

**JORNADA D'ECOSISTEMA DE TRANSFERÈNCIA
I INNOVACIÓ EN ENERGIA**



SOLS – Spectrum On Demand Light Source

**Nanostructured Materials for Optoelectronics
and Energy Harvesting**

**Institut de Ciència de Materials de Barcelona
(ICMAB-CSIC)**



Barcelona, 21st June 2023

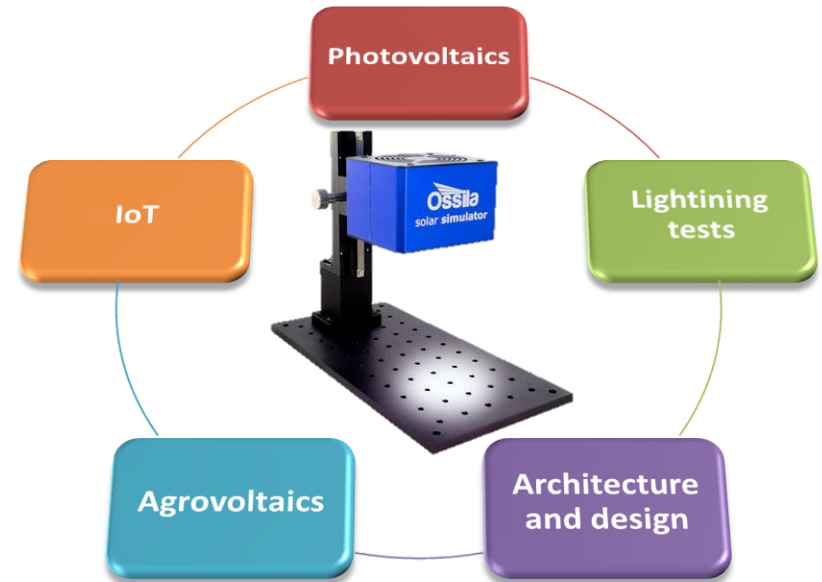
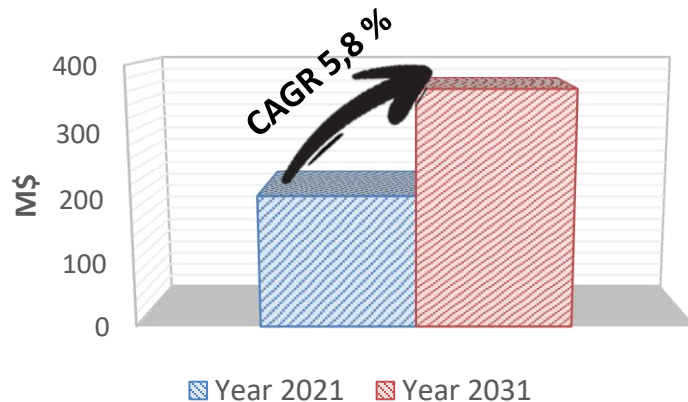
Miquel Casademont Viñas

CHALLENGES AND MARKET



Need for more efficient, affordable and environmentally friendly materials and devices.

SOLAR SIMULATORS MARKET IS GROWING

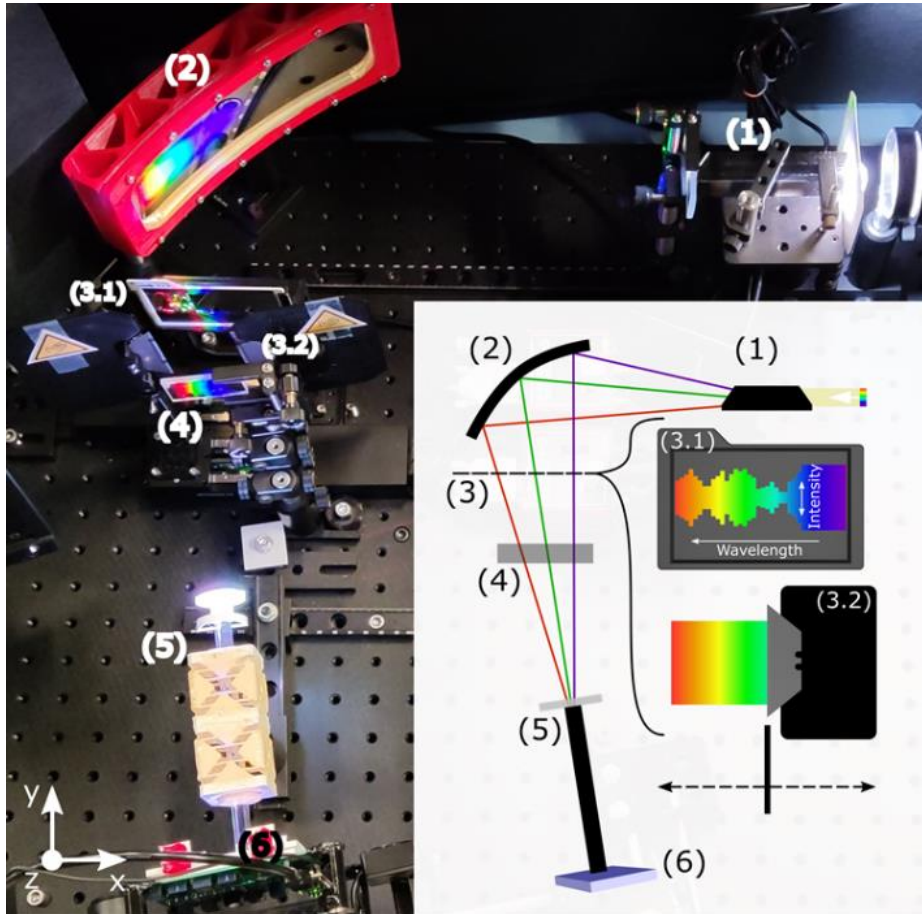


Nowadays a different type of simulator is needed for each application

OPORTUNITY: NEED FOR A **SINGLE DEVICE** THAT INCORPORATES DIFFERENT FEATURES AND CAN BE MODIFIED ON DEMAND ACCORDING TO **THE APPLICATION**, THUS **REDUCING COSTS** AND THE DIVERSITY OF **MACHINERY** IN THE LABORATORY.

CHALLENGE: TO DEVELOP A SOLAR SIMULATOR THAT PROVIDES A LIGHT SOURCE TUNABLE ON DEMAND, WITH A GOOD SPECTRAL RESOLUTION AND THAT CAN WORK UNDER NORMAL CONDITIONS OF TEMPERATURE AND PRESSURE.

SOLUTION: *Spectrum On demand Light Source (SOLS)*



Current State

- SOLS **prototype** demonstrated in an operational environment in the lab (TRL4 – TRL5).
- Developing: automation of the filter stage, improving NIR resolution, demonstrator assembly.

SOLS added values:

- ✓ **Highly tunable light spectrum**, from broad-band to narrow-band.
- ✓ **All-in-one** compact device with different types of photovoltaic characterization (PCE, EQE or recombination).
- ✓ Enable **novel characterization modes**, such as RAINBOW solar cells.
- ✓ Study of materials **beyond solar farms photovoltaics**: photocatalysis, agrivoltaics, light degradation in materials, etc.

Our main competitor are the LEDs solar simulators. However, they present some drawbacks:

- ✗ Limited spectral resolution
- ✗ Poor illumination dynamic range
- ✗ Need of refrigeration
- ✗ Very expensive to scale up in illuminated area

DEVELOPMENT PLAN – VALUE PROPOSITION



- **Innovative and versatile product** based on patented technology and supported by two innovation prizes and several research projects.
- **Accelerator of emerging photovoltaic technologies** due to its adaptability to the particular requirements of each particular technologies.
- **Cost-effective product**, which reduces costs for end users by integrating **several devices into one**.
- The **customer is assured of a return**. This is due to the precise knowledge of the problems and needs of end-users from our own experience as end-users ourselves.
- **Competitive proposition** because the customer can count on quality technical advice from a state-of-the-art R&D expert group.
- Ensures **constant innovation** by being a research group that keeps abreast of new trends and/or scientific/technological issues in the field of photovoltaics.

DEVELOPMENT PLAN – NEXT STEPS



- As for the next steps, turning the actual SOLS lab implementation into a compact, automated setup is crucial to its go-to-market step.
 - Automation of the filtering stage
 - Improving NIR resolution
- After this first step, we are also seeking for:
 - a collaboration towards (co-)development of a validated prototype that would finally lead to a commercial exploitation of the SOLS device.
 - to reach an agreement to transfer the technology use by sale or license of the patent (exclusive or non-exclusive).

TEAM – The NANOPTO Research Group

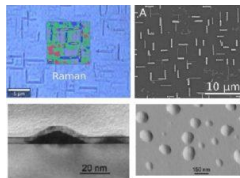


Members:

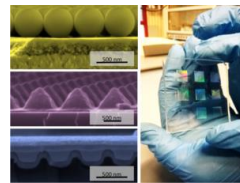
- 6 Seniors (permanent)
- 10 Postdocs
- 1 Project Manager
- 10 PhD students

Research Lines:

• [Optoelectronics of group-IV semiconductor nanostructures](#)



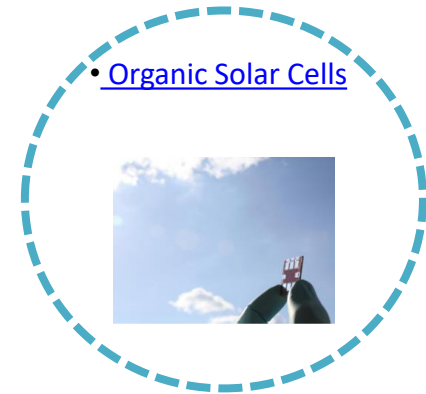
• [Photonic Architectures for Light Management](#)



• [Organic-Inorganic Thermoelectrics](#)

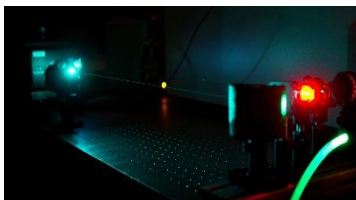


• [Organic Solar Cells](#)



Research Pillars:

• Optical Spectroscopy



• Materials Processing



Funding:



TEAM – The SOLS Research Team



Prof. Alejandro R. Goñi

ICREA Professor. Expert in optical spectroscopy and solid state physics. Broad expertise in design, development and assembly of optical spectroscopy systems, high-pressure techniques and metal halide perovskites.



Prof. Mariano Campoy-Quiles

Expert in materials science and organic photovoltaics. Co-founder of the spin-off Molecular Gate S.L., great experience in technology transfer activities and coordination of industrial projects.



Dr. Bernhard Döring

Postdoc. Experience in electronics and Arduino, automation of systems, especially for thermoelectric applications.



Miquel Casademont-Viñas

PhD Student. Organic solar cells, fabrication and characterization.
Co-inventor of the SOLS device patent.



Albert Harillo

PhD Student. Organic solar cells, fabrication and characterization, especially ternary organic solar cells.



Kai Xu

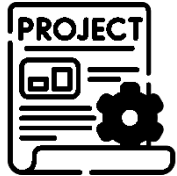
Technician. Practical experience in optics, electronics, automation, Labview design and 3D printing.



Eulàlia Pujades-Otero

Project Manager. Administrative procedures and support, financial research, knowledge transfer, market research, etc.

TEAM – Projects, Intellectual Property and Others



- PDC2022-134001-I00, Spectrum-on-demand light source for photovoltaic materials characterization (SOLS) "Proof of Concept 2022" call MICINN. Total: 149.500 €, Dec. 2022 – Nov. 2024.
- PID2021-128924OB-I00, Improving solar cell efficiency by spectral matching and charge mobility enhancement (ISOSCELLES), MICINN. Total: 272.250 €, Jan. 2022 – Dec. 2024.
- PGC2018-095411-B-I00, Efficient harvesting of visible and infrared solar energy through rainbow architectures (RAINBOW), MICINN. Total: 169.400 €, Jan. 2019 – Dec. 2021.



- Patent ES1641.1760: "*Spectral shaper illumination device*", M. Gibert Roca, M. Casademont Viñas, A. R. Goñi & M. Campoy Quiles



- 1st Prize in the Llabor Cathegory "Premi EmErgEnt" – Clúster d'Eficiència Energètica de Catalunya, June 2023.
- Top 10 finalist "Premio Ideas Innovadoras Isabel P. Trabal" – Caja de Ingenieros, May 2023.


FUTURE NEEDS - COLLABORATORS, PARTNERS AND OTHER NEEDS




To turn the device into a compact, automated setup:

- ELISAVA, Design and Engineering University  ELISAVA

Co-development Contract:

- Technology Transfer company  **Viromii**
- Leading company in the field of solar simulators

Device Validation:

- Fraunhofer Institute  **Fraunhofer**
- National Renewable Energy Laboratory (NREL)





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<https://xre4s.cat/>
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Con financiación de:

