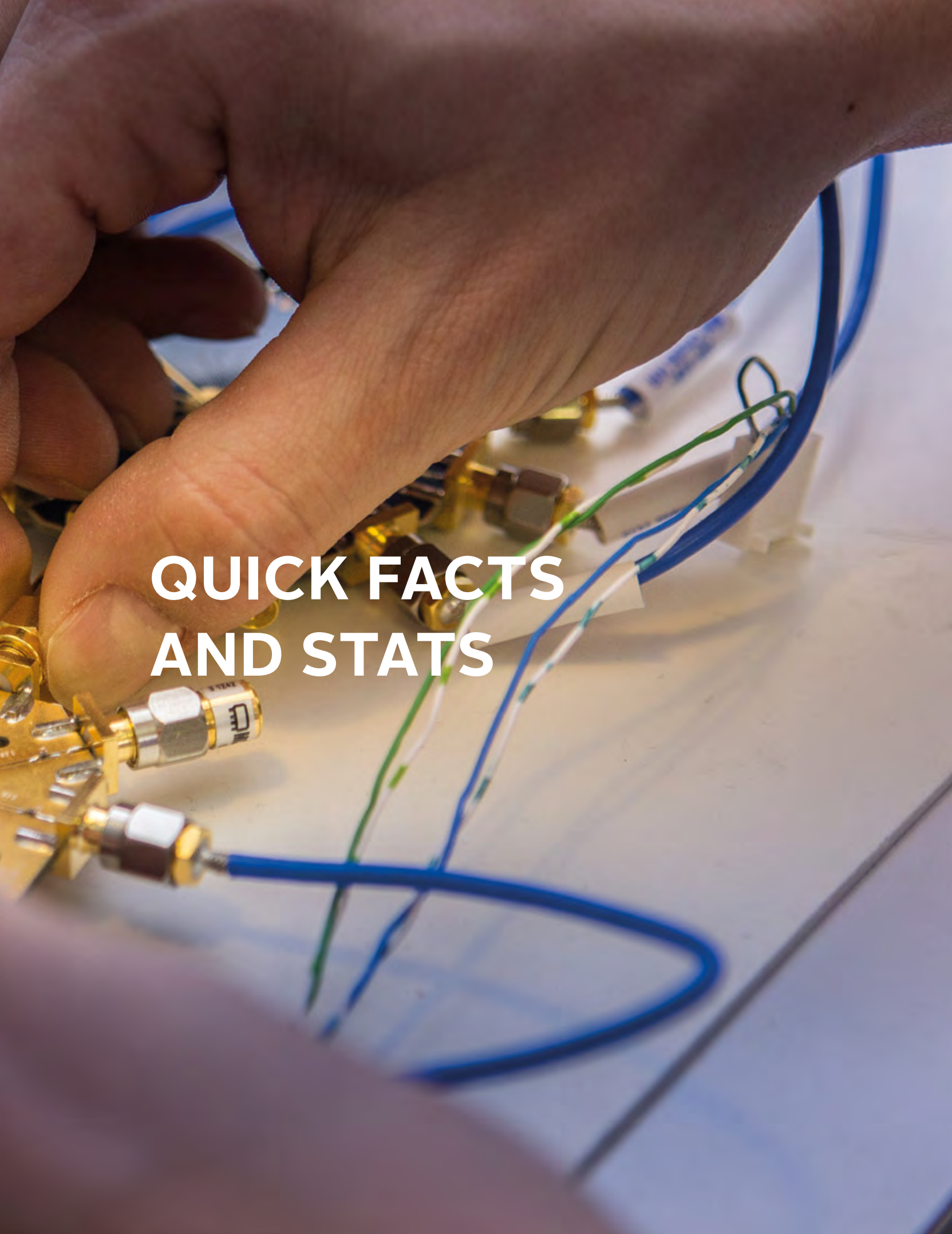


QUICK FACTS AND STATS

People

FACULTY BY DEPARTMENT

	FACULTY (FTE)			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2013**	**2014**		
Department of Environment and Planning	19	18	56%	
Department of Biology	32,7	33	43%	
Department of Social Sciences, Policy and Planning	25,4	25	26%	
Department of Communication And The Arts	73,2	72	33%	5%
Department of Economics, Management and Industrial Engineering	55,4	56	59%	3%
Department of Education	37,4	38	75%	
Department of Electronics, Telecommunications and Informatics	79,3	78	8%	1%
Department of Civil Engineering	17,6	16	19%	
Department of Materials Engineering and Ceramics	17	17	46%	2%
Department of Mechanical Engineering	27	26	11%	
Department of Physics	46,3	44	16%	7%
Department of Geosciences	13,5	14	37%	
Department of Languages and Cultures	44,2	44	61%	25%
Department of Mathematics	58,4	59	47%	10%
Department of Chemistry	46,3	45	52%	
Department of Health Sciences	13,9	15	60%	16%
POLITECHNIC SCHOOLS				
School of Design, Management and Production Technologies of Aveiro North	14	14	39%	
School of Health of the University of Aveiro	38,9	37	59%	
Águeda School of Technology and Management	46,9	48	45%	
School of Accounting And Administration of Aveiro	69,3	70	51%	
TOTAL	775,7	769	42%	4%

RESEARCHERS BY DEPARTMENT

	RESEARCHERS (FTE)			
DEPARTMENT	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
University	**2013**	**2014**		
Department of Environment and Planning	21	28	64%	36%
Department of Biology	86,8	87	72%	14%
Department of Social Sciences, Policy and Planning	4			
Department of Communication and the Arts	1	2	50%	50%
Department of Economics, Management and Industrial Engineering	2	1		
Department of Education	19	14	100%	7%
Department of Electronics, Telecommunications and Informatics	18	20	20%	30%
Department of Civil Engineering		2	50%	
Department of Materials Engineering and Ceramics	46,2	47,5	34%	52%
Department of Mechanical Engineering	24,4	28,4	42%	61%
Department of Physics	48,8	49	33%	35%
Department of Geosciences	11	9	67%	22%
Department of Mathematics	10	10	40%	60%
Department of Chemistry	116,5	114,5	64%	23%
Department of Health Sciences		2	100%	
Total	408,7	414,4	54%	33%

STAFF BY CATEGORY

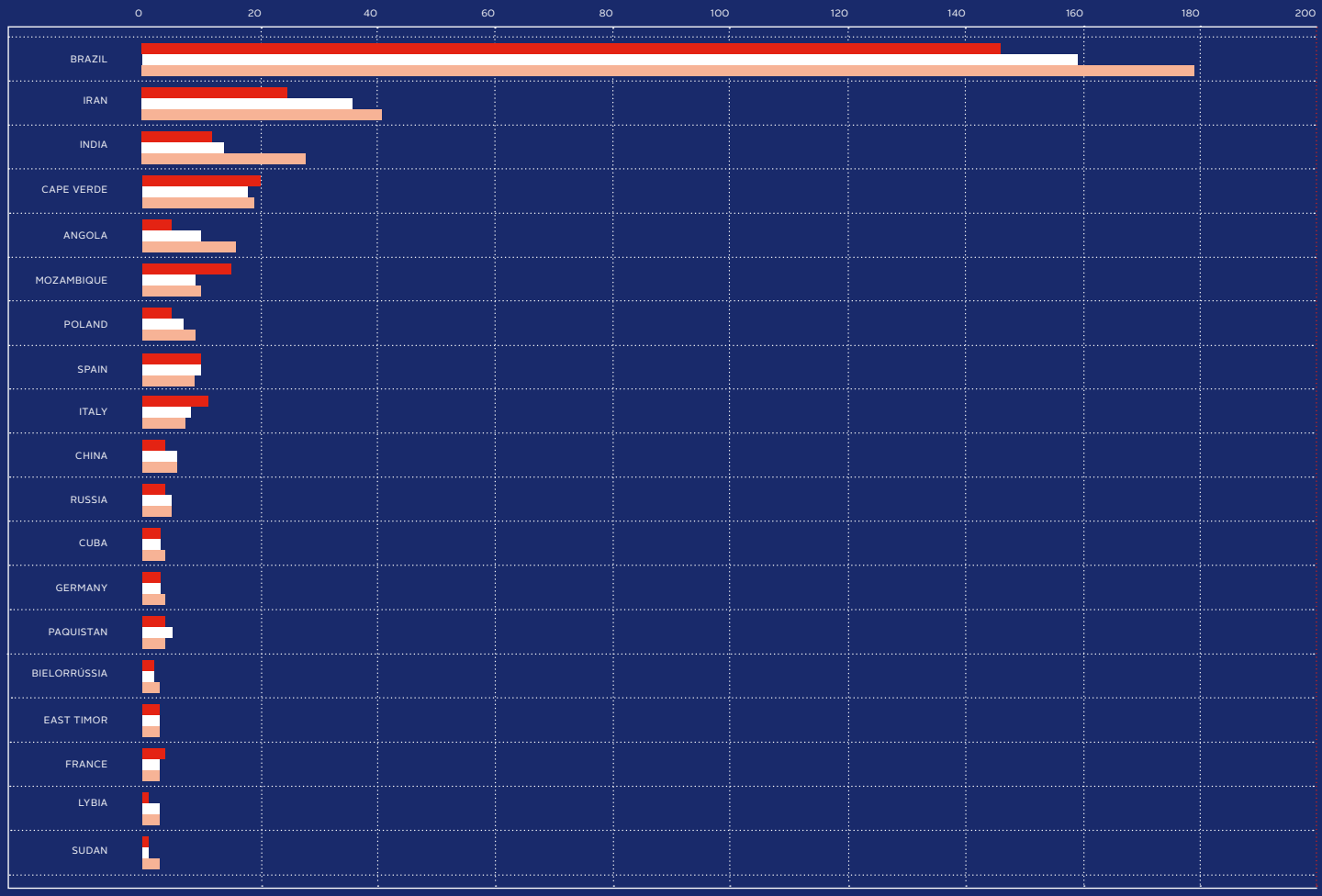
	FACULTY (FTE)			
CATEGORY	2013	2014		
UNIVERSITY	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
Full professors	54,3	53,3	10%	4%
Associate professors	116	119,9	38%	2%
Assistant professors	368,1	371,7	43%	4%
Lecturer	80,2	65,9	42%	2%
Other teaching staff	14,2	16,0	69%	50%
Researchers	114,7	96,4	46%	33%
Post-doctoral students	294	318,0	58%	29%
POLITECHNIC SCHOOLS				
Coordinator professors	11,6	13,6	37%	
Adjunt professors	94,2	95,0	49%	
Lecturer equivalent	37,1	33,6	56%	
TOTAL	1184,4	1183,4	46%	13%

PHD STUDENTS BY DEPARTMENT

	PHD STUDENTS				
UNIVERSITY	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS	PERCENTAGE OF NEW STUDENTS
DEPARTMENT	2012 / 2013	2013/2014			
Department of Environment and Planning	89	85	68%	24%	16%
Department of Biology	153	169	77%	22%	22%
Department of Social Sciences, Policy and Planning	19	31	58%	6%	48%
Department of Communication and the Arts	254	246	49%	27%	19%
Department of Economics, Management and Industrial Engineering	198	200	53%	28%	27%
Department of Education	233	235	77%	15%	24%
Department of Electronics, Telecommunications and Informatics	162	158	12%	29%	19%
Department of Civil Engineering	44	50	26%	22%	28%
Department of Materials Engineering and Ceramics	78	84	43%	39%	19%
Department of Mechanical Engineering	71	72	40%	22%	21%
Department of Physics	87	119	43%	15%	38%
Department of Geosciences	15	26	62%	19%	42%
Department of Languages and Cultures	68	61	70%	30%	28%
Department of Mathematics	31	32	75%	28%	19%
Department of Chemistry	114	129	74%	14%	22%
Department of Health Sciences	86	94	71%	4%	21%
TOTAL*	1535	1605	57%	23%	23%

* The students of joint doctoral studies are considered in each participating department. Therefore, the sum of the students by department is superior to the total.

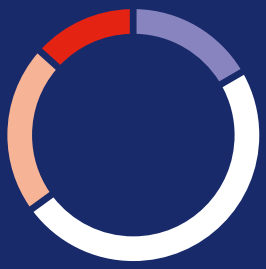
FOREIGN PHD STUDENTS BY NATIONALITY*



* 20 countries with the highest number of PhD students in UA of a total of 62 countries

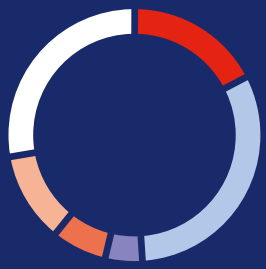
MSc and PhD theses

FOREIGN PHD STUDENTS BY CONTINENT



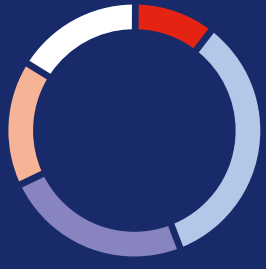
- Europe (13%)
- Africa (17%)
- Asia (22%)
- America (48%)

MSC THESES IN 2014 PER AREA



- Arts and Humanities (17%)
- Social Sciences (28%)
- Exact Sciences (5%)
- Health Sciences (7%)
- Life Sciences (11%)
- Engineering and Technology (32%)

PHD THESES IN 2014 PER AREA



- Arts and Humanities (11%)
- Social Sciences (16%)
- Exact Sciences (24%)
- Engineering and Technology (33%)
- Life Sciences (16%)

Sci Papers

TOP 10 SUBJECT AREAS FOR PAPERS PUBLISHED IN 2014	RECORD COUNT	% OF 1716
Chemistry	348	20,28%
Engineering	276	16,08%
Physics	215	12,53%
Environmental Sciences Ecology	210	12,24%
Materials Science	207	12,06%
Science Technology Other Topics	81	4,72%
Mathematics	78	4,55%
Computer Science	76	4,43%
Biochemistry Molecular Biology	69	4,02%
Marine Freshwater Biology	69	4,02%

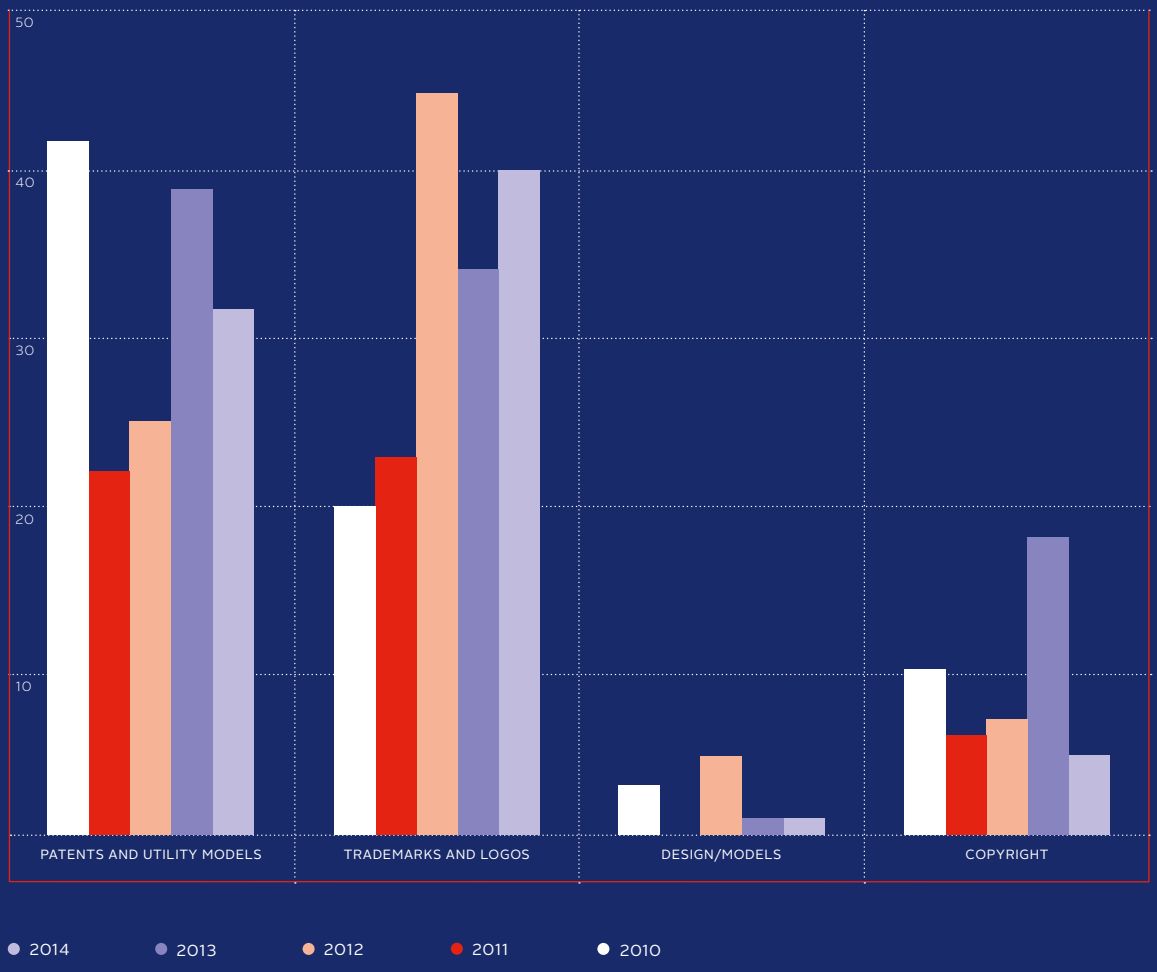
Data retrieved from ISI Web of KnowledgeSM (Thomson Reuters) in 10 april 2015

TOP 10 CITED PAPERS	TOTAL Nº CITATIONS (2010 - 2014)
Rocha, Joao; Carlos, Luis D.; Almeida Paz, Filipe A.; et al (2011). Luminescent multifunctional lanthanides-based metal-organic frameworks. CHEMICAL SOCIETY REVIEWS, 40: 926-940	416
Pohl, Randolf; Antognini, Aldo; Nez, Francois; et al (2010).The size of the proton. NATURE, 466: 213-216	304
Price, Nathan L.; Gomes, Ana P.; Ling, Alvin J. Y.; et al (2012).SIRT1 Is Required for AMPK Activation and the Beneficial Effects of Resveratrol on Mitochondrial Function. CELL METABOLISM, 15: 675-690	206
Almeida Paz, Filipe A.; Klinowski, Jacek; Vilela, Sergio M. F.; et al(2012).Ligand design for functional metal-organic frameworks. CHEMICAL SOCIETY REVIEWS, 41: 1088-1110	191
Carlos, Luis D.; Ferreira, Rute A. S.; Bermudez, Veronica de Zea; et al (2011).Progress on lanthanide-based organic-inorganic hybrid phosphors. CHEMICAL SOCIETY REVIEWS, 40: 536-549	169
Gandini, Alessandro (2011). The irruption of polymers from renewable resources on the scene of macromolecular science and technology. GREEN CHEMISTRY, 13: 1061-1083	152
Jeffery, S.; Verheijen, F. G. A.; van der Velde, M.; et al (2011).A quantitative review of the effects of biochar application to soils on crop productivity using meta-analysis. AGRICULTURE ECOSYSTEMS & ENVIRONMENT, 144: 175-187	151
Freire, Mara G.; Neves, Catarina M. S. S.; Marrucho, Isabel M.; et al (2010).Hydrolysis of Tetrafluoroborate and Hexafluorophosphate Counter Ions in Imidazolium-Based Ionic Liquids. JOURNAL OF PHYSICAL CHEMISTRY A, 114: 3744-3749	150
Paz, FAA; Klinowski, J; Vilela, SMF; Tome, JPC; Cavaleiro, JAS; Rocha, J (2012). Ligand design for functional metal-organic frameworks. CHEMICAL SOCIETY REVIEWS, 41: 1088-1110	120
Price, NL; Gomes, AP; Ling, AJY; Duarte, FV; Martin-Montalvo, A; North, BJ; Agarwal, B; Ye, L; Ramadori, G; Teodoro, JS; Hubbard, BP; Varela, AT; Davis, JG; Varamini, B; Hafner, A; Moaddel, R; Rolo, AP; Coppari, R; Palmeira, CM; de Cabo, R; Baur, JA; Sinclair, DA (2012). SIRT1 Is Required for AMPK Activation and the Beneficial Effects of Resveratrol on Mitochondrial Function. CELL METABOLISM, 15: 675-690	118

Data retrieved from ISI Web of KnowledgeSM (Thomson Reuters) in 2 may 2014

INTELLECTUAL PROPERTY RIGHTS REGISTRATION

	2010	2011	2012	2013	2014
Patents and Utility Models	42	22	25	39	32
Trademarks and Logos	20	23	45	34	40
Design/Models	3	0	5	1	1
Copyright	10	6	7	18	4



International Projects

EU-FUNDED PROJECTS STARTED IN 2014

EUROPEAN RESEARCH COUNCIL (ERC) GRANTS	ACRONYM	PROJECT COORDINATOR
Igy Technology: A Purication Platform using Ionic-Liquid-Based Aqueous Biphasic Systems	IgyPurTech	Mara Guadalupe Freire Martins

SEVENTH FRAMEWORK PROGRAMME	ACRONYM	PROJECT COORDINATOR
Towards natural Interation and Communication - IRIS	IRIS	António Joaquim da Silva Teixeira
Active PROtection of multi-material assemblies for AIRcrafts	PROAIR	Silvar Kallip
Social Enterprise as Force for more Inclusive and Innovative Societies	SEFORIS	Marlene Paula Castro Amorim

HORIZON 2020	ACRONYM	PROJECT COORDINATOR
Science@Aveiro, General public and researchers - Closing the Gap	Science@Aveiro	Pedro Miguel Marques Pombo

LIFE+	ACRONYM	PROJECT COORDINATOR
Environmental impacts on bacterial ecology of bacteriophage use in aquaculture	ENVIPHAGE	Maria Adelaide de Pinho Almeida

ERASMUS+	ACRONYM	PROJECT COORDINATOR
Euro4Science: Exploring 'CSI Effect' and Forensic Sciences to boost the appeal of science to young people and reinforce interdisciplinarity in European high schools	EU4SCI	Luís Manuel Souto de Miranda

ERASMUS+	ACRONYM	PROJECT COORDINATOR
More entrepreneurial life at European schools	MELES	Tatiana Tchemisova Cordeiro
Educational Advancement of ICT-based spatial Literacy in Europe	ENABLE	António Augusto de Freitas Gonçalves Moreira
Social Entrepreneurship Support Europe	SES EU	Marlene Paula Castro Amorim

NETWORK OF EUROPEAN UNIVERSITIES 2014

EU PROJECTS

BELGIUM (SEFORIS)
FINLAND (GEOSULF; NANOMFC)
GERMANY (MELES; ENABLE; SEFORIS; PROAIR)
GREECE (MELES)
ITALY (SES EU)
NORWAY (NANOMFC)
POLAND (GEOSULF; NANOMFC; MELES)
SPAIN (ENABLE; IRIS; SEFORIS)
SWEDEN (SEFORIS)
TURKEY (IRIS)
UNITED KINGDOM (SEFORIS)

EU projects without academic partners besides UA: EU4SCI; ENVIPHAGE; Science@Aveiro; Igy Technology

PUBLICATIONS (ISI)

1-6 7-13 14-20 21-27

Budget

TOTAL BUDGET BY RESEARCH CENTRE AND FUNDING AGENCY*

RESEARCH CENTRE	EUROPEAN UNION	FOUNDATION FOR SCIENCE AND TECHNOLOGY	INNOVATION AGENCY	OTHER NATIONAL	2013	2014
CBC					456.340	
CESAM	161.429	349.301	162.313	826.704	4.492.142	1.499.747
CICECO	1.565.550	833.476	742.420		3.603.227	3.141.446
CIDMA	49.342	43.619			73.044	92.961
CIDTFF	62.245				342.420	62.245
CINTESIS				38.037		38.037
GEOBIOTEC					9.000	
GOVCOPP	182.814					182.814
I3N		41.285	158.213		2.059.222	199.498
iBi-MED		53.060				53.060
ID+					136.360	
IEETA	47.392	190.717		64.015	2.043.250	302.124
INET-MD					183.811	
IT	513.235	1.118.326	419.287		2.969.304	2.050.848
Not integrated	165.001	39.899		201.320	3.569.766	406.220
QOPNA		168.089	244.902		2.055.269	412.991
TEMA		192.970			707.262	192.970
TOTAL	**2.747.008**	**3.030.742**	**1.727.134**	**1.130.077**	**22.700.416**	**8.634.960**

*Contracts with industry not included

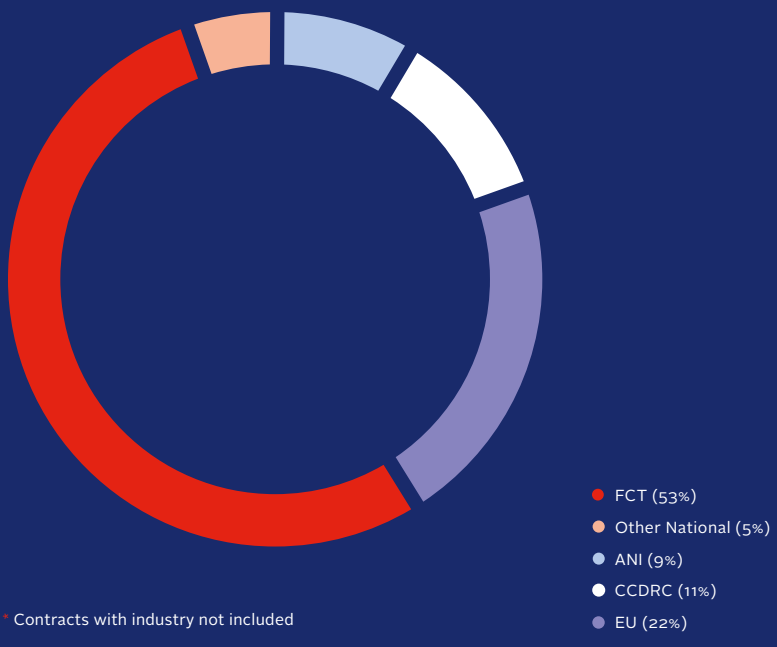
APPROVED BUDGET UNDER EU-FUNDED PROJECTS

EUROPEAN PROGRAMMES	2013	2014
FP7 - COOPERATION	3.043.713	632.469
FP7 - PEOPLE	566.716	226.922
FP7 - IDEAS		1.386.020
H2020		77.225
IMI-JU	779060	
ERASMUS +		262943
INTERREG - SUDOE	69.388	
LIFE+		161429
LIFELONG LEARNING	36.048	
POCTEP	136640	
TOTAL	**4.631.565**	**2.747.008**

APPROVED BUDGET UNDER FCT PROJECTS

RESEARCH CENTRE	ARTS, HUMANITIES AND SOCIAL SCIENCES	ENGINEERING	SCIENCES	2013	2014
CBC				456.340	
CESAM			349.301	2.431.183	349.301
CICECO			833.476	1.099.784	833.476
CIDMA			43.619	61.344	43.619
CIDTFF				220.052	
GEOBIOTEC				5.160	
iBi-MED	3.060		50.000		53.060
I3N			41.285	806.001	41.285
ID+				136.360	
IEETA		190.717		254.711	190.717
INET-MD				183.811	
IT		1.118.326		1.124.771	1.118.326
Not integrated	39.899			355.148	39.899
QOPNA			168.089	347.506	168.089
TEMA		142.970	50.000	343.181	192.970
TOTAL	**722.611**	**1.969.328**	**5.133.413**	**7.825.353**	**3.030.742**

DISTRIBUTION OF RECEIVED FUNDS, BY FUNDING AGENCY*



* Contracts with industry not included


7

RESEARCH SUPPORT

Support for researchers

The University of Aveiro (UA) aspires to become one of the foremost research organizations in Europe and a major player in the construction of the European Research Area and strongly encourages its researchers to create ties with their colleagues in European countries, by responding jointly to calls for proposals for international funding programs.

The Research Support Office (GAI) provides UA researchers with help in the development and implementation of international research projects, either in the preparatory phase, during the submission or with the management of European research activities, working closely with the Office of Financial Management of Programs and Projects, responsible for the monitoring and economic-financial management of the projects.

It provides researchers via email, webpage and Facebook publications with up-to-date information on research programs and fellowship programs. Furthermore, it continuously screens and scans specific calls and events, offers one-to-one coaching and support of proposal preparation and project management and is responsible for the organization of information events, among others.

Regarding dissemination of UA research activity, the initiative "Researcher of the Month" is promoted by the Research Support Office, aiming at enhancing high-level research developed at UA and the responsible researcher, both internally to the academy and to an external audience via website and social network. The edition of the the Research@UA magazine is also coordinated by the Research Support Office and serves as a vehicle of promotion of the interdisciplinary research on campus.

universidade de aveiro theoria poiesis praxis

www.ua.pt/research

Universidade de Aveiro
Campus Universitário de Santiago
3810 - 193 Aveiro
Portugal

tel (+351) 234 370 200
fax (+351) 234 370 985
email research@ua.pt