

Research Unit

FACULTY OF SCIENCES
& TECHNOLOGY
UNIVERSITY OF COIMBRA



MARE

Centro de Ciências do Mar e Ambiente

Marine and Environmental Sciences Centre

Coordinator

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MARE - Centro de Ciências do Mar e do Ambiente (MARE - Marine and Environmental Sciences Centre) is a Centre for research, technological development and innovation, with an integrative and holistic approach, concentrating a wide diversity of expertise, skills, and capabilities, with a nationwide territorial implementation, that develops its activities oriented to societal challenges, in close partnership with national and international research centres. MARE combines expertise allowing approaching scientifically and technologically all types of aquatic systems, from river basins and associated landscapes, to estuaries, coastal ecosystems, the open-ocean, on a context of global and regional changes and cumulative anthropogenic impacts.

MARE centre is based at Universidade de Coimbra, Universidade de Lisboa, ISPA - Instituto Universitário - Lisboa, Universidade de Évora, Universidade Nova de Lisboa, Instituto Politécnico de Leiria and Agência Regional para o Desenvolvimento da Investigação,

Tecnologia e Inovação - Madeira. MARE has five fully equipped marine research stations, two Research Infrastructures Networks in Environment Sciences and three Entrepreneurship infrastructures for knowledge transfer:

MARE was classified as Excellent R&D Unit by Fundação para a Ciência e a Tecnologia (FCT), the national funding agency for science, technology and innovation. MARE is organized in two ecosystem-oriented research groups and integrates seven research thematic lines, supported by one or both research groups.

Research groups:

- River Basins
 - Coastal Systems and Ocean
- Research thematic lines:
- Aquaculture and Fisheries
 - Biodiversity and Ecosystem Functioning;
 - Biotechnology and Resources Valorisation;
 - Environmental Risk;
 - Governance and Literacy;
 - Hydraulics, Hydrology and Sedimentary Environments;
 - Technological Tools for Exploration and Monitoring.

MARE comprises 517 researchers of which 255 with PhD, 49 technicians and administrative collaborators. In the last 3 years, on average 25 PhD works per year were successfully concluded in the Centre, while MARE researchers published an average of 350 articles per year in SCI journals. An average number of 100 active projects in each year funded research activities.

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CFE

**Centro de Ecologia Funcional -
Ciência para as Pessoas e para o Planeta**

Centre for Functional Ecology - Science for People & the Planet

Coordinator

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The Centre for Functional Ecology - Science for People & the Planet (CFE) is a R&D unit hosted by the Department of Life Sciences of the Faculty of Sciences and Technology of the University of Coimbra that brings together researchers from all fields of ecology, integrating knowledge from genes to the biome level to disentangle the mechanisms responsible for biodiversity maintenance, and for the composition, structure and functioning of biological communities and ecosystems. CFE holds a strong commitment to knowledge transfer to the general public and to the productive sector, with emphasis on the sustainability of territories and local communities.

CFE is composed by 245 researchers (88 integrated researchers with PhD) organized in 6 strategic research groups:

- Terrestrial Ecosystems and Global Change; Biodiversity, Conservation and Ecosystem Services;
- Marine and Coastal Ecosystems;
- Soil and Freshwater Stress Ecology;
- Forensic Anthropology and

Paleobiology; and Societies and Environmental Sustainability.

In addition, CFE inscribes two cross-cutting thematic lines: the UNESCO Chair on Biodiversity Safeguard for Sustainable Development and the Open Science.

The CFE's strategy is to consolidate a highly positive trajectory of the overall performance of the R&D unit, both scientifically and formatively. The vibrant research dynamic achieved in the past, the incorporation of highly qualified researchers with strong international dimension, the number and quality of published articles and of approved projects, the established synergies with the private sector, and the participation of CFE researchers in international networks, including support in decision making, sustain a greater affirmation of CFE nationally and internationally.

With ecology being the scientific matrix of CFE, with research focused in the fields of global change, water and food management, protection of the oceans, biodiversity, ecosystem services, among other, CFE researchers are compelled to pursue a great commitment towards sustainable development, in a concerted, transdisciplinary, transnational and translational vision, supported by knowledge sharing and open science, and fully embodying the UN 2030 Agenda for Sustainable Development.

For all the above, the mission of CFE is to continue to push the boundaries of knowledge across all areas of Ecology and its interfaces with technology and society, with a permanent commitment to produce state-of-the art science for improving the livelihoods of people and for the protection of the environment in a truly Science for People & the Planet.

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CEMMPRE

Centro de Engenharia Mecânica, Materiais e Processos

*Centre for Mechanical Engineering Materials
and Processes*

Coordinator

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The CEMMPRE - Centre for Mechanical Engineering, Materials and Processes (ex-CEMUC- Centre for Mechanical Engineering of the University of Coimbra) is an interdisciplinary R&D Research Unit of the Foundation for Science and Technology and currently comprises 74 integrated researchers with PhD degree, 63 integrated members without PhD and 25 collaborators, working on fundamental and applied research in Mechanical and Materials Engineering, and other related areas such as Industrial Innovation, Robotization and Production Transformation.

CEMMPRE has as its policy the cooperation between universities and research centres with the business sector and society in general, promoting innovation, the dissemination of scientific and technological knowledge, advanced training, and strategies for regional, national and international development. The relationships between CEMMPRE and other institutions, such as Instituto Pedro Nunes - IPN, have led to stimulating new ideas for new materials,

technologies, prototypes and products to be directly transferred to enterprises, mainly through its laboratories "LED&Mat" and "Electrochemistry and Corrosion", headed by researchers from CEMMPRE.

CEMMPRE is organized into two scientific groups: Mechanical and Intelligent Manufacturing, and Materials and Processes. The research activity of CEMMPRE takes societal and social policy issues into account and is aligned with the four innovation platforms of Research and Innovation Strategies for Smart Specialisation (RIS3) of the central region of Portugal, that interact with its different areas of research on Intelligent Manufacturing; Design & Testing, Surface and Interface Engineering, Nanomaterials and Nanotechnology, Bioengineering, and Advanced Sensor Systems (keywords of CEMMPRE).

CEMMPRE's main objectives for the next 5 years are:

- Pursue research with regional, national and international impact and participate in international infrastructures and networks;
- Increase the number of undergraduate and graduate research grant opportunities;
- Contribute to the employment of highly-qualified scientists in Portugal;
- Increase the scientific indicators up to 2022, dissemination based on the concepts of Open Science, Open Innovation, and Openness to the World;
- Build and maintain shared research facilities and equipment.

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CFisUC

Centro de Física da Universidade de Coimbra

Centre for Physics of the University of Coimbra

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CFisUC is a research centre of the University of Coimbra committed to excellence in Physics. CFisUC research is focused on multidisciplinary and transdisciplinary topics, covering a wide range of areas in Physics: from Particle and Nuclear Physics, to Condensed Matter, Nano and Applied Condensed Matter Physics, Biological Physics, Astrophysics, and Teaching and History of Physics.

CFisUC is also strongly committed to High Performance Computing at a national and European level. It profits from excellent experimental and computational equipment and has access to large scale facilities (ESRF, ILL, ISIS, PSI).

CFisUC has established a large number of important international collaborations.

CFisUC research activities are organised in four working groups:

- Hadron Physics and Fundamental Interactions with Quantum Chromodynamics (QCD), Neutron Stars and Fundamental Interactions as main interests;
- Multifunctional Materials, with a focus on Electronic and Magnetic Structure of Molecules, Clusters, Surfaces and Solids;
- Chemical and Applied Condensed Matter Physics;
- Soft and Biological Matter and three transfer and outreach groups:
- Physics Education and Science Outreach;
- Physics in World Heritage
- Physics for Industry

Members of CFisUC represent Portugal in PRACE (Partnership for Advanced Computing in Europe) and in several COST Actions.

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CGeo

Centro de Geociências da Universidade de Coimbra

Geosciences Center of the University of Coimbra

Coordinator

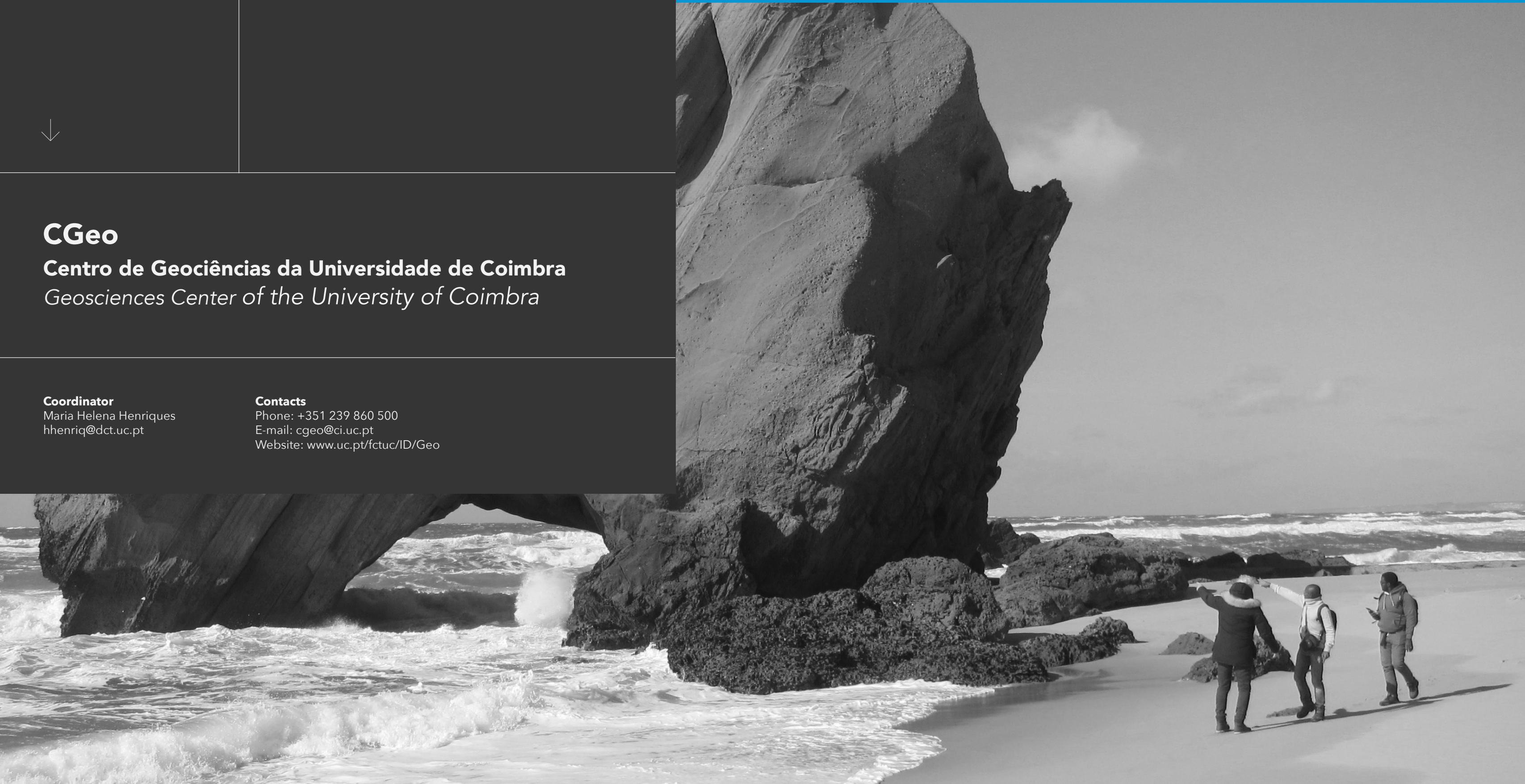
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CGeo is a R&D unit of the Faculty of Sciences and Technology of the University of Coimbra (FCTUC) since 1992. Created in 1976 at INIC (National Institute of Scientific Research), the CGeo is a consortium gathering the University of Coimbra (UC), the University of Trás-os-Montes e Alto Douro (UTAD), the Polytechnic Institute of Tomar (IPT) and the Earth and Memory Institute (ITM).

CGeo aims at targeting the identification and characterisation of energy and mineral resources, as well as their transformation and use, and understanding of Human related adaptive strategies.

It is currently organised into 3 research groups dealing with:

- Resources exploration, in academic research on sedimentary basins and collaborative projects with the oil industry (Fossil Energy and Sustainable Development);
- Engineering geology developments, study and engineering use of natural

materials, management of the geological environment and multi risk assessment (Geotechnology);

- Past adaptations in lower complexity societies, namely studying processes of adaptation and innovation relating resources and technologies knowledge and availability (Quaternary and Prehistory).

The CGeo is a multidisciplinary unit and integrates 113 members including senior scientists and Master and PhD students whose activities are supported by Brazilian, European and Portuguese research institutions and by industry projects through financial contributions, grants and contracts.

In the 2014 units' assessment initiative, conducted by a European committee, the CGeo was the best classified R&D unit in the earth sciences domain at national level, reaching the grade "Excellent".

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CISUC

Centro de Informática e Sistemas da Universidade de Coimbra

Centre for Informatics and Systems of the University of Coimbra

Coordinator

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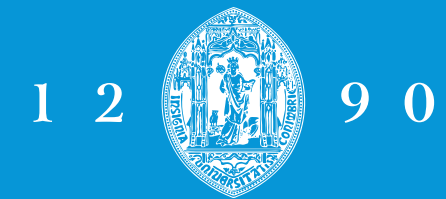
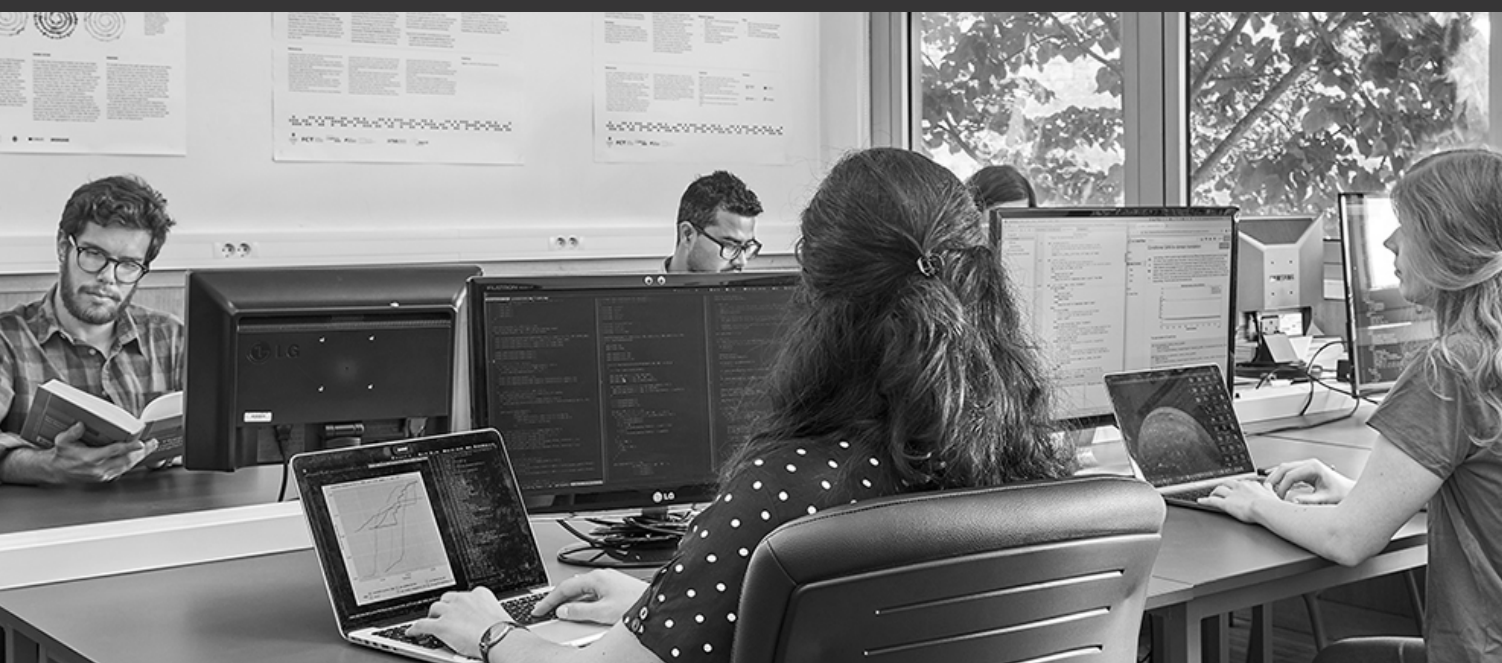
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The Center of Informatics and Systems of the University of Coimbra (CISUC) is a dynamic and multidisciplinary R&D unit, comprising 150 researchers. With a solid background in computer science, computer engineering and communication technologies, CISUC aims to conduct pre-competitive R & D by training young highly qualified researchers, collaborating in national and international projects and programs, and promoting the dissemination of results through contracts with different companies.

It is organized in 6 groups: Cognitive and Multimedia Systems (CMS), Adaptive Computing (CA), Systems and Software Engineering (SSE), Communications and Telematics (CT), Information Systems (IS) and Complex Evolutionary Systems).

To foster cohesion, gain critical mass and promote synergies, the groups are clustered into 3 thematic lines: Resilient Software and Internet Services (SSE, CT, IS), which focuses on Internet architectures and technologies, cloud infrastructures and service-oriented software and architecture services; Intelligent Systems (AC, CMS, ECOS), focused on the development of computational methodologies for research, optimization, learning and visualization; Human Centric Computing (IS, CMS) encompasses emerging extensions of human capabilities and organizational models. In support of its mission of excellence,

CISUC establishes the following strategic priorities:

1. Elevate its research
2. Improve its recognition
3. Energize its education and training
4. Engage its stakeholders
5. Explore its research outcomes

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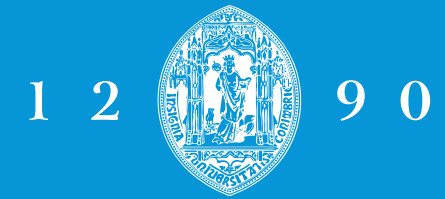
CITEUC

**Centro de Investigação da Terra e do Espaço
da Universidade de Coimbra**

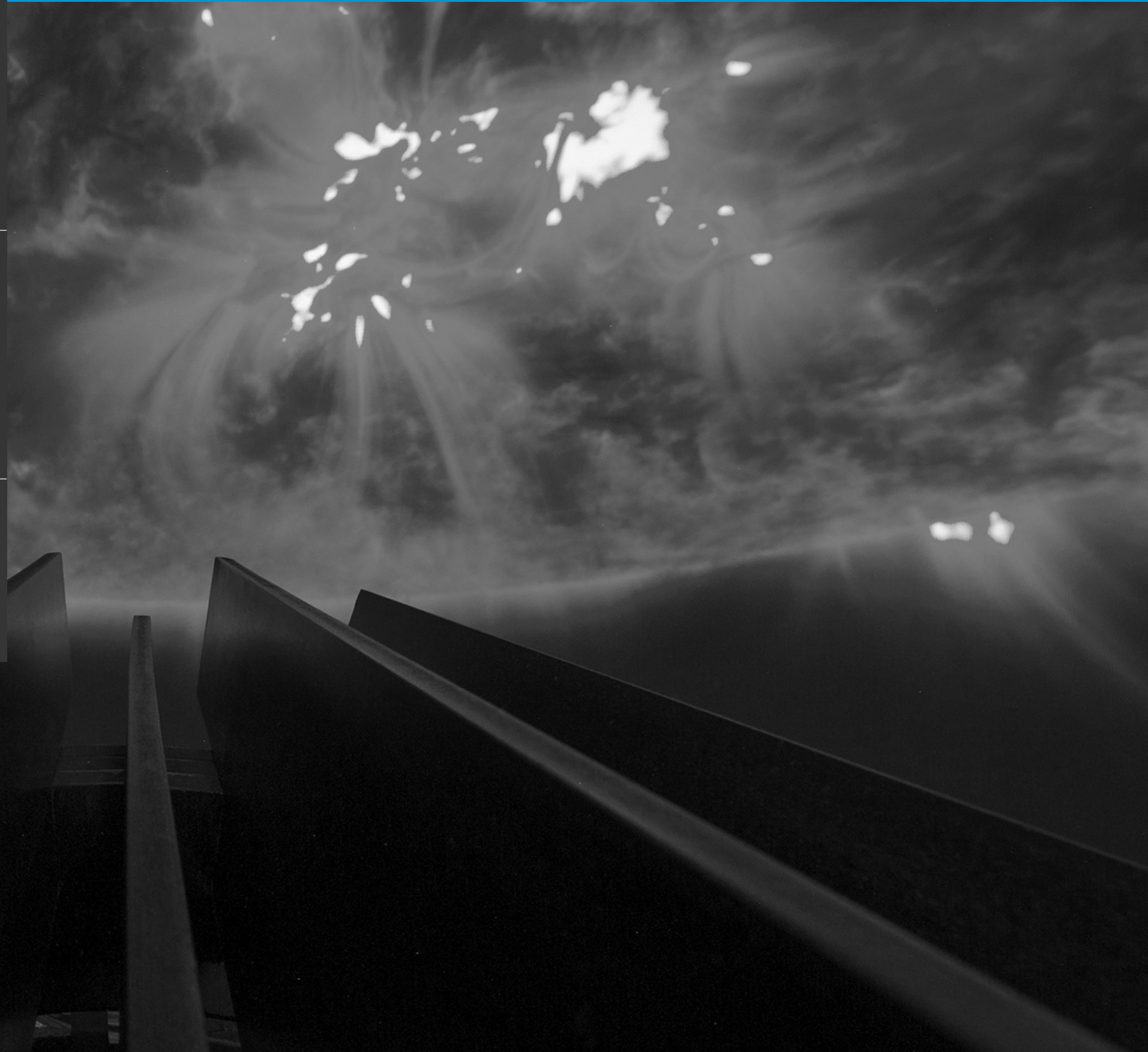
*Centre for Earth and Space Research
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The Centre for Earth and Space Research of the University of Coimbra (CITEUC) is a research unit dedicated to fundamental and applied research in Earth and Space Sciences, including their teaching sciences, history, applications, and dissemination. We are a group of about 40 researchers including 10 PhD students. We work in a wide range of Earth and Space Sciences.

CITEUC has two research groups:

- Earth Dynamics, focusing on Earth's inner structure and processes therein, crustal evolution, and Earth's history;
- Solar System Sciences, focusing on solar physics, celestial mechanics, minor bodies of the solar system, and planetary geology.

We highlight that we are developing, at CITEUC, areas with dim representation in the Portuguese science, so far, as the Space Weather and the Light Pollution, but with impact on the society. Our research projects are involved in international collaborations in the five continents and with transnational organisations such as European Space Agency, UNESCO, and European Southern Observatory. We

have been also strongly involved in the post-graduation supervising. Most of our members have been involved in Education and Public Outreach activities participating, during the last 5 yrs, in actions for more 15000 participants. CITEUC is housed at the Geophysical and Astronomical Observatory which lead to a unique combination of continuously, acquired data requiring intensive laboratory work, to verify and certify all data integrated into national and international publicly accessible databases. Our central goal is the study of Earth and Solar System Sciences, but not only as pure research. We aim to serve even more the community by pointing out the potential natural threats, coming from inside the Earth and outside of it. We continue to propose to look upon the Earth as an integrated complex system interconnecting the information on what affects us either having an inner and/or outer origin. In this context, on the shoulders of our fundamental and applied research, we have made a global strategic structuring creating the "Space-Planetary Interactions Monitoring and Forecasting Laboratory" to characterise/ quantify solar activity parameters, and their temporal evolution, and to integrate

them with the analysis and recognition of patterns in magnetograms, in order to create Space Weather alerts. On the other hand, taking advantage of CITEUC's expertise in geosciences, OGAUC's data series, and our team members responsible for the "Natural Radioactivity Laboratory", we are developing another strategic transversal theme centred in Natural and Anthropic Hazards and Risks, and their analysis. In short, in order to achieve this transfer of knowledge in a way to be useful to society we are implementing three transversal themes, combining the two groups, namely, Space Weather Natural and Anthropic Hazards and Risks and History and Education and Dissemination/ Popularisation of Sciences.

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CITTA_UP.UC

Centro de Investigação do Território, Transportes e Ambiente

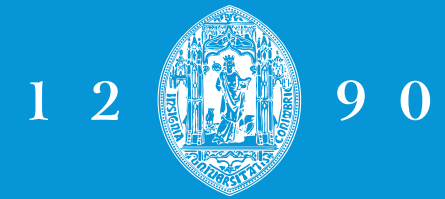
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CITTA UP.UC is a research unit of FEUP and FCTUC (the Engineering Schools of the Universities of Porto and Coimbra) officially created in 2012 and dedicated to the advancement and dissemination of knowledge in the fields of Spatial Planning, Environmental Policy and Transport Planning and Engineering.

The unit is the result of the merging of a smaller homonymous unit of FEUP with the Spatial Planning and Transportation Engineering group of FCTUC's Civil Engineering Research Centre (CIEC), in a process that was initiated in 2009.

At present, CITTA comprises four Research Groups:

- Planning and Environmental Assessment (PEA);
- Urban Planning and Housing (UPH);
- Transport Analysis and Planning (TAP);
- Transport Engineering and Management (TEM).

The two former groups are based at FEUP and the two latter at FCTUC, but they all involve researchers from both and other institutions.

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CIAS

Centro de Investigação em Antropologia e Saúde

Research Centre for Anthropology and Health

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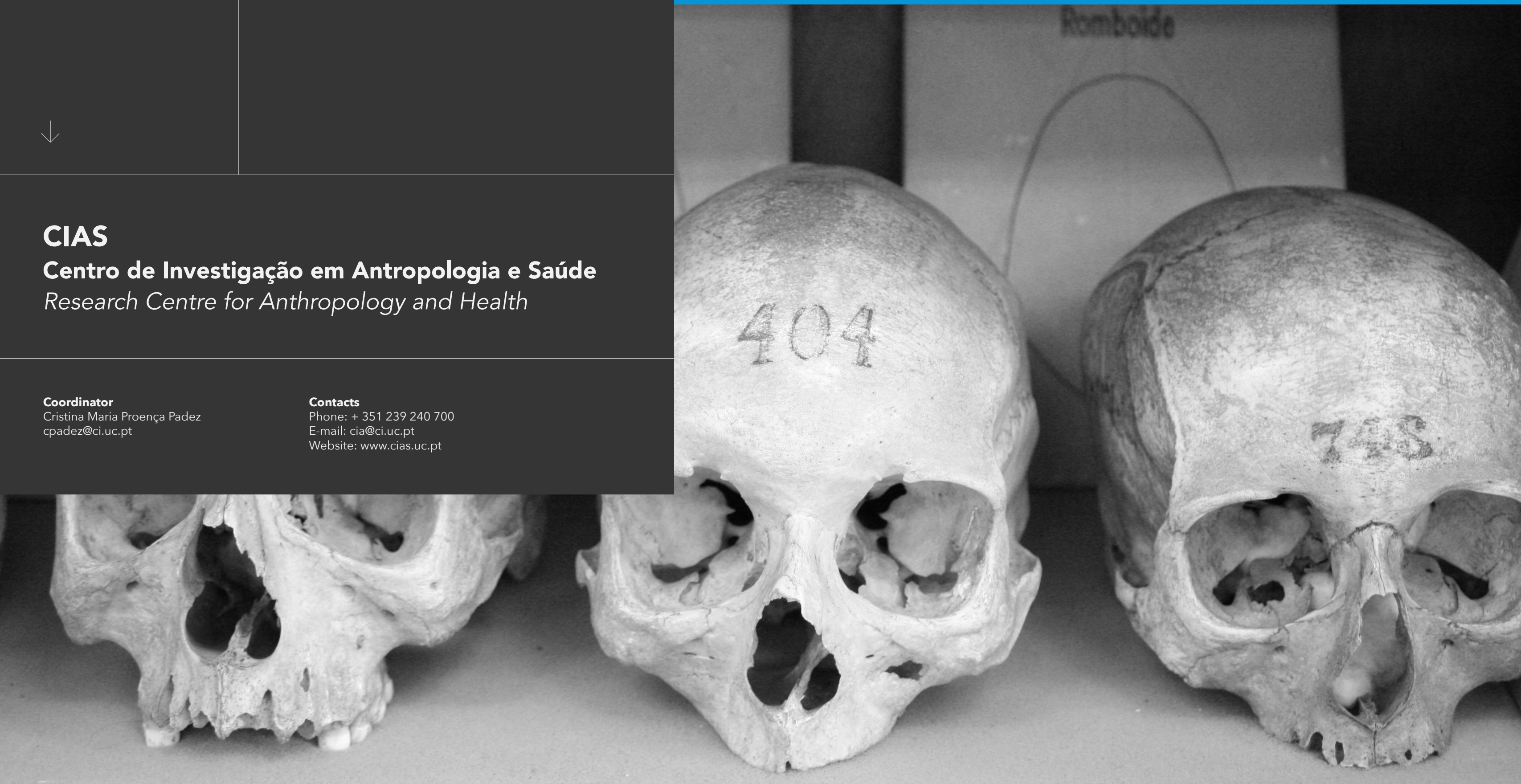
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CIAS is a research unit in the field of Biological Anthropology housed in the Department of Life Sciences (DLS), Faculty of Sciences and Technology, University of Coimbra and funded by the Portuguese Foundation for Science and Technology (UI283). CIAS was classified as “excellent” in the last evaluation of Portuguese R&D units. CIAS is the only institution in Portugal in the field of Biological Anthropology. The primary research area of CIAS is the study of the determinants of human health, disease and well-being both in past and living populations from a biocultural perspective, with strong emphasis on cultural, historical, societal, familial and politico-economic circumstances and on the understanding of our evolutionary background.

CIAS has almost 90 researchers and collaborators across three research groups:

1. Genes, Populations and Diseases (GPD)

The main research focus of GPD group is the assessment of genetic variation across populations, including both normal and disease phenotypes.

2. Human Biology, Health and Society (HBHS)

The main purpose of HBHS group is the study of human biological variation, understood in its widest sense to include patterns of health and disease over the course of the life cycle, with a strong emphasis on social, cultural, and political-economical circumstances as major determinants of this variation.

3. Past Cultures and Populations (PCP)

The main aim of PCP group is the biocultural study of past human populations, from the Mesolithic to the Modern era. Human skeletons, both from archaeological contexts and from the identified collections housed at DLS, are used as the primary source of morphological variation and palaeodemographic and palaeopathological evidence to reconstruct past human life histories at both the individual and the population levels.

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CIEPQPF

**Centro de Investigação em Engenharia dos Processos
Químicos e dos Produtos da Floresta**

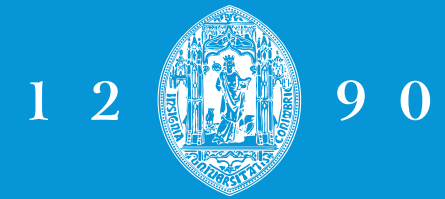
*Centre for Chemical Processes Engineering and
Forest Products*

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CIEPQPF

Centro de Investigação em Engenharia dos Processos Químicos e dos Produtos da Floresta

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The Chemical Processes and Forest Products Engineering Research Centre (CIEPQPF) was established in 1994 aiming to contribute to the advancement of Science and Technology in Chemical Engineering and its related domains. It is located at the Department of Chemical Engineering of the University of Coimbra. Most of the academic staff of this department integrates CIEPQPF, and many visiting scholars/researchers and MSc/PhD students in Chemical, Biomedical, Environmental and Materials Engineering collaborate in several research projects. In addition, many other researchers, namely from diverse departments/faculties of the University of Coimbra (e.g., Chemistry, Mechanical and Civil Engineering, Pharmacy), as well as from neighbouring polytechnic institutes, are also integrated in the Centre.

CIEPQPF is organized in 4 research groups: Particles, Polymers and Biomaterials Technology (PPB), Process Systems Engineering (GEPSI), Computing and Materials (CeM), and Environment, Reaction, Separation and Thermodynamics (GERST). Although these groups actively develop research in a relatively autonomous way, there is a large number of common actions, scientific collaborations and synergies between them, namely through several multidisciplinary projects. The multilateral cooperation with other top national/international academic and R&D institutions has been reinforced across the years. In addition, the

collaboration with national/international industry has also been intensified, and many projects are currently being financed by industrial partners.

The objectives of CIEPQPF can be summarized as follows:

1. Reinforcement of the acquired know-how in the main and strategically defined critical areas. This goal is accomplished by taking advantage of the available common analytical facilities and infrastructures, by binding research group activities around common scientific objectives, and by promoting the integration of interdisciplinary/multidisciplinary problem-solving approaches;
2. Development of integrated methodologies for materials, products and chemical plant design development, by bridging fundamental science and technology, assisted by advanced simulation and computing methods;
3. Reduction of chemical processes environmental impacts and development of “greener” ways of production, namely with regards to new materials obtained from renewable sources, to new fuels and to pollutants treatment/recovery/reuse.

CIEPQPF has unique attributes in the Chemical Engineering research panorama in Portugal as it favours multidisciplinary and multiscale unified approaches to Chemical Engineering problems

in view of developing new products/processes. Tools like advanced computational methods, together with modern product engineering strategies that combine experimental developments with structured (molecular) modelling, simulation and data-driven approaches, provide a deeper understanding of phenomena of interest in the realm of Chemical Engineering.

As a strategic concern in the accomplishment of its research goals, CIEPQPF is fully committed to strengthening the involvement of their researchers into industrial partnerships and international collaborative actions, framed in accordance with four key thematic lines: functionalization and structuring of materials; model-based engineering; marine/forest products and biorefineries; and green and environmental technologies.

Research topics such as pulp and paper technology, bioprocesses, nanotechnology and nanomaterials, biofuels, molecular modelling and simulation, materials functionalization, biomaterials for different health-related applications, nanotoxicology, process intensification, modelling and monitoring multiphase flows, smart polymers, multiphase catalytic reactors, waste management, advanced effluents treatment, wastes/residues recovery and valorisation, etc., are just a few examples of subjects that have been and will continue to be successfully investigated at CIEPQPF.

Research Unit

FACULTY OF SCIENCES
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CMUC

Centro de Matemática da Universidade de Coimbra

Centre for Mathematics of the University of Coimbra

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The Centre for Mathematics of the University of Coimbra (CMUC) is a research unit with interests in pure and applied mathematics, actively involved in research as well as in postgraduate education. CMUC facilities are located in the Department of Mathematics of the University of Coimbra.

CMUC hosts more than seventy researchers, currently organized in six research groups:

1. Algebra and Combinatorics
2. Algebra, Logic and Topology
3. Analysis
4. Geometry
5. Numerical Analysis and Optimization
6. Probability and Statistics

Besides these research groups, CMUC has three transverse Thematic Lines of activities, on Computational Mathematics, Outreach and Popularization of Mathematics, and History of Mathematics. The Centre's size and diversity encourages collaboration between people working in different fields, keeping in mind the fundamental unity of Mathematics. The Laboratory for Computational Mathematics (LCM) of CMUC promotes research in computational mathematics and scientific computing, as techniques for the solution of challenging quantitative problems arising in Science, Engineering, Finance, and Management.

CMUC is a research unit funded by the Portuguese Foundation for Science and Technology (Fundação para a Ciência e a Tecnologia). It has been awarded the highest classification by the last three international evaluation panels ("Excellent" in 2002 and 2008, and "Exceptional" in 2013).

Research Unit

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CQC

Centro de Química de Coimbra

Coimbra Chemistry Centre

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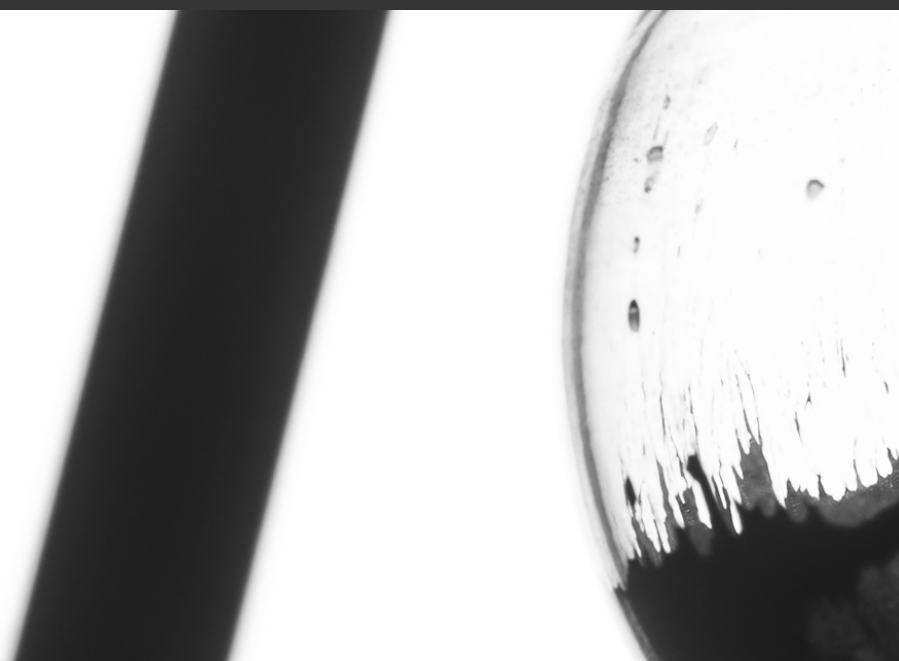


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The CQC is the leading unit in the University of Coimbra committed to the research in Chemistry, holding the research infrastructure of Chemistry Department - Faculty of Sciences and Technology of the University of Coimbra.

It involves about 100 integrated scientists with the degree of Ph.D., together with a large number of Doctoral, Masters and project students and various associate members, both within and outside the University of Coimbra. The scientific subjects covered by the CQC span areas ranging from theoretical and computational chemistry, physical chemistry and chemical physics, photochemistry, through sustainable synthetic processes for the development of new materials/active molecules with applications in alternative energy systems, forensic, biological and medicinal chemistry.



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IA Instituto de Astrofísica e Ciências do Espaço *Institute of Astrophysics and Space Sciences*

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The mission of the Instituto de Astrofísica e Ciências do Espaço (IA) is to foster research with the highest impact in the field of astrophysics and space sciences and to support teaching and training of young researchers and students in close collaboration with the Universities of Lisbon, Porto and Coimbra. It also aims to promote wide-ranging science communication activities that enhance public understanding of the Universe and our place in it, as well as awareness of the importance of research in this field.

Our vision is to achieve international leadership in key areas of astrophysics and space sciences, taking full advantage and realizing the potential created by the national membership of the European Space Agency (ESA) and the European Southern Observatory (ESO). This is done through state-of-the-art research, enabled by our leading participation in strategic international ground and space-based projects and missions.

Research Groups:

Towards the detection and characterization of other Earths

Recognized as an international player in this field, the team of Planetary Systems is focused on the characterization of Solar System atmospheres, detection of exoplanets and characterization of exoplanetary systems.

Towards a comprehensive study of stars

The research within this thematic line focus on the characterization of stars and stellar systems and on the exploration of new stellar physics, covering most phases of evolution for stars with a wide range of properties.

The assembly history of galaxies resolved in space and time

This IA team is participating or leading international efforts that are, literally, “shedding light” into our understanding of galaxy evolution throughout the history of the Universe, from the study of supermassive black holes to the interpretation of galaxies’ radiative output.

Unveiling the dynamics of the Universe

The research within this thematic line focus on the study of early and late-time evolution of the Universe, including the evolution of galaxies and galaxy clusters and the assessment of cosmological paradigms using available and simulated data.

Astronomical Instrumentation and Systems

This team participates in the scientific and technical development for instrumentation and for space and ground systems, in the context of international consortia, ESO and ESA, national space agencies and areas of the Space program of the European Union Horizon 2020.

Science Communication

IA fosters the proximity between society and scientific research. We organize activities in schools and public spaces, exhibitions, planetarium sessions, astronomical observations, and monthly public events. IA is a member of the network of outreach partners organizations of the European Southern Observatory (ESO).



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ISISE

**Instituto para a Sustentabilidade e Inovação
em Estruturas de Engenharia**

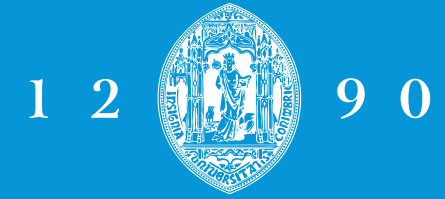
*Institute for Sustainability and Innovation
in Structural Engineering*

Coordinator

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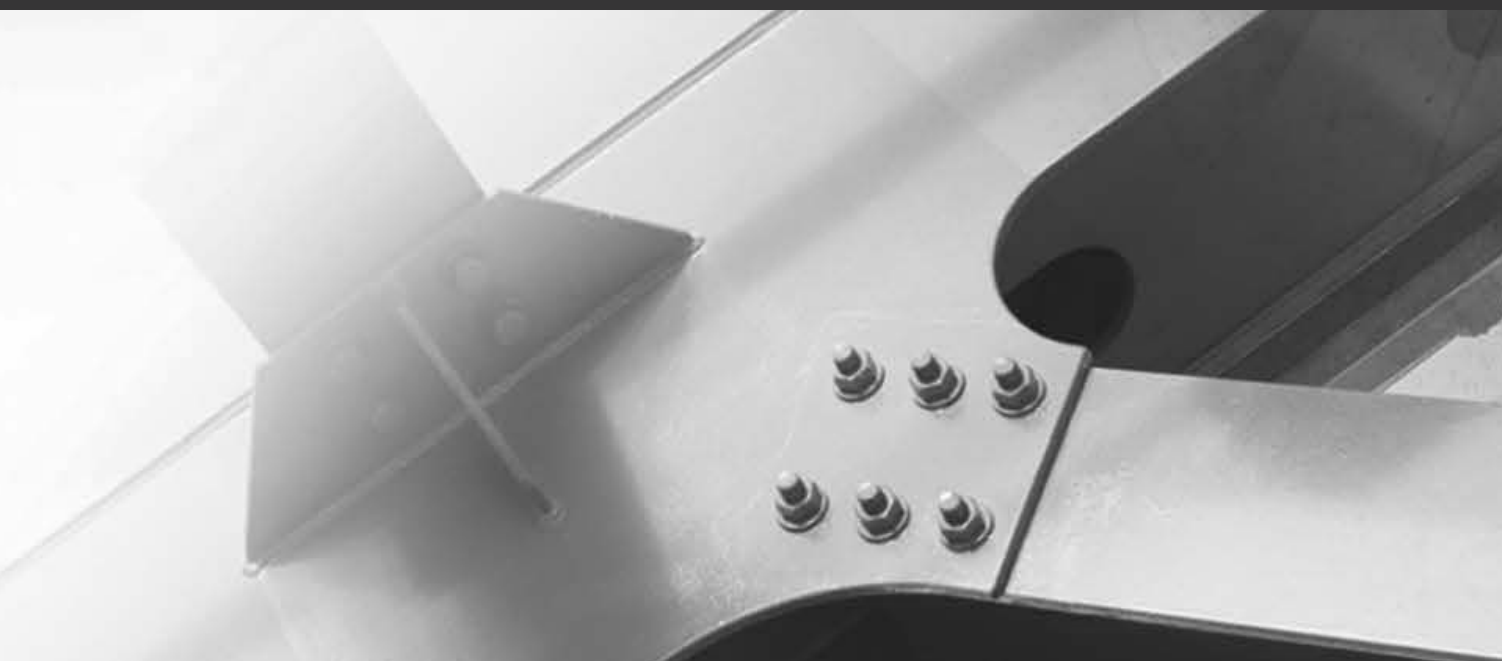


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The Institute for Sustainability and Innovation in Structural Engineering (ISISE) is a research unit funded by the Portuguese Science Foundation (FCT), incorporating Universities of Coimbra and Minho as hosting institutions. The Unit is organized in four Research Groups, addressing the topics of functional performance, historical and masonry structures, steel and mixed construction technologies and structural concrete. In short, ISISE aims at promoting innovation and sustainability, with a close link to the construction sector industry.

The most relevant focus areas include:

- Integrated conservation of Cultural Heritage Buildings;
- Increasing the use of structural timber and masonry;
- Increasing the use of masonry
- Innovation in concrete (fiber reinforced, high performance, selfcompacting, lightweight);
- Increasing the use of steel and mixed construction technologies;
- Development of innovative structural systems and strengthening techniques;
- Characterization of ground geotechnical parameters and performance predictions of geotechnical structures;
- Integral lifetime design including aspects related to functional performance of the constructions.



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LIBPhys

**Laboratório de Instrumentação, Engenharia
Biomédica e Física da Radiação**

*Laboratory for Instrumentation, Biomedical
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LIBPhys-UC is an University of Coimbra partner of the LIBPhys research center (also including partners from the NOVA Univ. of Lisbon and the Univ. of Lisbon). LIBPhys-UC is mainly focused on R&D and innovation in the generic field of instrumentation encompassing systems, apparatus and methods - involving radiation and particle physics, biomedical signals acquisition systems, digital processing techniques and embedded systems platforms.

There are 4 thematic lines for LIBPhys- UC activities:

- Biomedical Engineering;
- Cryogenics, Electronics and Radiation detection Instrumentation;
- Fundamental Parameters and Metrology;
- Analytical Techniques and Applications;

The Biomedical Engineering (Electronics and Instrumentation) research is centered on the vision of understanding the living body as an integrated system. For that we aim at developing new and efficient devices able to provide more detailed information to be used as diagnostics support or to improve therapeutic strategies. The focus of this line is on the hemodynamic status assessment (macrocirculation and microcirculation) of individuals/populations, on living

tissue characterization through the use of bio-impedance spectroscopy and tomography techniques, on the development of monitoring and tracking devices on the scope of ambient assisted living, rehabilitation and well being, on the improvement of medical imaging techniques in ophthalmology and phototherapy, and on the proposal of new methods for electrophysiological signal processing.

Activities in this area include:

- Cardiovascular Instrumentation
- Electric Impedance Spectroscopy;
- Rapid Diagnostic Test instrumentation for Malaria;
- Otorhinolaryngology Studies

The Cryogenic, Electronics and Radiation Detection Instrumentation research area aims the development of innovative techniques for neutron and gamma detection with gaseous detectors, contribution to the development of new instrumentation for WIMP and neutrinoless double beta-decay detection and for the precise measurement light nucleus dimensions in muonic atoms, innovation in cryo Energy Storage Units and heat switches and in domestic & industrial energy management systems, to be also

extended to ambient-assisted living, healthcare and security.

The Fundamental Parameters and Metrology research area focus on the ability to characterize new materials and products, and detailing chemical and structural analysis by electromagnetic radiation, from the visible and ultra-violet (VUV) to the X-rays and gamma-rays regimes. Consequently, there will be determined theoretically and experimentally essential data related to the interaction of the radiation with matter, called fundamental parameters.

The Analytical Techniques and Applications, is devoted to the implementation and development of new X ray spectrometry sources, and combining them with imaging techniques and molecular techniques bridging physics and chemistry to Biomedical Sciences, Art and Cultural Heritage research and toxicology fields in human being, in food and in forensic sciences.

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QFM-UC

**Unidade de Investigação e Desenvolvimento
Química-Física Molecular (QFM-UC)**

Molecular Physical-Chemistry R&D Unit

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The Molecular Physical -Chemistry (QFM-UC) is a multidisciplinary research unit founded in 1994 and hosted in the Chemistry Department of the Faculty of Science and Technology of the University of Coimbra, financed by the Portuguese Foundation for Science and Technology. It comprises 26 members, within two interacting groups:

Molecular Structure vs Biological Activity

- Development of new anticancer strategies based on platinum and palladium compounds. Improvement of the antitumour efficacy towards several human neoplasias, with particular emphasis on metastatic breast cancer. Vibrational microspectroscopic monitoring of the biodistribution, mode of action and cellular response of these novel antitumour agents. - Use of spectroscopic imaging methods (e.g. Raman and FTIR) for an early diagnosis of cancer (aiming at a successful translation to the clinics). - Characterisation of the molecular mechanisms of Cr(VI) carcinogenic action (e.g. in bronchial cells). - Assessment of the effect of dietary antioxidants in chemotherapeutic intervention, as an adjuvant strategy to enhance the efficacy of the conventional therapy. - Evaluation of the health-beneficial properties (antioxidant, anti-inflammatory) of halophyte extracts from the portuguese seaside (e.g. salicornia), for use as additives in new food products (nutraceuticals). - Studies on burned human bones, aiming at tackling heat-prompted changes which are crucial for an accurate characterisation of the bones source and post mortem transformations, with a high impact in victims' identification and understanding of ancient civilisations (forensic and archaeological

scenarios). - Interdisciplinary studies applied to cultural heritage, namely characterisation of pigments in XVI century religious imagery and sculptures. Apart from vibrational spectroscopy (including neutron scattering techniques, at dedicated synchrotron facilities), molecular biological assays are used.

Molecular Structure vs Education, History & Philosophy of Science

- School sciences research, guided by principles of education for sustainability and concepts of scientific literacy. - Teaching to promote problem based learning guided by principles of education for sustainability in contexts of sciences and exploring inter-relations Science-TechnologySociety. - Historical and social development of scientific work carried out by some relevant Portuguese chemists.

The Unit's research activity has been developed within several R&D Projects (financed by the Portuguese Foundation for Science and Technology, and by european and bilateral cooperation programs), currently:

- (i) BioImpact - Biochemical Impact of Platinum and Palladium-based Anticancer Agents;
- (ii) VIBSonCANCER - Molecular Cancer Diagnostics by Vibrational Spectroscopy;
- (iii) Ideas4Life - New Nutraceuticals from Maritime Plants: where Functional is Better;
- (iv) Growing Out of the Lab: Tamarilho Breeding;
- (v) ReNATURE - Valorisation of the Endogenous Natural Resources of the Central Region of Portugal.

The scientific interplay among research partners has always been the keynote of QFM-UC, that has a comprehensive scientific network with both national and international laboratories, namely: Lab. Associados CICECO (Aveiro), REQUIMTE (Porto) e CCMar (Faro); Manchester Institute of Biotechnology (UK); Focas - Dublin Institute for Technology (Ireland); Univ. Malaga (Spain); Humboldt-Universität (Berlin, Germany); NAST Centre, Univ. "Tor Vergata" (Rome, Italy); ISIS and Diamond Synchrotron Facilities (UK).

Several members of QFM-UC belong to CLIRSPEC/International Society for Clinical Spectroscopy, Clinical Infrared and Raman Spectroscopy for Medical Diagnosis. They were also members (and the portuguese delegate) of the European COST Action Raman4Clinics/ Raman-based Applications for Clinical Diagnostics. At present, they are involved in Raman4Pathology, a follow-up of this previous Action - aiming at creating a European-wide network of spectroscopists (specially focused on Raman-based techniques) and align it to diagnostic requirements and pathological application aspects, which are currently an unmet clinical need. Additionally, cooperation with health institutions are ongoing - Portuguese Oncology Institute of Coimbra and Regional Health Association of the Centre (within the Project salt.com).

QFM-UC is responsible for the Vibrational Imaging Laboratory of the UC (VibIma), which is within the best similar laboratories worldwide and comprises highly versatile equipment. Leading edge microvibrational experiments (Raman and FTIR) are underway: (i) in human cells, fluids and tissues; (ii) in human bones; (iii) in archaeological and art artifacts.

