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Marie Skłodowska-Curie Doctoral Network (DN)

# PhD position in Marie Curie Doctoral Network "MonaLisa"
## Motorised nanomachines: Innovations, Fundamentals, Applications

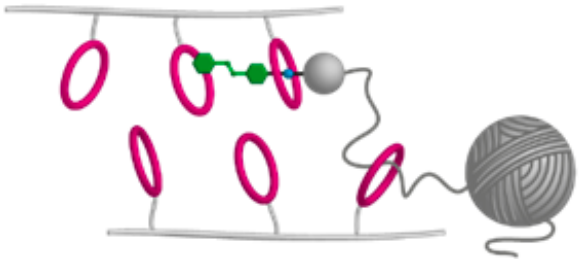
The Center for Light Activated Nanostructures (CLAN), Dipartimento di Chimica Industriale "Toso Montanari" of the University of Bologna, Italy, is offering a PhD position on:

Topic: **Polymeric materials for non-equilibrium photo- and electro-mechanical actuation**

Reference: **MonaLisa-DC05** https://euraxess.ec.europa.eu/jobs/337747

The project is funded by the Marie Skłodowska Curie Innovative Doctoral Network "MonaLisa", within the Horizon Europe Programme of the European Commission. within the Horizon Europe Programme of the European Commission. The project aims to structure a training network for doctoral students in the field of Artificial Molecular Machines for a period of 48 months. MonaLisa is a consortium of 20 partners composed of high-profile universities, research institutions and companies located in 5 European countries, and will train 15 Doctoral Candidates. More information about the MonaLisa consortium and activities can be found in the dedicated page on the CLAN web site: https://centri.unibo.it/clan/en

**PROJECT DESCRIPTION:** The role of DC5 is to integrate photo- and redox-active (supra)molecular machines into (supra)molecular polymeric scaffolds in order to generate changes at larger scales in a material as a result of their collective operation at nanometer scale. The molecular scaffolds will be primarily based on threaded molecular topologies (see figure) and will be subsequently refined using established design methodologies pioneered by the UNIBO team. The main objectives of the project are: (a) synthesis and characterization of the molecular machines components/monomers; (b) synthesis and characterization of the (supra)molecular polymers embedding the active molecular machine components; (c) the characterization of the materials/blends under light irradiation or redox stimulation. Different architectures (e.g. rotaxane-based mechanical switches and pumps) will be investigated to optimize the kinetic and thermodynamic parameters of the movements. Various polymers will be explored as scaffolds for the machine components to tune the properties of the resulting materials (such as elasticity, tensile strength, crystallinity). It is envisaged that the movement of the individual nanoscale machines can be collected and amplified in the polymer, producing either a photo- or electrically-triggered change in the mechanical properties of the material, or a macroscopic motion (extension/contraction, bending, shape change). We anticipate being able to drastically change the rheological properties of the polymeric mixture in a fully reversible way, eventually controlling its physical state depending on the intensity of the light or electrical energy input. Implications for light or electrical energy conversion/storage will be analyzed. Research tools include: organic/supramolecular synthesis and characterization (MS/NMR spectroscopy), optical spectroscopy, photochemistry and electrochemistry, microscopy and imaging, polymer characterization.



References: 10.1021/ja5080322; 10.1038/s41565-022-01151-y; 10.1002/anie.202414609.

**PhD SUPERVISOR: Alberto Credi**, Professor of Chemistry at the University of Bologna and CNR Associate Research Director. For enquiries about the position, please write to: alberto.credi@unibo.it.

**LOCATION**: The PhD will be based in **Bologna, Italy**, at the Center for Light Activated Nanostructures (CLAN), a joint laboratory between the University of Bologna and the Italian CNR.

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

CLAN CENTER FOR LIGHT ACTIVATED NANOSTRUCTURES

Consiglio Nazionale delle Ricerche

**ELIGIBILITY CRITERIA:** In order to be eligible, each applicant must fulfil the following criteria:

***Nationality:*** Candidates may be of any nationality.

***Mobility:*** At the date of recruitment, the applicant must not have resided or carried out his/her main activity (work, studies etc.) in Italy for more than 12 months in the last 3 years immediately prior to his/her recruitment. Compulsory national service and/or short stays such as holidays are not taken into account.

***Qualifications and research experiences:*** the applicant must fulfil the requirements defined for Doctoral Candidates (DCs): DCs are researchers who **at the date of recruitment have NOT yet been awarded the doctoral degree and are in the first 4 years (full time equivalent) of his/her research career.** Full-time research experience is measured from the date when a researcher obtained the degree that formally entitled him/her to begin a doctorate, either in the country in which the degree was obtained or in the country in which the researcher is recruited or seconded, irrespective of whether or not a doctorate is or was ever envisaged.

**KEY RESPONSIBILITIES:** The position is available for 36 months and the key tasks as a PhD student are:

- To manage and carry out through research projects
- To attend and participate in research and training activities within the MonaLisa network and local courses
- To write articles for scientific peer reviews
- To write a PhD thesis
- To teach and disseminate research in the scientific community (international conferences) and non-scientific community, by outreach and public engagement
- To be involved in departmental and group activities

**FORMAL REQUIREMENTS:** Applicants should hold MSc degree (or equivalent) with good grades and good English skills. As criteria for the assessment of your qualifications, emphasis will also be laid on relevant work experience and previous publications (if any).

**BACKGROUND OF SUCCESSFUL CANDIDATE:** We are looking for an outstanding highly motivated candidate with a strong academic record holding a Master degree in Chemistry. An excellent theoretical background, experience in supramolecular chemistry / organic synthesis / polymer chemistry / photochemistry / spectroscopy / electrochemistry, and good laboratory skills are prerequisite for this ambitious project. Candidates will become part of an international multidisciplinary team and will have to integrate in other laboratories of the network for training periods. The candidate must therefore have excellent personal skills and be able to work in a team. Women are especially encouraged to apply.

**TERMS OF EMPLOYMENT:** The successful candidate will receive an attractive salary in accordance with the MSCA regulations for doctoral candidates. The generous financial package includes a living allowance (gross 3300€/month), a mobility allowance (600€/month) and a family allowance (if eligible, 660€/month). The candidate will be enrolled in the PhD program in Chemistry at the University of Bologna. The guaranteed PhD funding is for 36 months.

A career development plan will be prepared for each fellow in accordance with his/her supervisor and will include training, planned secondments and outreach activities in partner institutions of the network. The DC fellows are supposed to complete their PhD thesis by the end of the third year of their employment.

More information can be found on the CORDIS page: https://cordis.europa.eu/project/id/101169136.