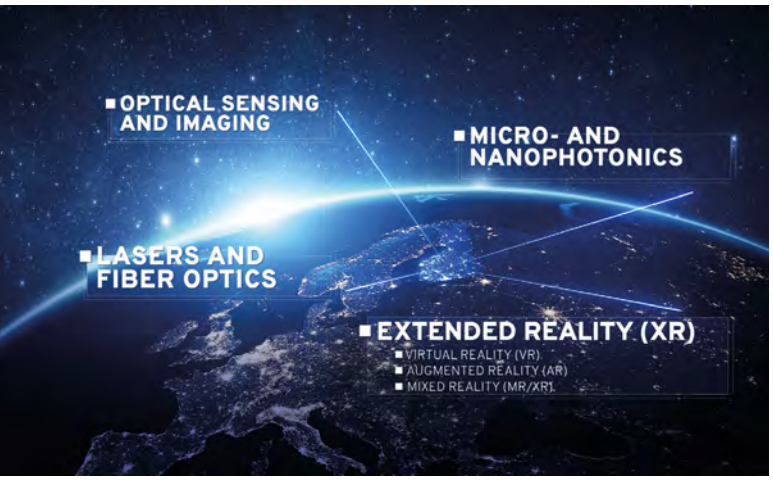
Photonics in Finland

Finland has a long tradition of photonics research and industry, which has led to many pioneer photonics related technologies developed in the country. Together with a world-class research and education environment, wide range of competencies and leading know-how in optical sensing and imaging, micro- and nanophotonics, lasers and fiber optics, and in extended reality (XR), makes Finland an ideal place for innovations in photonics, commercialization of new products, company growth, and for international success.



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History of photonics research in Finland

Photonics research in Finnish universities has a long and rich history of almost six decades. Originally, research developed mainly within the disciplinary field of physics, and focused on optics and optoelectronics. The first university in Finland to establish a dedicated photonics research group was the Helsinki University of Technology (now Aalto University) in the 1960s. Another of the pioneering institutions was the University of Joensuu (current University of Eastern Finland), which introduced photonics as a research area of its own already at the time of establishing the university in 1969. Another important university for the early years of photonics research in Finland, was Tampere University of Technology (current Tampere University), where optoelectronics and particularly research on Modular Beam Epitaxy was initiated in the early 1980s and received international recognition. Since then, several other universities in Finland have established photonics research groups and centers, including the University of Helsinki, University of Jyväskylä, University of Oulu and University of Turku complementing the photonics research landscape, and contributing to the history of photonic research in Finland.

Photonics research in Finnish universities has been characterized by a strong interdisciplinary focus, with collaborations between physicists, materials scientists, electrical engineers, and other researchers. This approach has led to many significant advances in the field and positions Finland as a leader in photonics research on the global stage.

Photonics research and education in Finland today

Today, Finnish photonics research is carried out in universities and specialized research institutes with dozens of photonics research employing more than 700 researchers. Most research groups operate with a less than 1M€ annual research budget, but the total annual research funding in Finland amounts to more than 80 M€. Research is funded by universities' basic funding, but to a significant extent also by external sources, especially Business Finland, the Academy of Finland, EU and directly by industry. Photonics research covers the whole scientific spectrum from fundamental phenomena to the search for cutting-edge applications in collaboration with leading industries.

Academic research also provides a crucial platform for educating skilled workforce. Degree education in photonics in Finnish universities is based on top-level research and is closely integrated with the photonics industry and its needs. There is a growing demand on master's and doctoral graduates in Finnish industry.

It is possible to study photonics in several Finnish universities from the bachelor level to doctoral degree. Bachelor's degree programmes give more general science and engineering skills and provide a solid foundation to focus on a specialization on the master's level. Photonics is offered as a specialization in degree programmes in physics, materials science, or electrical engineering, but there are also master's degree programmes specializing in photonics. Bachelors' degrees can be completed in Finnish or English, whereas most master's degree programmes are international and offered in English. In general, photonics education is very international with programs attracting students from around the world. Erasmus Mundus funded joint master programmes and double degrees on master's and doctoral level with renowned international universities and are a clear indication of the high quality of the education in photonics in Finland. It is possible to pursue a doctoral degree in photonics in Finnish universities and most doctoral researchers work full-time in research groups. A doctoral degree may also be completed while employed in the photonics industry.

The Flagship for Photonics Research and Innovation – a long term project boosting photonics research

Photonics research in Finland has received an extra boost recently through national research funding. The Academy of Finland Flagship programme launched in 2029, is a funding scheme that aims to support and promote top-level research and innovation in Finland, sparking a new and unique way of combining research, development and innovation in Finland. The programme provides funding for large-scale, long-term research projects that have the potential to generate significant economic, societal, and cultural impacts. The Flagship programme focuses on interdisciplinary research that addresses major societal challenges and opportunities, such as sustainable development, health and wellbeing, digitalization, and clean energy, and emphasizes collaboration between academia, industry, and other stakeholders, as well as international cooperation.

The Flagship for Photonics Research and Innovation PREIN was named as one of the six flagships which started their eight-year funding period in 2019. PREIN is an initiative that brings together the main actors of the Finnish photonics research scene to develop the new generation of light-based technologies. PREIN is a joint venture of the coordinator, Tampere University and three partners, University of Eastern Finland, Aalto University and VTT Technical Research Centre of Finland. The mission of PREIN is to generate future research in photonics and promote the Finnish know-how by expanding frontier research into business opportunities, educating photonics professionals, and raising awareness of the critical role of light-based technologies for our society.

Photonics industry in Finland

Finland has a long history of excellence in technology and innovation, and the photonics industry is an important part of the country's high-tech ecosystem. Main sectors for photonics industry are in photonics systems, instruments • • •

Photonics Finland has over 110 organizational and over 300 individual members.

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Photonics Finland projects represented at the Pavilion

PHOTONICS 4 industry

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and components manufacturing. In addition to large established companies, Finland has a thriving startup ecosystem focused on developing new photonics technologies and bringing them to market. The photonics industry in Finland is a vibrant and growing sector, with a strong focus on developing and commercializing cutting-edge photonics technologies for use in a range of applications. Based on 2020 Industry survey (updated in 2022), photonics companies in Finland are highly export intensive, and the key export area is Europe, especially Germany.

Photonics Finland connects the whole photonics ecosystem in Finland

Photonics Finland is the single point of contact for the whole photonics ecosystem in Finland. The history of Photonics Finland started in the year 1996, when the Finnish Optics Society was first established as a research association. In 2014, Photonics Finland was re-launched as a cluster together with 19 members to provide better service and visibility for the emerging photonics industry, as well as to the academia members.

Today, Photonics Finland is a growing technology cluster that drives forward photonics industry and research in Finland. With over 300 individual and over 110 organizational members, it connects photonics companies, universities, research institutes, and public authorities. Especially startups and companies utilizing photonics are strongly represented in the new members.

Photonics Finland supports the development of new business and research opportunities and helps realize the full potential of photonics in industry and society in areas such as life science, health care, ICT, energy efficiency, safety, industrial manufacturing, agriculture, forestry, and sustainability. Photonics Finland also coordinates the national collaboration by working closely with the international photonics clusters.

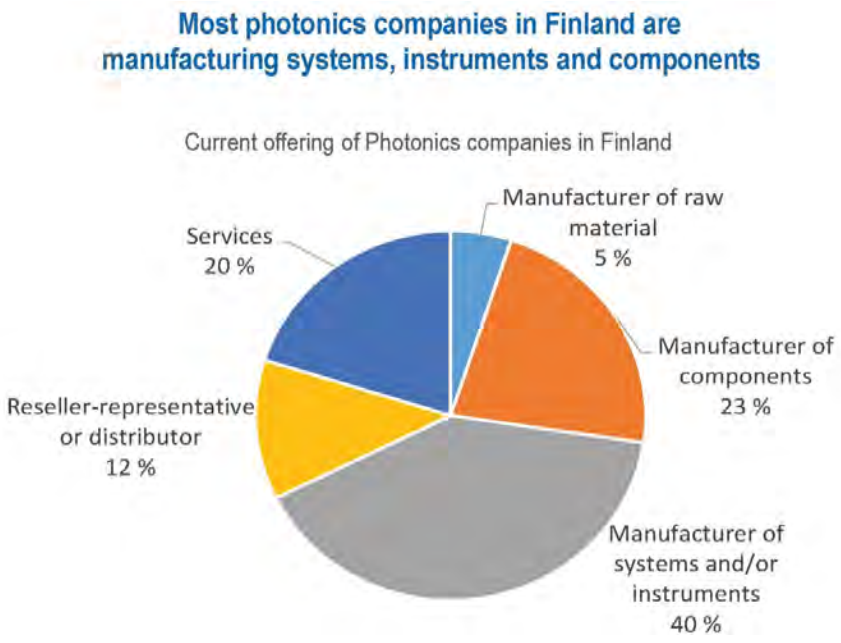
Photonics Finland supports its members by creating new networking and matchmaking opportunities through Photonics technology and solution related events and webinars. The annual main event is Optics and Photonics Days (OPD) which gathers over 350 photonics experts from industry and academy from Finland and abroad. The event consists of plenary talks and parallel academic and industry sessions offering a unique opportunity to learn from academic presentations, to network with companies, students, and researchers in the field of photonics and optics, but also to explore products and services in OPD Exhibition that is held during the conference.

KEY PHOTONICS COMPETENCES IN FINLAND

- Optical Sensing and Imaging
- Micro- and Nanophotonics
- Lasers and Fiber Optics
- Extended Reality (VR, AR, MR / XR)

PHOTONICS INDUSTRY IN FINLAND (UPDATED 2022)

- 300 companies
- 4 500 employees
- 1,5 billion euro market
- 15 % annual growth



Photonics industry sectors in Finland (2020 photonics industry survey)

Photonics companies in Finland are looking for new partners and employees (2020 photonics industry survey)

Global networks, activities, and growth

Photonics companies in Finland are growing significantly and recruiting actively. New employees are needed from vocational training background to doctoral level expertise. Companies benefit the Photonics Job Board platform together with Photonics Finland social media channels to receive visibility to their open positions, and when looking new talents especially from abroad.

Industry representatives have praised the Photonic Finland activities. *"Our company has grown a lot during a year, and we have hired many new employees throughout of 2022. Photonics Finland has been a great partner as we continue to recruit talents across multiple areas of our business"*, says Antti Sunnari, CEO and co-founder of the company Dispelix.

Photonics Finland provides new opportunities for companies to network, find partners and customers internationally. One of the key actions are participation to global industry fairs which are closely linked to academic conferences. Photonics Finland has been organizing the Finnish Pavilion at Photonics West in San Francisco, USA since 2011, and Laser World of Photonics in München, Germany since 2012. The Photonics Finland pavilion provides a turnkey solution for growing companies that wish to receive the best possible visibility and hall placement for their booth, easily and with additional services. Finland Pavilion is highly recognized among other exhibitors and well-known for its great and welcoming atmosphere.

Company feedback on the Pavilion has been very positive. "It's effortless to go to the tradeshows with Photonics Finland because the company can focus only on the few relevant topics while Photonics Finland organizes the rest.", says Uula Kantojärvi from PiBond.

Jaycee Lui-Conckova from Comptek-Solutions continues on a similar vein: *"We have enjoyed this co-exhibiting opportunity at Photonics West 2023 with Photonics Finland Pavilion. Not only did we succeed in obtaining a lot of quality leads and prospects worldwide through this flagship industrial platform, the collective branding effect as a Finland Pavilion has also been very beneficial for our corporate branding as a deep tech solution provider from Finland. The support from the Photonics Finland team has been instrumental in helping small companies like us to focus on our sales and marketing preparations and efforts onsite."*

Best practices and cluster development through European project partnerships

Photonics Finland is an active partner among the European photonics networks and projects which have an important role of developing the Photonics Finland cluster and its services. Through international co-operation and best practice exchange between project partners, Photonics Finland develops the Finnish photonics industry and academic collaboration and creates new export, training and networking opportunities based on the strategic cluster and project partnerships.

Photonics Finland is already part of several European projects and is actively seeking new partnerships and opportunities. Currently Photonics Finland is a trusted partner of PhotonHub Europe, BestPhorm21, Photonics4Industry and PIMAP4Sustainability projects.

Future directions

The main goal for photonics in Finland is to strengthen the already close industry and academy collaboration which creates new innovations through research, and forms into solid world-class technological know-how and business.

Key areas are visibility enhancement and building new networks and partnerships and attracting new talents for photonics research and industry. Also, partners are needed from non-photonics industry which utilizes photonics technologies or would benefit from new technology solutions.

Also, one of the focus areas is to influence the decision makers in Finland for providing new possibilities for photonics funding, research, development, and growth. One of the main tools are sharing and providing information through photonics themed events, projects, and surveys.

To achieve these goals, European projects plays a key role in providing resources, know-how and new networks when developing Photonics Finland and its actions.

Team Finland in front of Photonics Finland Pavilion at Photonics West 2023 (Photo: Photonics Finland)