# Interview with Goëry Genty

**Professor at the university of Tampere-Finland, specialist of non-linear optics in optical fibers and integrated photonics.**

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***Could you describe your background and how you discovered science?***
I was born in Bordeaux, where I completed all my schooling up to the end of high school, and I was always drawn to scientific subjects, especially mathematics and physics. I knew early on that I wanted to become an engineer, and after graduating, I joined a scientific preparatory class in Toulouse-France at Lycée Fermat, which had an excellent reputation at the time. I sat the competitive entrance exams like everyone else, and although I had no prior interest in optics, my initial preferences were more aligned with advanced marine engineering, but everything changed when I received the school brochures after the exam results. The Ecole Supérieure d'Optique in Paris presented optics and photonics as a dynamic, promising field, and that convinced me. Without that brochure, I might have gone in a completely different direction, but that was the turning point that oriented me toward photonics.

***How did your training in optics go?***
Rather well. In the second year, the school strongly encouraged summer internships abroad, using contacts from former students. At that time, many aimed for the United States, but I opted for a more strategic approach: fewer applicants meant greater chances. Finland turned out to be such an option, and since students from the previous year spoke highly of their experience there, a friend and I applied. We were both accepted and spent the summer at Helsinki University of Technology (now Aalto University), which turned out to be a decisive experience.

***What was your internship topic?***
I worked on measuring the linewidth of laser sources using self-homodyne and heterodyne techniques. The internship went well, and I maintained excellent contact with the Finnish laboratory. In my final year, they offered me a PhD position Although I initially hesitated between research and industry, I thought that completing a PhD would allow me to explore research while keeping the option of transitioning to industry later. So I returned to Finland to begin my doctorate.

***What was the focus of your PhD?***
The project initially focused on advanced measurement techniques such as linewidth characterization, fiber dispersion, ultrafast metrology, but a major shift occurred when I spent three months in Denmark and encountered the first photonic crystal fibers produced by a local spin-off. The Danish group gave me samples because our Finnish lab had suitable dispersion measurement tools, and around the same time I attended CLEO, where supercontinuum generation was being presented for the first time. I was fascinated by the idea of generating broadband light from a narrowband input. Once back in Finland, I initiated experiments using the ultrafast laser of a neighboring group led by Prof. Matti Kaivola and, with the freedom given by my supervisor Dr Hanne Ludvigsen, my PhD evolved into a study of ultrafast nonlinear dynamics and supercontinuum generation. I defended my PhD in early 2004.

***What did you do after your PhD?***
I continued for two years as a postdoc in the same lab. Two important events occurred: a late-night call from Prof. John Dudley inviting me to co-author a major Reviews of Modern Physics article, which triggered a long-term collaboration that still lasts today; and a call from Prof. Martti Kauranen in Tampere offering a postdoc position in nonlinear optics. After joining Martti's group, I quickly obtained independent funding from the Academy of Finland and was able to build my own research line around nonlinear fiber optics, supercontinuum, and hydrodynamic analogies.

***How did you get a permanent position?***
Before securing a permanent professorship, I received a five-year Academy of Finland "junior group leader" grant which gave me substantial independence. Shortly before the end of that period, a professorship opened and I was appointed associate professor in 2012, then full professor in 2014. Looking back, my trajectory owes much to timing and opportunity: internships, research stays, and unexpected phone calls all played a decisive role.

***What are the main scientific themes that structure your research?***
My work is structured in several blocks. First, between 2009 and 2015/2016, we focused heavily on studying extreme nonlinear dynamics in fibers, special propagation solutions, and the influence of noise and instabilities. In parallel, we launched a second line of research on ghost imaging, translating the concept from spatial to temporal and spectral domains, enabling ultrafast pulse reconstruction, ghost spectroscopy and ghost OCT. A third direction emerged from applying machine learning to nonlinear optics, initially to predict extreme wave events from spectral measurements and later to systematically control nonlinear propagation and supercontinuum generation via feedback optimization. To gain more degrees of freedom, we moved into multimode fibers, exploring active (spatial/spectral modulation) and passive (nonlinear self-organization) control of structured light. We also developed advanced real-time measurement •••

techniques, sub-30 fs temporal resolution and pulse-by-pulse spatial/phase characterization. Most recently, we began using fibers themselves as physical analog computing elements for classification tasks, a direction we are now extending to multimode fibers for higher dimensionality.

***You also work on integrated waveguides. What is the objective there?***

We are now in the process of transferring part of what we learned in fibers to integrated platforms such as thin-film lithium niobate or tantalate. These systems offer strong nonlinear and electro-optic effects over very short distances, enabling compact devices with lower power requirements. Our goal is to determine whether key nonlinear fiber phenomena can be replicated, or re-engineered, on-chip for future integrated photonic applications.

***Which emerging topics do you find particularly promising?***

Two lines of inquiry stand out. The first is optical computing using nonlinear media, whether in fibers or integrated waveguides, to act as analog processors. This is attractive, although I remain cautious: it is beautiful physics, but it may not replace GPU-based computation. The second is nonlinear self-organization in multimode systems, enabling passive shaping of spatial and spectral profiles simply by tuning input power and conditions. Overall, the unifying theme is structured light across temporal, spectral and spatial dimensions using nonlinear control.

***What about modelling and numerical complexity?***

In single-mode systems, well-established models accurately describe nonlinear propagation. In multimode systems, however, simulation becomes dramatically more complex: one moves from one-dimensional fields to three-dimensional spatiotemporal data cubes. Simulating long propagation distances with high resolution becomes computationally prohibitive, especially when scanning parameters. This is one reason why we increasingly combine experiments and machine learning instead of relying solely on brute-force numerical modelling.

***What are your main collaborations?***

Locally, I collaborate with several groups at our university. Internationally, my longest-running collaboration is with Prof. John Dudley in the Louis and Marie Pasteur University in France. I also collaborate with groups in Sapienza University in Italy, the Institute for Photonics Technologies in Germany and a group in Chengdu University in China.

***Are you using photonics to support machine learning or machine learning to support your investigations in photonics?***

Both directions are now active. Initially, machine learning served photonics by helping to analyse and control nonlinear dynamics. More recently, we have also used photonic systems themselves as hardware for analog computation. Stabilization of experiments is another area where machine learning can be valuable using feedback algorithms to compensate for drifts and maintain alignment during long data acquisitions.

***How has the photonics ecosystem developed in Finland, particularly with the national flagship?***

Until mid-2000, Finland was not a leading EU country in photonics research despite solid infrastructures in Helsinki, Tampere and Eastern Finland. Three key developments changed the landscape: significant university investments in fabrication technologies; the transformation of the Finnish Optical Society into Photonics Finland integrating industrial stakeholders; and the Academy of Finland's call for eight-year flagship programmes. By unifying the main national academic groups and leveraging industrial momentum, we secured a national photonics flagship in 2019, now involving nearly 500 researchers, with an application for an eight-year extension underway.

***What has been the impact of the flagship?***

The flagship has increased research quality, strengthened funding, accelerated innovation (more patents and start-ups), expanded training programmes, multiplied scientific and industrial events, and significantly improved international diversity. Finland now hosts more than 300 photonics companies for a population of 5.5 million (which is one of the highest densities in Europe) creating strong demand for highly trained graduates.

***What about doctoral education reform?***

PhD studies in Finland were considered too long and insufficiently connected to industry. National pilot programmes were launched two years ago to shorten doctoral timelines and increase industry placement. We secured one of these programmes for photonics, and now coordinate a national doctoral network with about 70 PhD students aligned with the flagship and industrial needs.

***You also coordinate a national infrastructure network. What does this involve?***

Our fabrication and characterization platforms were labelled national infrastructures of strategic importance, meaning they are open to researchers and industry across the country. We provide access, expertise, and support for design and prototyping. This complements the flagship and the doctoral network, forming an integrated ecosystem of research, training and innovation.

***How did EOSAM come to be organised in Tampere?***

EOSAM is the annual conference of the European Optical Society, whose headquarters are in Finland. I already knew the EOS coordinator, Elina Koistinen, and during discussions I suggested hosting the conference in Finland in Tampere. EOS lacked the manpower to organise it alone, but with the flagship administrative resources, budgetary support and network, we could take on the local organisation. The proposal was submitted and accepted, and EOSAM 2026 will take place in Tampere on August 2026.

***What guides your approach to research?***

What matters most to me is the articulation between fundamental research, genuinely useful applications, and strong investment in training and mentoring. If this contributes to strengthening photonics in a small country like Finland, then it is a very positive outcome. ●

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