In the news

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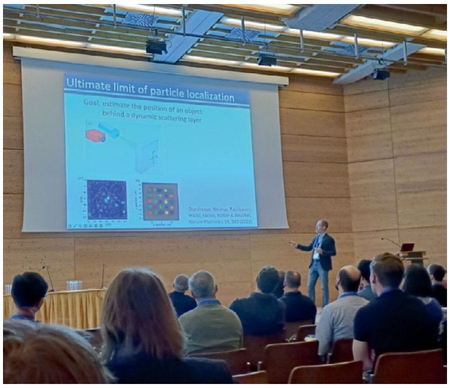
The 10th International Topical Meeting on Nanophotonics and Metamaterials (NANOMETA 2026)



Held in Seefeld in Tirol, Austria, from 6 to 9 January, NANOMETA 2026 brought together researchers from 25 countries working on nanotechnology, photonics and materials science. The conference series began its inaugural meeting in Seefeld in January 2007, and this year marks the tenth edition of the event. Around 150 participants attended, contributing to a programme of 131 presentations: 7 plenary talks, 4 breakthrough talks, 37 invited talks and 31 oral presentations, together with 2 technology talks and 50 posters.

"NANOMETA is, in a sense, only a nominal title. From the outset, its true ambition has been to embrace emerging directions in the science of light and to help shape the field rather than simply following it. As a photonics conference, it has been at the forefront of pioneering topics, such as low-dimensional photonic materials, topological photonics, time crystals and Fisher information in optics. Nano and Meta will remain vibrant and relevant disciplines for as long as they continue to anticipate and define new directions," said proudly Nikolay Zheludev from the University of Southampton, UK, who has co-chaired the meeting with Harald Giessen from the University of Stuttgart, Germany, since 2007.

During the meeting, Allard Mosk from the Utrecht University in the Netherlands, Dorian Bouchet from Université Grenoble Alpes in France and Stefan Rotter from Vienna University of Technology in Austria were awarded the 2026 European Physical Society-Quantum Electronics and Optics Division (EPS-QEOD) Prize for Research into the Science of Light for their pioneering research on the fundamental limits of information and precision in electromagnetic scattering, leading to a quantitative understanding of how light carries and processes information. Following the prize announcement, Rotter delivered a plenary lecture on Fisher information (FI).

"Fisher information provides a quantitative theory of sensitivity and precision in noisy electromagnetic systems, which lies at the core of sensing, detection and estimation. As such, FI is the quantitative backbone of modern electrical engineering, right from radar and wireless communications through to precision metrology and neural network-based signal processing," explained Rotter.

According to Rotter, FI describes how precisely a quantity can be measured in the presence of noise. Whenever engineers attempt to detect a weak signal — whether in radar, wireless communication, imaging or sensing — there is a fundamental limit to how accurately a parameter can be estimated. FI quantifies this limit. "Traditionally, FI has been used as an abstract mathematical tool to calculate the best possible precision. Our work adds a new perspective — in electromagnetic systems, FI can be treated much like an energy. It can be generated when waves interact with an object, it can propagate through space, and it can be redistributed by resonances, interference and scattering. This viewpoint turns FI into something engineers can actively shape and control — providing a physically intuitive way to design systems for maximum sensitivity," said Rotter. He also disclosed that FI provides a powerful benchmark for sensitivity, however, translating that benchmark into real-world performance still requires careful experimental design.

"A key insight is that FI should not merely be treated as a statistical quantity, but instead as a physical entity carried by electromagnetic fields. This is reflected in the fact that FI admits a local density and flux satisfying a continuity equation analogous to the seminal Poynting theorem. In direct analogy to energy conservation, we show that FI is conserved in regions without information sources or sinks, allowing us to interpret it as a quantity that propagates, resonates, diffracts and interferes. We also extended these ideas to FI flow in artificial neural networks," Rotter added.

Applications of FI are wide ranging, including nanophotonic sensing, feedback control in levitated optomechanics, microscopy through complex media and metasurface-based measurement design, as well as, more broadly, estimation of electromagnetic parameters. From an information-flow perspective, structures can be engineered to direct information towards detectors, analogous to how antennas and waveguides guide energy. Extending this viewpoint to neural networks also suggests a unifying framework to analyse how information propagates in both physical and artificial signal processing systems.

Kevin MacDonald from the University of Southampton, UK, also presented a talk on controlling the flow of FI in sub-atomic precision optical metrology. He showed that measurement precision in light scattering metrology can be enhanced dramatically by controlling the flow of FI near a target object via the design of its environment. In experimental nanowire localization measurements at a wavelength of 640 nm, this approach enabled a precision of about 61 pm (less than $\lambda/10{,}000$).

"Plasmonic and dielectric resonances can enhance information flow, while gratings and near-field structures reshape information radiation patterns. This perspective reframes metrology as a discipline in which resolution can be purposely engineered by tailoring the sources and flow of information to serve applications in atomic-scale diagnostics and fabrication. It is a game-changer for the photonics community," explained Zheludev. A better understanding of FI enables optimization of atomic-scale diagnostics, light detection and ranging, remote sensing and radar technologies, he added.

NANOMETA 2026 highlighted a field advancing rapidly, with new ideas and technologies setting the stage for even greater advances in 2028. "You can do very well in the mainstream, but you can do much better if you create it. Come to NANOMETA to be inspired," Zheludev enthusiastically urged.

See you in Seefeld in 2028!

Rachel Won