PRESS RELEASE

SUPERLASER: EU-funded Research Project Launches to Revolutionise Lasing Technology with Ultra-Narrow Superradiant Perovskite Lasers

Using novel gain material and device design, this new type of laser will achieve high performance and narrow linewidth, all while being environmentally friendly.

Athens/Greece, 23 September 2024 **– Today marks the official kick-off of the EU-funded research project SUPERLASER, an ambitious initiative set to redefine the field of lasing. Coordinated by the National Centre for Scientific Research "Demokritos" in Athens, the project aims to develop a groundbreaking type of laser based on halide perovskite materials. These innovative lasers promise to deliver high performance, unprecedented precision, and environmental sustainability, making a significant impact on both science and technology.**

The SUPERLASER project, funded by the prestigious European Innovation Council (EIC) Pathfinder Programme with a budget of EUR 3.6 million over three years, brings together a consortium of nine partners from seven countries across Europe. An important pillar of the European Union's Horizon Europe Framework Programme for Research and Innovation, the EIC Pathfinder Programme targets visionary and disruptive innovations that can bring about decisive societal transformation. The project's goal is to create sustainable, low-cost, and highly efficient lasers that produce ultra-narrow linewidths achieving superradiance at room temperature —an essential innovation for numerous advanced technologies.

Dr. Maria Vassilopoulou, Director of Research at the Institute of Nanoscience and Nanotechnology, emphasised the significance of this work: *"Creating lasers that are both powerful and have an extremely precise output while also being environmentally friendly requires highly innovative approaches in the development of new materials and the design of the devices. The interdisciplinary project SUPERLASER will address these challenges by employing synergies across scientific, technological and ecological boundaries."*

Addressing Current Limitations

Ultra-coherent lasers with nearly atomic-linewidth radiation are fundamental for a range of cutting-edge technologies, including quantum computing, accurate time definition, and gravitational wave detection. However, existing laser technologies face significant challenges related to linewidth stability, cost, and environmental impact. Free-electron gas lasers, for instance, require large and costly equipment, while solid-state semiconductor lasers suffer from thermal noise instability.

The use of halide perovskite—a synthetic material with unique intrinsic properties—offers a promising solution to reduce dependency on critical raw materials. SUPERLASER aims to overcome current limitations by developing ultra-narrow linewidth superradiant halide perovskite lasers that are not only more stable and precise than current state of the art lasers, but also environmentally friendly.

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Scope and Impact: Developing the Lasing Technology of the Future

Over the next three years, the SUPERLASER team will focus on two main goals: first, identifying new types of perovskite materials that have unique properties due to the interaction between their electron spins and their orbital movements (known as spin-orbit coupling); and second, developing layered structures, called superlattices, that can sustain a state of enhanced light emission, known as superradiance, even at room temperature. The development of these novel materials will reduce dependency on critical raw materials that are currently used in all types of modern electronic devices.

Throughout the project environmentally sound processes with zero carbon footprint will be applied and recyclability and reuse protocols will be implemented continuously to minimise e-waste and environmental impact.

SUPERLASER's ultimate goal is to realise the first electrically pumped perovskite laser, potentially paving the way for its application in quantum technologies, photovoltaics, and 6G communications, where coherent light plays a critical role in network synchronisation.

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Project Key Facts

Title: Room Temperature Superradiant Perovskite Lasers

Start: 01.09.2024

Duration: 36 months

Budget: 3.6 Mil €

Coordinator: National Center for scientific research "DEMOKRITOS"

Website: www.superlaser-project.eu

LinkedIn: SUPERLASER – EIC Pathfinder

Project Partners

Belgium

- Interuniversitair Micor-Electronica Centrum

Germany

- Eurice - European Research and Project Office GmbH

Greece

- National Center for Scientific Research "DEMOKRITOS"
- Ethniko Kai Kapodistriako Panepistimio Athinon

Spain

- Universitat Jaume I De Castellon

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Sweden

- Linkopings Universitet
- LinXole AB

Switzerland

- École Polytechnique Fédérale de Lausanne

United Kingdom

- The University of Nottingham

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