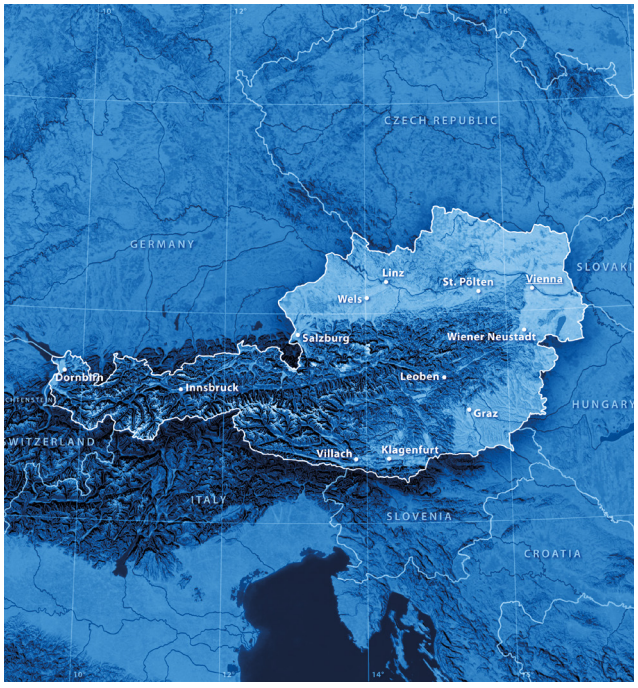
Photonics in Austria

Innovation, Research, and European Leadership

Photonics, a key enabling technology, is at the heart of Austria's high-tech industrial and research landscape. From advanced optical sensors, light sources and laser technologies to Photonic integrated circuits and quantum applications, Austria has established itself as a powerhouse in the European Photonics ecosystem.



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The 2024 study of the Austrian Institute of Economic Science identifies Photonics to have the highest revealed technology advantage of all key enabling technologies in Austrian (specialization in the technology based on patent applications). Austria's focus on Quantum Optics – that is underlined by two Physics Nobel prices won for Photonics research done in the country in the last years (Anton Zeilinger, 2022, and Ferenc Krausz, 2023) – can stand representative for the countries blending of cutting-edge research and the strong industrial impact realized in the country.

The History of Photonics in Austria

Austria's contributions to Photonics trace back to its deep scientific tradition in optics and physics, which has played a major role in global advancements. Some of the earliest contributions to the field date to the late 19th and early 20th centuries, when Austrian physicists such as Ernst Mach, Ludwig Boltzmann, Wolfgang Pauli and Erwin Schrödinger laid the groundwork for the understanding of light propagation, energy distribution and quantum physics. Over time, the country's strong foundation in precision optics and engineering led to the emergence of Photonics as a distinct field of research and industry.

A vital sign of the blooming landscape of Photonics was the establishment of Photonics Austria in 2013 as a non-profit association. The national technology platform was created to foster innovation, collaboration, and integration within the European Photonics landscape. It was a direct response to the growing importance of Photonics, facilitated by the Austrian ministry of technology and driven by the local Photonics industry today comprised of around 300 companies that practice Photonics R&D. This variety helped putting Austria on the map internationally: the "Advanced Technology for Industry" dashboard of the European commission placed Austria's Photonics industry on the third rank of all European countries.

Iconic Austrian Companies in the Field of Photonics

Traditionally, Austria has a very strong industry in light sources, with companies like Zumtobel, ZKW, XAL and Lumitech leading the way. Photonics manufacturing technologies are spearheaded by companies like Sony DADC or STIWA. A long tradition in Laser technology is based on established companies like Spectra Physics, TROTEC

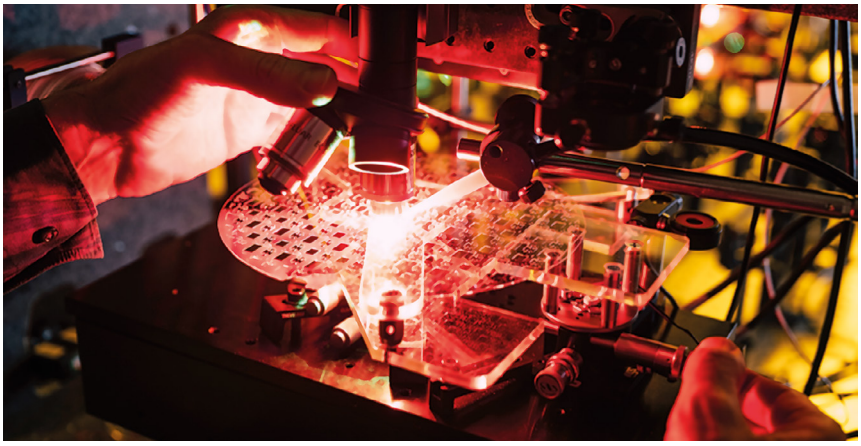


Figure 1. © JOANNEUM RESEARCH/Bergmann

or Trumpf and specialists like Montfort Lasers, nlight Plasmo, upnano or weldmetrix. The Photonics integrated circuit segment is the third pillar of the Photonics industry in Austria with companies like ams-OSRAM and Infineon Technologies at the forefront. System integrators like WILD, Swarovski Optics, In-Vision or the start-up Cerabyte play a leading role in providing optical precision products. And finally, promising start-ups in the Quantum Photonics sector, like qtlabs or Quantum Industries, are developing rapidly in the wake of established stakeholders like Infineon or Astro Systeme Austria in the race for the commercialisation of the technology.

Photonics in Austria's main Universities

Photonics is embedded in Austria's academic curricula and is a key subject in undergraduate and graduate programs in physics and electrical engineering at Austrian universities. Several universities and technical institutions offer specialized programs with a focus on photonics, including: TU Wien (integrated optics, laser physics, and quantum photonics) and TU Graz (optical communication, metrology, and silicon photonics), University of Vienna (Photonic materials science, spectroscopy, and optoelectronic applications), University of Graz, University of Linz, University of Innsbruck (quantum physics, biomedical optics), and University of Salzburg (teacher training programs), as well as Universities of Applied Sciences: FH Vorarlberg, FH Technikum Wien, and FH Burgenland.

Photonics is also integrated as a subject in many other technical degree programs across Austria.

Leading Research and Technology Organizations (RTOs)

Austria is home to several prominent non-university research institutions making significant strides in Photonics. Key players are: the Austrian Institute of Technology (AIT), JOANNEUM RESEARCH, RECENDT, Silicon Austria Labs (SAL), and V-Research.

Austrian Institute of Technology (AIT)

AIT is Austria's largest non-university research institute, known for its cutting-edge research in Photonics. AIT focuses on photonic sensing, data processing, and optical communications. Notable projects include LIDAR technology and neuromorphic hardware architectures for efficient computing and AI applications. AIT's work is crucial for advancing telecommunications, quantum optics, and sensor technology.

JOANNEUM RESEARCH

JOANNEUM RESEARCH emphasizes applied research, with its MATERIALS Institute specializing in sensors, photonics, and production technologies. The institute is involved in green photonics, developing smart, energy-efficient lighting and sensor solutions. Their research includes advanced optical systems and functionalized surfaces, contributing to industrial innovations.

RECENDT

RECENDT is the Research Center for Non-Destructive Testing, based in Linz. The internationally renowned research company develops solutions for industrial sensing and quality inspection, based on cutting edge photonic technologies. Technologies like Laser-Ultrasonics, Optical Coherence Tomography, Terahertz-sensing or various solutions in Infrared- & Raman Spectroscopy serve to solve challenging measurement and NDT-tasks in all industrial branches. The latest field of research is quantum sensing, to be made available for industry soon.

Silicon Austria Labs (SAL)

SAL develops integrated photonic systems and technologies, covering the optical spectrum from UV to mid-IR. Their applications include optical sensors, high-performance laser systems, and intelligent spectroscopic systems. SAL's interdisciplinary work combines optics, physics, and engineering to create solutions for industries like automotive, consumer electronics, and telecommunications.

V-Research

V-Research focuses on energy-efficient lighting, developing next-generation LED systems that save energy and improve functionality through Human Centric Lighting. They collaborate with European lighting manufacturers to create advanced LED drivers and systems that support health, productivity, and sustainability.

Austria's non-university research institutions are making remarkable contributions to Photonics. Through their innovative efforts, AIT, JOANNEUM RESEARCH, SAL, RECENDT and V-Research are driving advancements that have far-reaching implications for various industries, enhancing our • • •

understanding of photonics and paving the way for a sustainable future.

Main Programs and Funding in Austria

The Austrian government has recognized the huge potential of the Photonics sector and supports its development through a dedicated funding program within the "Key technologies in the production-related environment". The program is endowed with a yearly budget of around 7-10 Mio. €. This dedicated budget is complemented by open programs managed by the FFG (Austrian Research Promotion Agency). In total the FFG handled a funding budget of 1,8 Bn. € in 2023, a major boost for research, with its main target being applied research including projects in Photonics and Quantum technologies. Furthermore, companies in Austria can benefit from funding by the aws the Austria Wirtschaftsservice Gesellschaft, that focuses on supporting investments that create jobs in Austria, including foreign companies. Austrian stakeholders complement the national funding by being very active and successful in European programs, especially with the focus on Photonics. In the framework program H2020 Austria managed to place fourth in the category funding per capita of photonics21 funded programs. In that respect Photonics Austria supports the European Photonics R&D as an interface between the European stakeholders and potential Austrian partners.

Photonics Research in Austria

Austria's fundamental research is supported by the FWF, the Austrian Science Fund. In Photonics the community covers a wide range of cutting-edge topics, including:

Ultrashort pulse laser, Quantum optics and quantum communication, Optoelectronics, Micro- and nano-photonics, Spectroscopic methods, Photonic measurement concepts, Detectors and sensors, Integrated optics and silicon photonics, Photonic crystals, Laser-based material processing, Optical communication technologies, Lighting and illumination technologies. Research in these areas is conducted

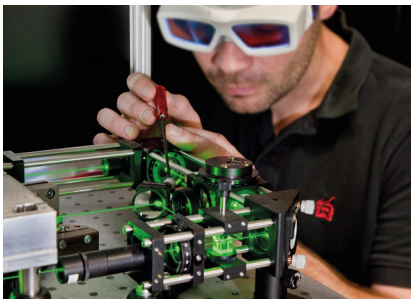


Figure 2. © RECENDT GmbH.

at an internationally competitive level. However, nearly all fields face the challenge of rising costs for experimental and technical infrastructures, which remains a significant concern for Austrian photonics research.

Photonic Austria Roadmap

The Photonics Austria Roadmap 2021-27, available on the Photonics Austria homepage, provides a comprehensive overview of Austria's research areas in Photonics and their future prospects. Austrian Photonics has particularly strong potential and expertise in seven core fields:

Lighting

Intelligent, environmentally friendly lighting "Made in Austria" is used worldwide, whether with a focus on Human-Centric Lighting or horticulture applications. Research into intelligent systems and efficient optical solutions has been *a priori*ty for Austrian companies and research institutes for years.

Mobility and Security

Developments in mobility and security include matrix and laser headlights, cutting-edge 3D camera technologies for autonomous driving and unmanned aerial vehicles (drones), as well as fiber-optic sensors for real-time monitoring and tracking of trains and traffic infrastructure surveillance.

Life Sciences, Health, and Environment

In life sciences, health, and environmental applications, Austria has made significant contributions to optical imaging technologies, such as optical coherence tomography (OCT), which enables non-invasive, high-resolution visualization of tissues. Equally important are advancements in sensors and environmental monitoring methods, including air and water purification and agricultural production technologies.

Sensor, Production, and Quality Assurance Technology

Austrian expertise is also prominent in sensor, production, and quality assurance technology. Photonic methods for non-destructive quality control are highly sought after by industries, and Austrian companies and research institutes are at the forefront of these developments. Lasers are not only essential for high-precision welding but are also the preferred energy source for 3D printing and additive manufacturing.

Information and Communication technologies

Energy efficiency, free-space communication and photonics integrated circuits are the main topics of interest for Austria's ICT research. Compared to electrons, photons in fibre optic cables travel long distances with up to 20 times less signal loss. Photonic technologies are also invaluable for data storage and future computing architectures.

Optical Quantum Technology

Austria is a global leader in optical quantum technology, particularly in the development of optical quantum computers and quantum communication. This leadership is largely due to Austria's high level of education and excellence in fundamental photonics research, which is recognized internationally.

Austria's photonics industry and research institutions continue to drive innovation in these key areas, ensuring the country remains at the forefront of global photonic advancements.

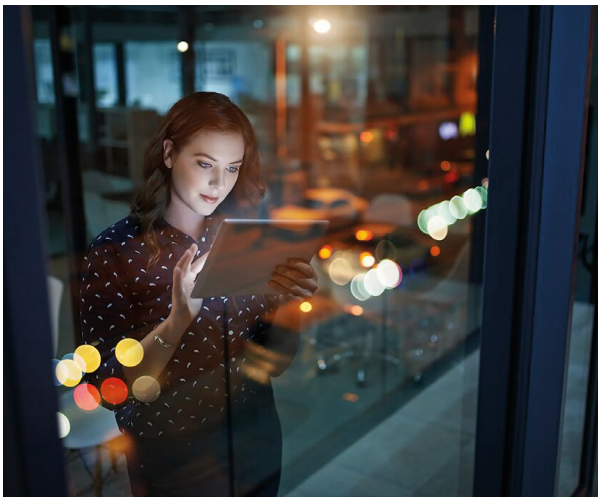
Photonics Austria association

While starting off small in 2013, with less than 20 founding members, today the platform harbours over 60 organisations from industry, research and education.

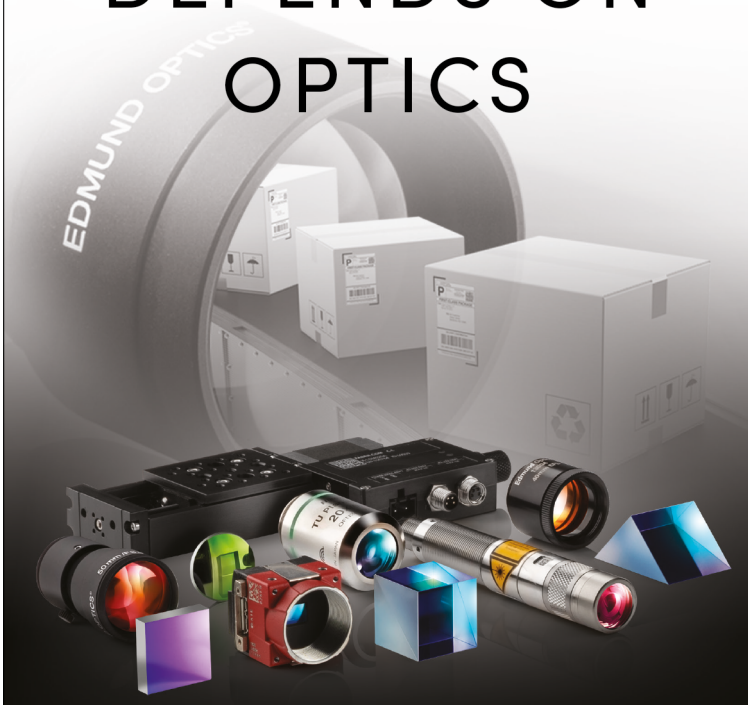
The platform plays a crucial role in networking and collaboration, connecting experts through meetings, working groups, and innovation workshops while organizing industry events such as the "Photonics4x" series and partnering with other technology clusters like Industry 4.0 and Silicon Alps. It also engages in advocacy and representation, promoting Photonics through public events, publications, and trade fairs like a joint Austria booth at the Laser World of Photonics 2025 while actively lobbying for research funding and policy support. Another key focus is information and support, where Photonics Austria provides insights into funding opportunities, technology trends, and research developments, as well as facilitating expert working groups, such as the Austrian Laser Production Network (ALPIN). By integrating stakeholders from research, industry, and government, Photonics Austria fosters innovation, funding access, and international collaboration, strengthening Austria's role in the global photonics landscape.

Across Europe, Photonics Austria actively connects Austrian and European stakeholders, supporting collaboration and strengthening the photonics ecosystem. By engaging in EU-funded projects, the platform plays a key role in supporting research and innovation while facilitating joint initiatives such as delegation visits and workshops with leading photonics networks like Photonics Finland, Photonics Bretagne, Photonics Baden-Württemberg, Optonet, and Swiss Photonics. These collaborations help Austrian researchers and companies exchange knowledge and explore new opportunities. Additionally, Photonics Austria represents the national community within Photonics21, the European public-private partnership shaping Photonics strategy. It also participates in cascading funding initiatives like PhotonHubEurope and PhotonQBoost, which provide financial support to promising Photonics research and applications. Through these efforts, Photonics Austria helps drive technological progress in Austria and beyond, ensuring that Austrian innovations remain at the forefront of European Photonics development.

Figure 3. © ams OSRAM



THE FUTURE DEPENDS ON OPTICS



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