PHOTONICS FRONTIERS AWARD 2025

Brought to you by Electro Optics

CATEGORY DESCRIPTIONS

The Photonics Frontiers Award 2025, brought to you by Electro Optics, provides OEMs and integrators with an opportunity to demonstrate their innovative photonics projects in a new awards scheme.

We will shortlist two to three projects per category for Photonics Frontiers Award 2025, and one project will be selected by our independent jury to win the overall Photonics Frontiers 2025 Award.

This supporting document is intended to help applicants to choose the correct category from the seven options below for their innovation.

To enter your application, please go to the link below before Friday, 14 March:
https://forms.gle/pvXmCdQS2Z8cuyhA8

PHOTONIC AND OPTICAL SENSORS

Projects that use devices to measure the change in optical properties of a material or system, including parameters such as temperature, pressure, strain, light intensity, wavelength, phase, polarisation or refractive index.

Examples of photonic sensor techniques may include (but are not limited to): lidar; infrared spectroscopy; raman spectroscopy; surface plasmon resonance sensors; photonic crystal sensors; fluorescence-based sensors; optical coherence tomography (OCT); distributed temperature sensing (DTS); laser interferometry; uv-vis spectroscopy; cavity ring-down spectroscopy (CRDS); tunable diode laser absorption spectroscopy (TDLAS); terahertz imaging sensors; hyperspectral imaging sensors.

Photonic sensors have applications in areas such as structural monitoring in civil infrastructure; air quality and gas detection; precision agriculture (soil and crop analysis); biomedical diagnostics and imaging; environmental monitoring (water and soil quality); renewable energy efficiency and performance monitoring; industrial process control and automation; leak detection in oil and gas pipelines; food safety and quality assurance; autonomous vehicle navigation (obstacle detection); real-time oceanographic studies; security and surveillance systems; space exploration

and satellite technologies; optical strain and temperature sensing for smart materials.

IMAGING TECHNOLOGIES

Projects that use equipment, likely cameras, to generate, transmit or process images (including but not limited to VIS, IR, NIR, hyperspectral, 2D, 3D, line cameras etc).

Imaging technologies may have applications in manufacturing and quality control; inventory management; agriculture; aerospace and defence; automotive etc.

SPECTROSCOPY AND ANALYTICAL TECHNIQUES

Projects that use spectrometers in absorption, emission or fluorescence spectroscopy, including VIS, UV, IR, hyperspectral, Raman etc. Applications include food safety, quality assurance; pharmaceutical analysis; material characterisation.

Examples of spectroscopy methods may include fourier-transform infrared (FTIR) spectroscopy; raman spectroscopy; near-infrared (NIR) spectroscopy; ultraviolet-visible (UV-VIS) spectroscopy; laser-induced breakdown spectroscopy (LIBS); surface-enhanced raman spectroscopy (SERS); cavity ring-down spectroscopy (CRDS); x-ray fluorescence (XRF) spectrometry; hyperspectral imaging; mid-infrared (MID-IR) spectroscopy; fluorescence spectroscopy; tunable diode laser absorption spectroscopy (TDLAS); terahertz spectroscopy.

Examples of application areas include: real-time environmental monitoring (air, water, soil); pharmaceutical quality control and regulatory compliance; food safety and adulteration detection; advanced materials characterization in r&d; non-destructive testing of industrial components; microplastic and pollution detection in oceans; process optimisation in metal and additive manufacturing; early disease diagnosis in biomedical applications; recycling and waste sorting technologies; forensic analysis and counterfeit detection; monitoring emissions for industrial compliance; energy storage research (battery and fuel cells); soil and crop analysis in precision agriculture; detection of hazardous chemicals and explosives.

BIOPHOTONICS & HEALTHCARE APPLICATIONS

Projects including, but not limited to, the diagnosis of diseases or their treatment; disease monitoring (e.g. diabetes); pathogen detection; non-invasive analysis; real-time brain imaging; live surgical tissue analysis; monitoring of drug delivery; prosthetics and tissue scaffolds.

Photonic methods employed include, for example, optical coherence tomography (OCT); surface-enhanced Raman spectroscopy (SERS); near-infrared spectroscopy; functional near-infrared spectroscopy; fluorescence imaging; low-level laser therapy; hyperspectral imaging; photoacoustic microscopy; endoscopy; additive manufacturing/3D printing etc.

OPTICAL COMMUNICATIONS & NETWORKING

A huge area of activity in our industry, entries can be drawn from projects using devices or techniques such as silicon photonics for optical interconnects; dense wavelength division multiplexing (DWDM); photonic integrated circuits (PICs); free-space optical communication (FSO); coherent optical systems; optical amplification (e.g. erbium-doped fiber amplifiers); optical frequency combs for WDM networks; micro-electro-mechanical systems (MEMS) for optical switching; ultra-low-latency fibre optic technologies; advanced optical modulation formats (e.g. QPSK, DP-QAM); AI-driven optical network optimisation; optical time-domain reflectometry (OTDR) for monitoring; optical fibre sensor technologies; terabit optical wireless communication systems.

Projects may come from application areas such as: ultra-secure data transmission in quantum networks; high-capacity data centres with optical interconnects; gigabit broadband access via FTTH; 5G network backhaul and infrastructure; ‘smart cities’ and dynamic traffic management networks; inter-satellite links in low earth orbit (LEO); high-frequency trading with ultra-low-latency networks; energy-efficient optical systems for data centres; urban connectivity through terabit optical wireless communication; high-speed optical communication links for autonomous systems; scalable wavelength-division multiplexing networks for enterprise solutions; next-generation satellite communications and space applications.

LASER TECHNOLOGIES AND APPLICATIONS

Projects that involve laser technologies or applications in industrial settings. Techniques including, but not limited to, laser welding; laser cutting; laser sintering; laser powder bed fusion; laser cleaning; laser micro-machining; laser cladding; hardening; laser peening; laser texturing; laser drilling; laser marking; laser-based additive repairs.

Applications include high-precision manufacturing, surface preparation and restoration; electronics manufacturing; repair and wear resistance; sheet metal fabrication; enhanced material durability; improved surface adhesion; aerospace component manufacturing; traceability in supply chains; rapid prototyping applications; metal fatigue resistance.

ENVIRONMENTAL MONITORING AND SUSTAINABILITY

Projects that involve photonic technology delivering, for example, a benefit in the efficiency or scope of environmental monitoring and sensing, or a photonic technique that increases sustainability efforts, such as enabling reduced power or resource consumption.

Photonic techniques may include, but are not limited to: laser-based remote sensing; hyperspectral imaging; lidar; photonic sensors; laser-induced breakdown spectroscopy (LIBS); satellite imaging; fiber optic sensing; UV-based disinfection systems; photovoltaic efficiency monitoring with spectroscopy; thermal imaging; infrared imaging; fluorescence spectroscopy; Raman spectroscopy.

Examples of application areas include air quality monitoring; deforestation and biodiversity assessment; coastal erosion and flood risk mapping; real-time water quality analysis; soil contamination detection; tracking polar ice melt; leak detection in pipelines; water treatment; renewable energy efficiency; identifying heat loss in buildings; renewable energy site analysis; microplastic pollution monitoring; precision carbon sequestration measurements; rapid waste sorting in recycling; methane emissions monitoring from landfills.

If you have any queries on the Photonics Frontiers Award 2025, please contact rachel.marston@europascience.com