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TOPOCOM NEWS

Third Edition · Summer 2026

About TOPOCOM

TOPOCOM - Topological Solitons in Ferroics for Unconventional Computing

The TOPOCOM project, financed under the Marie Skłodowska-Curie Actions (MSCA-DN), is a network of leading European groups from diverse disciplines and sectors. Our mission is to provide comprehensive training on the integrative concepts of topological solitons in ferroic materials and their applications in unconventional computing. The TOPOCOM doctoral candidates benefit from a unique training program that combines scientific expertise with transferable business and cultural skills.

Beneficiaries



IBM Research | Zurich



Associated Partners



nature portfolio

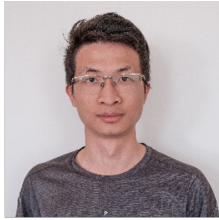


This project has received funding from the European Union's Horizon Europe Programme Horizon.1.2 under the Marie Skłodowska-Curie Actions (MSCA).

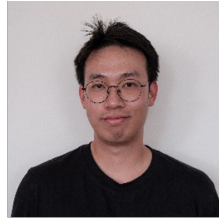
Doctoral Candidates



Maurice Colling



Yan Meng Chong



Minh Duc Tran



Yuean Zhou



Memoona Ismail



Ali Hasan



Krishna Patel



Anusree Navallur



Alen John



Elisa Zaccaria



Nikhil Vijayan

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Highlights

Summer 2025 – Summer 2026

Publications

Physical Review B

Positional memory of skyrmions in magnetic bilayers

B. Barton-Singer, **Anusree Navallur**, S. Komineas

doi.org/10.1103/wrrw-by3t

Nature Physics

Time-resolved imaging of antiferromagnetic skyrmion interactions

M. Bhukta *et al.*, including **Minh Duc Tran**

doi.org/10.1038/s41567-026-03383-4

Communications Physics

Control of helix orientation in chiral magnets via lateral confinement

Maurice Colling, M. Stepanova, M. Hentschel *et al.*

doi.org/10.1038/s42005-026-02808-z

Awards

Best talk

Krishna Patel — 4th TOPOCOM Workshop, Villach, April 2026.

Best poster

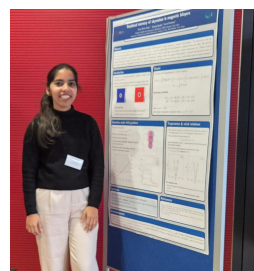
Yuean Zhou — 4th TOPOCOM Workshop, Villach, April 2026.

Poster award (one of three)

Anusree Navallur — WE-Heraeus Seminar 847, Bad Honnef, January 2026.



Krishna Patel (best talk) and Yuean Zhou (best poster) at the 4th TOPOCOM Workshop in Villach



Anusree Navallur with her award-winning poster at WE-Heraeus Seminar 847

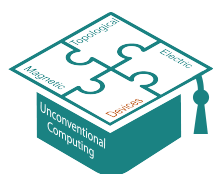
Workshop

April 2026

4th TOPOCOM Workshop — hosted by Infineon Technologies in Villach, Austria. A programme built largely around lectures from industry professionals, alongside talks and posters from the doctoral candidates and a look inside Infineon's labs and cleanroom. Full report on p. 15.



The Infineon Technologies site in Villach, Austria



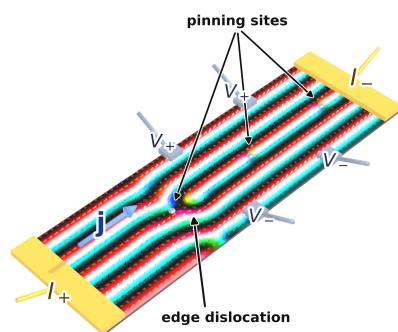
Geometry steers the helix

Maurice Colling · Norwegian University of Science and Technology (NTNU), Norway

Scientific Progress

Maurice's first research paper as lead author within the TOPOCOM project has been published in *Communications Physics* (Nature Portfolio). In some magnetic materials, such as FeGe, the magnetization does not stay fixed but turns steadily as one moves through the material, like a corkscrew. This pattern is called a magnetic helix. Combining computer simulations with magnetic imaging, the paper shows that the direction in which the helix runs can readily be controlled by changing the shape of the material. This gives a robust way to steer the helix in future devices. The work was carried out with collaborators in Japan and Germany, under the supervision of Prof. Meier.

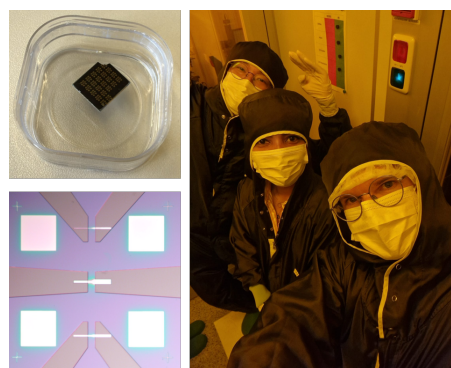
Building on this, Maurice is now preparing the next manuscript: Using computer simulations, he shows that a single defect in the magnetic helix, called an edge dislocation, can easily move through the material. Placing the defect in a narrow track with a row of pinning sites, a stop-and-go motion can be achieved via short electric or magnetic field pulses. Each pulse frees the defect from one site, and it then moves on by itself to the next. Its position therefore shows how many pulses have arrived. The count is kept without power and can be read out electrically, which makes the defect interesting for low-energy event counting.



Device concept: an edge dislocation in a confined FeGe track, guided past engineered pinning sites and read out electrically at a Hall contact.

Secondment at JGU Mainz, Germany

In spring 2026, Maurice completed his final TOPOCOM secondment at Johannes Gutenberg University Mainz in the group of Prof. Kläui. Over six weeks, he was introduced to device nanostructuring by electron-beam lithography and to magnetic-force-microscopy imaging of synthetic antiferromagnets, linking his simulations directly to fabricated samples. He is grateful to the Kläui group for their warm hospitality and for sharing their experimental expertise and knowledge about magnetic materials for unconventional computing.



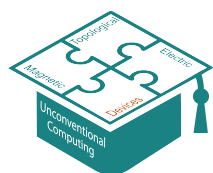
Secondment Mainz

Workshops and Conferences

Maurice presented his now-published work on controlling helix orientation in two talks: in March at the DPG Spring Meeting in Dresden, and in April at the 4th TOPOCOM Workshop in Villach.



Maurice's talk at the 4th TOPOCOM Workshop in Villach



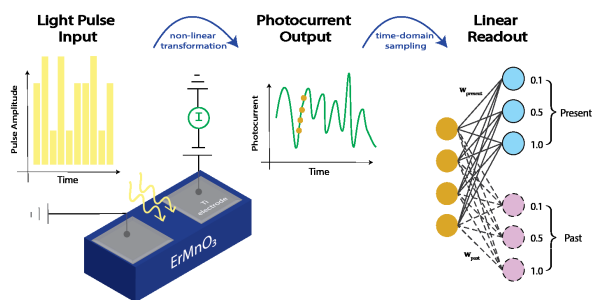
A semiconductor that reads light in time

Yan Meng Chong · Norwegian University of Science and Technology, Norway

Scientific Progress

Yan Meng's manuscript as lead author from the TOPOCOM project has been submitted for publication and is available as a preprint on arXiv.¹ In a collaboration between the groups of Prof. Meier at NTNU and Prof. Everschor-Sitte at the University of Duisburg-Essen, the work explores whether a ferroelectric semiconductor can recognise time-varying signals encoded in light pulses on its own, using the small-band-gap p-type semiconductor ErMnO_3 as a model system.

Under white-light illumination, ErMnO_3 produces photo-induced currents that evolve non-linearly and relax on a timescale tunable through the type of electrical contact that is used for readout, supplying both ingredients a physical reservoir needs: a high-dimensional non-linear projection of the input and a fading memory of it. Training only a single-layer linear readout on the sampled photocurrent, the recognition accuracy for a "Past" light pulse rises from $\sim 33\%$ at chance level to $\sim 93\%$.



Light pulses are non-linearly transformed into a photocurrent and classified by a single-layer linear readout, adapted from [1]

Workshops and Conferences

In spring 2026, Yan Meng attended the DPG Spring Meeting in Dresden, Germany, where he

gave a talk on photocurrent-based recognition of time-series tasks using reservoir computing. The meeting was also an excellent opportunity to meet up with his TOPOCOM peers outside the project's own events, and to visit the industrial exhibition, where he spoke with Nanosurf — one of TOPOCOM's associated partners — about their scanning-probe platforms.



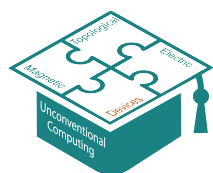
DPG Spring Meeting: the talk, lunch with TOPOCOM peers, visiting the Nanosurf booth

The 4TH TOPOCOM workshop was hosted by Infineon Technologies in Villach, Austria. Alongside exchanging results with his TOPOCOM peers, Yan Meng followed a programme built mainly around lectures from industry professionals, which made this workshop a distinctly different one for him: he got a direct view of how research questions are framed, prioritised and turned into products in industry. He also got to visit Infineon's labs and cleanroom, seeing advanced fabrication and failure-analysis techniques first hand.



TOPOCOM members at Infineon and in Villach's old town

1. Y. M. Chong, A. Majumdar, M. Zahn, et al., *Photo-induced currents and short-term memory for reservoir computing in a ferroelectric semiconductor*, 2026, arXiv:2607.20810



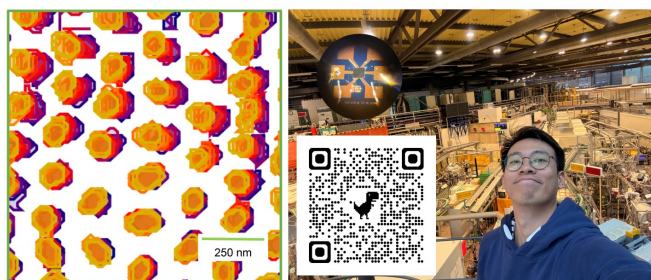
Where antiferromagnetic skyrmions recoil

Minh Duc Tran · Johannes Gutenberg University Mainz, Germany

Scientific Progress

A project Duc contributed to was recently published in *Nature Physics* (<https://doi.org/10.1038/s41567-026-03383-4>).

The work visualizes, for the first time, interactions between antiferromagnetic skyrmions with nanosecond time resolution: pinned skyrmions act as local scattering centers, and neighboring mobile skyrmions recoil off them over timescales of 3–20 ns. The study also shows that antiferromagnetic skyrmions move reproducibly along straight paths aligned with the driving electrical current. The skyrmion Hall effect, which deflects motion sideways in ferromagnetic systems, does not come into play. The results were obtained through multiple synchrotron experiments Duc took part in, among many failure, but that what happens when doing science at the edge. Building on this, Duc and colleagues are now exploring new types of composite spin textures with unconventional current-driven behavior. More results are in preparation, so stay tuned for updates.



Capturing skyrmion lattice dynamics in nanosecond time scale at BESSY II synchrotron. No beamtime is deemed worthy without a honorably sacrificed sample

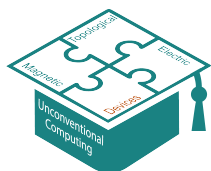
Workshops and Conferences

Approaching the final year of his PhD, Duc has been busier than ever, with even more travel for experiments, conferences, and most importantly, networking with industrial partners. He presented his work at DPG 2026 in Dresden, shared his beamtime findings, and gave talk to macaques during the TOPOCOM workshop hosted by Infi-

neon in Villach, Austria. Touring one of Infineon's flagship fabs, he was introduced to industrial production lines and commercial R&D for cutting-edge technologies, and discussed career opportunities with industry experts. He also received two consecutive trainings on state-of-the-art cryogenic SPM and ultra-high-resolution, low-noise AFM at attocube and Nanosurf, further extending his knowledge at the forefront of the technology. Alongside this, he learned a great deal about product development and management, identifying customer needs, and how industry approaches growing market demands. Such experiences greatly strengthen his connections with industry for a future career transition. He, Yuean, and Alen also welcomed Maurice, Anusree, Nikhil for their secondment in Mainz, during which they enjoyed a day trip on a boat exploring the Rhein river.



Socializing with TOPOCOM DCs, industrials training at attocube and Nanosurf, presenting a talk in Nature, and exciting secondments

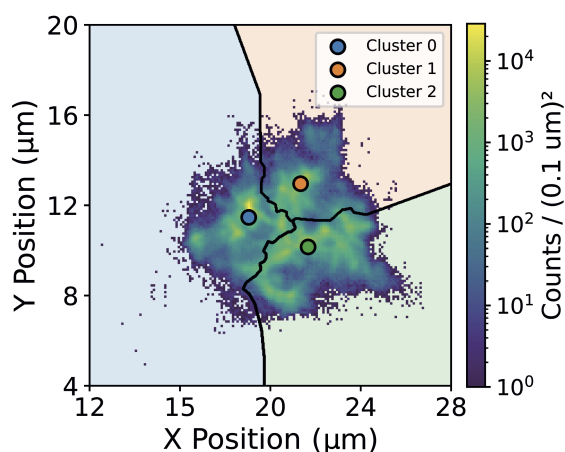


Driving diffusion with an oscillating field

Yuean Zhou · Johannes Gutenberg University Mainz, Germany

Scientific Progress

Yuean continued her research on the dynamics of confined skyrmions, focusing on how an oscillating out-of-plane magnetic field can enhance thermally activated skyrmion diffusion. Her work aims to clarify how periodic excitation modifies the effective energy landscape and facilitates stochastic skyrmion motion, providing further insight into the controlled manipulation of skyrmion dynamics for unconventional computing. A manuscript reporting these results is currently in preparation.



AC-field-enhanced stochastic skyrmion dynamics in a confined geometry

Secondment at UG Groningen, Netherlands

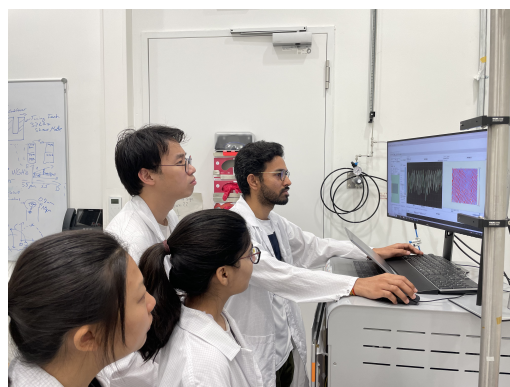
Yuean carried out a research secondment at the University of Groningen, where she further explored skyrmion dynamics and their potential for unconventional computing. During the visit, she exchanged ideas with researchers from the Cogni-Gron community and discussed theoretical and experimental aspects of skyrmion-based computing. She also gave a talk presenting her recent work on skyrmion dynamics and probabilistic computing, which stimulated valuable discussions and provided new perspectives for her ongoing research.



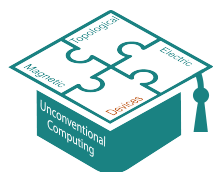
Research secondment and seminar at the University of Groningen

Workshops and Conferences

Yuean presented her research at several scientific meetings in 2026. At the DPG Spring Meeting, she gave a talk on her recent work on skyrmion dynamics. She also presented her research at a Wilhelm and Else Heraeus seminar in Bad Honnef, where she exchanged ideas with researchers working on unconventional computing. Yuean also participated in hands-on training on scanning probe microscopy technologies at attocube, gaining practical experience with high-resolution AFM and advanced characterization techniques. In addition to the technical aspects, she gained a valuable perspective on how advanced scientific instrumentation is translated into industrial products and tailored to research needs. This experience strengthened both her experimental skill set and her connection with industry, providing useful perspectives for future career development.



Hands-on SPM training at attocube



Two phases, self-organised in bands

Memoona Ismail · University of Groningen, Netherlands

Scientific Progress

Memoona's research focuses on the synthesis of ferroelectric thin films engineered to exist near phase transitions, independent of temperature. The ability to manipulate ferroelectrics near phase transitions is crucial for enhancing the efficiency and adaptability, particularly for applications in memristive devices. This control could pave the way for more advanced, energy-efficient materials in neuromorphic computing and memory storage technologies, where precise tuning of material properties is essential for optimizing device performance. Within this project, the aim is to demonstrate this concept for ferroelectrics and one such good example is BaTiO₃ which shows that dielectric permittivity has very large dynamical range close to phase transitions. Recently, Memoona has been performing Piezo-response force microscopy (PFM) measurements on BTO films grown with Pulsed Laser Deposition (PLD) and found different generations of domain walls and unique pattern of long and short range domains. In addition, we also found the coexistence of two different phases self-organized in bands which hasn't been observed before.

Workshops and Conferences

Since last year, Memoona has participated in various scientific events. From attending TOPOCOM workshop in Crete which was a perfect blend of interdisciplinary topics



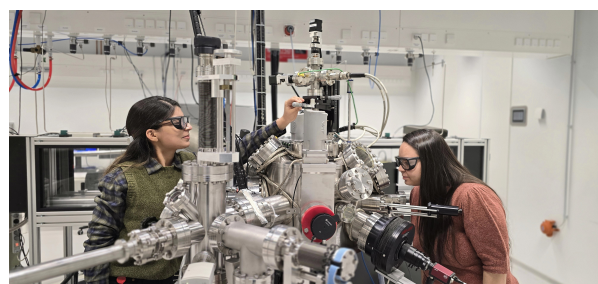
TOPOCOM Workshop at Crete

including mathematical perspectives on topological solitons, theories of ferroelectricity and thin film synthesis and characterization. She also presented her poster explaining domain formation in low symmetry BaTiO₃ at CogniGron Research Away Day'25 where she got the best poster prize. Summer was quite happening time for Memoona. In June, Memoona attended PLD course offered by Demcon TSST, Twente which helped her in developing in-depth understanding of scientific and technical aspects in RHEED controlled PLD. In July, she attended International School of Oxide Electronic'25 at Corsica, France which led to many fruitful discussions about theoretical approaches to experimental synthesis as well as the fundamentals of magnetism and ferroelectrics with leading researchers and other doctoral students working in the field. Memoona also presented her poster during summer school and got constructive feedback.

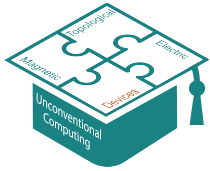


ISOE'25 corsica

Lately, Memoona has hosted Krishna from LIST for her secondment and is actively working on her memory devices before going for her first secondment at NTNU, Trondheim in spring.



Hosting Krishna at UG

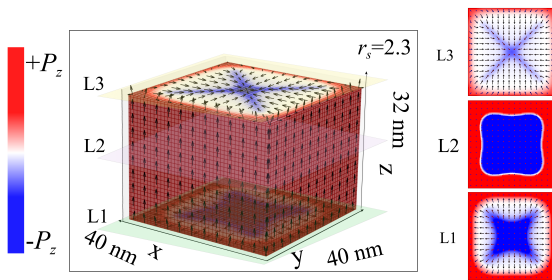


A solver fast enough to chase ferrons

Ali Hasan · University of Messina, Italy

Scientific Progress

Ali has completed a high performance microelectric solver for polarization dynamics in ferroelectrics, built with CUDA and the Thrust library. The solver resolves the full three dimensional polarization vector field, capturing the time dependent Ginzburg-Landau equation with complete contributions from the Landau free energy, the gradient energy, the electrostatic energy, and external field effects. This work is now available as a preprint.¹ To make the tool more broadly accessible, Ali also built a CPU version of the solver using FFTW, confirmed that it reproduces the GPU results to high numerical precision, and benchmarked the execution time of both implementations across a range of grid sizes, showing that the GPU version becomes substantially faster as the system size grows. Figure below shows skyrmion stabilization obtained with the microelectric solver.



Skyrmion stabilization obtained with the microelectric solver, adapted from [1]

In a related project, Ali contributed to a machine learning approach for estimating the interfacial Dzyaloshinskii-Moriya interaction directly from magnetic bubble domain images, using a compact convolutional neural network trained on a micromagnetic dataset designed to emulate magneto optical Kerr effect imaging. This work is also now available as a preprint. Ali is currently extending the microelectric solver to describe ferrons, propagating polarization waves that carry

electric dipole moments in ferroelectrics, with a new paper in preparation studying their dispersion relation, group velocity, and spatial decay rate in BaTiO₃ nanowires.

Secondment at UoC Heraklion, Greece

In May 2025, Ali completed a four-week secondment at the University of Crete with Prof. Komineas and Anusree, where he worked on deriving analytical solutions for the Landau free energy involved in the TDGL equation.

Workshops and Training Schools

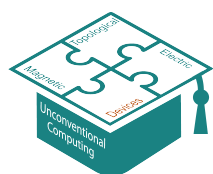
Ali also attended a training school in Budapest, Hungary focused on the theoretical and mathematical foundations of ferromagnetism. In December 2025, he attended the fourth edition of the PETASPIN School on spintronics, held in Messina, Italy.

In April 2026, Ali took part in the TOPOCOM workshop at Infineon in Villach, Austria, where he delivered a scientific talk on his GPU based solver and presented a poster alongside fellow doctoral candidates. In July 2026, he attended the SPICE workshop on Ferrons and Magnons in Ingelheim, Germany, where he presented a poster titled "A GPU-Accelerated Solver for Polarization Dynamics in Ferroelectric Materials". These engagements were highly valuable for networking and collaboration opportunities.



Scientific Gatherings and Collaborations

1. A. Hasan, E. Piccolo, A. Giordano, et al., A GPU-based Solver for Polarization Dynamics in Ferroelectric Materials, 2026, arXiv:2605.28800

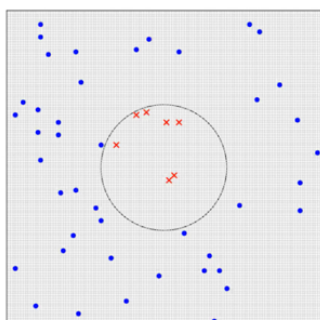


Electric bubbles as a source of randomness

Krishna Patel · Luxembourg Institute of Science and Technology, Luxembourg

Scientific Progress

Krishna has developed a computational model that reproduces the diffusion of electric bubbles in a ferroelectric layer at a much lower cost than atomistic simulations. The Brownian motion of these bubbles can be exploited as a physical source of randomness for a random number generator, in which the number of bubbles under a circular top electrode is read out and each reading is one raw output. Interestingly, she has shown that the speed of the random number generator can be optimized by controlling the geometric parameters defining the system. Her treatment includes a strategy to deal with correlations between consecutive readings.



Top view of the simulated system. The blue points are electric bubbles in the ferroelectric layer, the black circle is the area under the circular top electrode, and the red crosses are the bubbles counted under it. As the bubbles diffuse, this number changes, and the fluctuation is the source of randomness.

Secondment at IBM Research Zurich, Switzerland

In June 2026, Krishna completed her final secondment at IBM Zurich, where she familiarised herself with the group's neuromorphic comput-

ing research through discussions with the team there. She also attended the "Women in Science" event, covering topics including atom manipulation, nanothermal transport, and communication between quantum processors, and spent weekends visiting nearby towns. She is grateful to everyone at IBM Research for hosting and supporting her throughout her stay.



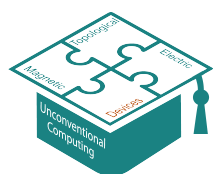
Secondment at IBM Zurich

Workshops and Conferences

Krishna attended the 4th TOPOCOM Workshop, hosted by IFAT in Villach, Austria, where she presented her current research to project partners and researchers from academia and industry. The sessions brought fresh perspectives on hardware, neuromorphic computing, and AI tools for science, along with how such work finds its way into industrial applications. Her talk was awarded best presentation of the workshop.



Best talk award and group photo at Infineon during the TOPOCOM Villach workshop



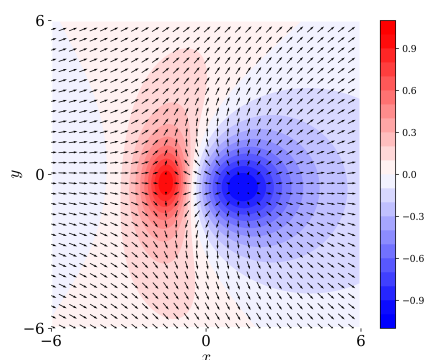
Skyrmions that remember where they were

Anusree Navallur · University of Crete, Greece

Scientific Progress

Anusree's work on the positional-memory behaviour of skyrmions in antiferromagnetically coupled magnetic bilayers has now been published in *Physical Review B*. This work combined micromagnetic simulations and analytical modelling to explain the field-driven dynamics and memory effect of coupled skyrmions.

She is currently studying the dynamics of bimerons driven by spin-orbit torque, combining numerical simulations and analytical approaches to investigate their motion and stability. This broadens her research on the current-driven dynamics of topological magnetic textures.



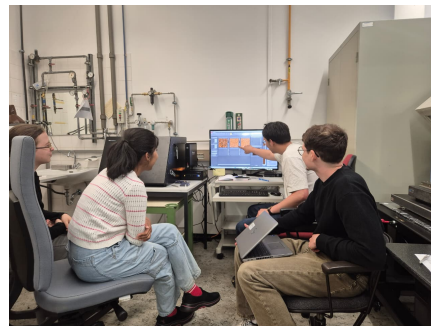
Bimeron with interfacial DMI. The colour map represents the m_z component of the magnetization, while the vectors indicate the in-plane magnetization components.

Secondment at JGU Mainz, Germany

In June 2026, Anusree completed a research secondment at Johannes Gutenberg University Mainz. During the secondment, she studied the dynamics of skyrmions in a ferromagnet-antiferromagnet junction using micromagnetic simulations and gained hands-on experience with MuMax3.

In addition to the simulation work, she received practical training in device nanostructuring using electron-beam lithography and in magnetic force microscopy (MFM) for imaging synthetic antiferromagnetic systems. The secondment allowed

her to broaden her experience from theoretical and computational studies towards experimental techniques used to investigate magnetic textures.



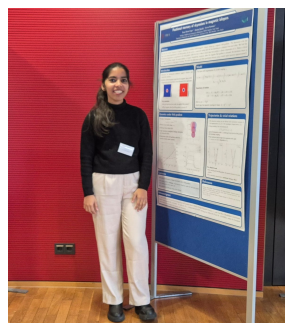
With Duc and Maurice during the secondment at JGU

Workshops and Conferences

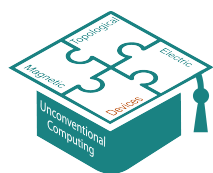
In January 2026, Anusree participated in the WE-Heraeus Seminar 847 in Bad Honnef, Germany, where she presented a poster on her research and received one of the three poster awards of the seminar.

In April 2026, she participated in the TOPOCOM Workshop at Infineon in Villach, Austria, where she gave a presentation on "Dynamics of Magnetic Textures" and also presented a poster. The workshop provided opportunities for scientific discussions and exchange with other researchers and Doctoral Candidates in the network.

In June 2026, she also participated in the POLYTOPO workshop in Iași, Romania, where she presented a poster and took part in scientific sessions covering theoretical, computational and experimental aspects of topological textures.



WE-Heraeus Seminar and TOPOCOM workshop in Villach



An ultrathin layer that tunes the whole stack

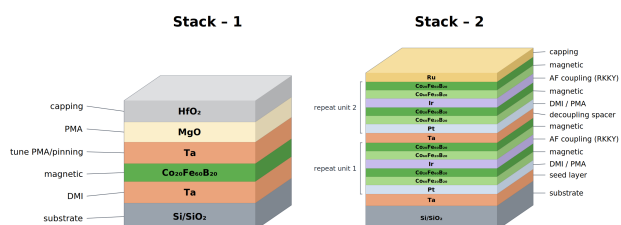
Alen John · Singulus Technologies AG, Germany

Scientific Progress

Alen's research focuses on engineering multilayer magnetic thin films to stabilize micrometer-sized skyrmions and enable their room-temperature thermal diffusion. This is achieved by systematically optimizing magnetron sputtering parameters, such as sputter power and argon pressure, to tailor the structural and magnetic properties of the films.

His initial work centered on Ta/CoFeB/MgO multilayers with perpendicular magnetic anisotropy (PMA), where an ultrathin Ta dusting layer at the CoFeB/MgO interface was used to precisely tune the magnetic anisotropy and stabilize skyrmions. The resulting thin films are characterized using X-ray reflectivity (XRR), SQUID magnetometry, and Kerr microscopy to correlate structural and magnetic properties with skyrmion formation and thermally driven diffusion.

More recently, his research has expanded to synthetic antiferromagnetic (SAF) multilayers that host skyrmions. He is currently optimizing SAF stacks across different magnetic compensation states to achieve stable room-temperature SAF skyrmions and their electrical detection via the anomalous Hall effect (AHE), advancing their potential for energy-efficient spintronic devices.



Sample stacks - PMA stack with MgO and SAF stack

Workshops and Conferences

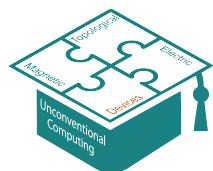
In March, Alen attended the DPG Spring Meeting in Dresden, where he presented a talk on the optimization of magnetic thin film stacks for skyrmion stabilization. The talk covered his efforts to tune the layer composition and growth parameters of the deposited stacks in order to control the magnetic properties relevant for skyrmion formation.

In April, he participated in the TOPOCOM workshop hosted by Infineon Technologies in Villach, Austria, delivering a scientific presentation entitled *Thin Film Deposition for Topological Solitons* on the progress of his doctoral project. He further took an active part in the technical sessions and discussion rounds, exchanging ideas with early-stage researchers and senior scientists across the network.

As part of the industry-engagement activities of JGU Mainz, Alen joined the *Industry Meets Science* program at Sensitec GmbH, where he gave a short presentation introducing his research to an industrial audience and visited the company's research laboratories and production facilities. The visit provided first-hand insight into how fundamental research on magnetic thin films is translated into commercial sensor technology.



Scientific presentations at TOPOCOM workshop, Villach and at Sensitec GmbH



25% more polarisation from a nanolaminate

Elisa Zaccaria · IBM Research Europe-Zurich & University of Groningen, Switzerland & Netherlands

Scientific Progress

The Back-End-of-Line (BEOL) is the final stage of semiconductor fabrication. In addition to conventional wiring, the BEOL can be functionalised by integrating emerging electronic devices for non-volatile memory, in-memory computing, and advanced power delivery. Relevant technologies include oxide-semiconductor transistors (OxFETs) and ferroelectric field-effect transistors (FeFETs).

During the first part of her PhD, Elisa focused on the optimisation of BEOL-compatible ferroelectric hafnium–zirconium oxide (HZO) material stacks. She fabricated ferroelectric capacitors and investigated how the HZO layer architecture influences the ferroelectric response. In particular, she compared a homogeneous $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ solid solution with $\text{HfO}_2/\text{ZrO}_2$ nanolaminates having different periods.

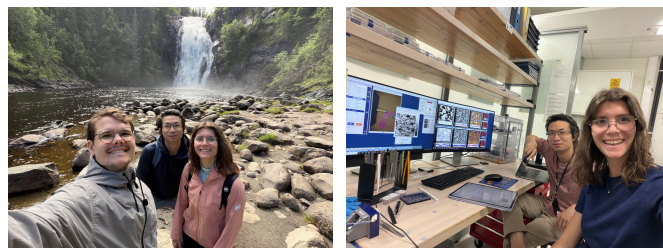
A fine-period nanolaminate provides approximately 25% higher remanent polarisation than the solid solution while maintaining a comparable coercive field, whereas a coarse-period nanolaminate shows lower polarisation. Capacitance–voltage measurements and transmission electron microscopy were also used to investigate the capacitive response and the possible microstructural origin of the different electrical performances. These results are currently being prepared for publication.

In parallel, Elisa has continued developing an OxFET platform based on amorphous oxide-semiconductor channels. These materials combine high electron mobility, low off-state leakage, and compatibility with BEOL processing.

Secondment at NTNU Trondheim, Norway

Elisa completed her secondment at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. During the secondment, she worked on piezoresponse force microscopy (PFM)

measurements to investigate the local electromechanical and ferroelectric response of HZO-based materials, with the support of Yan Meng.



Secondment at NTNU in Trondheim

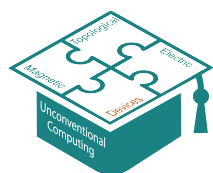
Workshops and Conferences

Elisa participated in the 2026 TOPOCOM workshop hosted by Infineon in Villach, together with the other doctoral candidates. The workshop provided an opportunity to present research updates, exchange knowledge, and take part in scientific discussions with the project partners.

She also presented her research at the 92nd Erice Workshop, "Unconventional Computing: Materials, Science, Informatics, Hardware, Software".



TOPOCOM workshop at Infineon in Villach



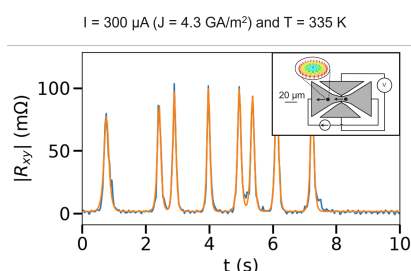
Skymions found without ever seeing them

Nikhil Vijayan · Infineon Technologies AG, Villach, Austria

June 2026 marked the end of Nikhil's first year as a PhD researcher — a year defined by hands-on discovery, new collaborations, and a growing international footprint.

Secondment at JGU Mainz, Germany

A significant portion of this year was spent on secondment at JGU, Mainz. Making the most of his time there, Nikhil took on teaching duties that are an integral part of doctoral training. He served as a tutor for a physics course for bachelor's students, and also supervised laboratory sessions for multiple student groups, guiding them through measurements of hysteresis curves in different types of magnetic materials — a topic close to his own research.



Time evolution of the Hall voltage (μV) and the characteristic peaks originating from skyrmions passing through the Hall junction.

Scientific Progress

Back at IFAT, Villach, Nikhil achieved a key milestone during his first year: building a setup capable of reliably nucleating and detecting skyrmions without any optical tools. Driven by this success, he set out to map the complete stability regime in which skyrmions exhibit predictable motion — systematically varying temperature, magnetic field, and applied current. Now, his secondment in Mainz is giving him the opportunity to complement these all-electrical findings with direct optical imaging using the Kerr microscope setup, adding visual confirmation to his results.

Workshops and Conferences

Nikhil was part of the organising committee for the TOPOCOM workshop at IFAT in Villach, where he also gave a talk and presented a poster on his findings. The feedback from peers opened up new perspectives on skyrmion dynamics and control. He also had the chance to present his work to a broader, industry-oriented audience at the PhD Discovery Days — an event organised by Infineon for its doctoral students. This was a valuable exercise in communicating not just the science, but also the technical feasibility, industrial compatibility, and potential impact of skyrmion-based sensing to a non-specialist audience.



Collaborations

Mainz has proven to be a hub for TOPOCOM collaboration. Nikhil has been engaged in ongoing discussions with Anusree (University of Crete) and Alen (Singulus) on extending skyrmion stability using Synthetic Antiferromagnets (SAFs) — a promising direction for the field. In June, six of TOPOCOM's eleven doctoral candidates and collaborators took a day trip to Bacharach along the Rhine, enjoying good food, wine, and the camaraderie that makes a network like TOPOCOM special.

Nikhil also visited Nanosurf's branch in Langen — a close TOPOCOM collaborator — where he received hands-on training with state-of-the-art atomic force microscopy (AFM) setups. This new skill adds a powerful characterisation tool to his arsenal, giving him an additional degree of freedom in probing skyrmion properties.

Fourth Workshop in Villach

April 2026

The 4th TOPOCOM Workshop, hosted by Infineon Technologies in Villach, Austria, brought the network together for a dynamic program bridging academic research with industrial innovation.

Lectures from industry

The sessions offered diverse perspectives on the future of hardware, ranging from advancements in neuromorphic computing and research in industry to insights into career paths, deep-tech startups, and emerging AI tools for science.



From technology transfer and deep-tech startups to career paths and AI tools for science

Talks and posters

Beyond the lectures, the workshop provided a platform for doctoral candidates to showcase their evolving research through talks and posters, sparking lively discussions that transformed the conference room into a hub of collaborative energy. Two of them were recognised for it: **Krishna Patel** received the best talk award and **Yuean Zhou** the best poster award.



The poster session, doctoral candidates presenting their work, and the best talk and best poster awards

Beyond the science

Complementing the scientific rigor, the workshop featured unique social experiences that integrated the local culture and environment. From the fantastic atmosphere provided by Infineon to a memorable visit with Japanese Macaques in a natural, barrier-free setting, the event balanced technical depth with meaningful networking. Set against the scenic backdrop of Villach, the workshop further strengthened the collaborative spirit of the network, blending professional growth with unforgettable shared experiences.



Welcome to the Affenberg — a barrier-free visit with the Japanese Macaques

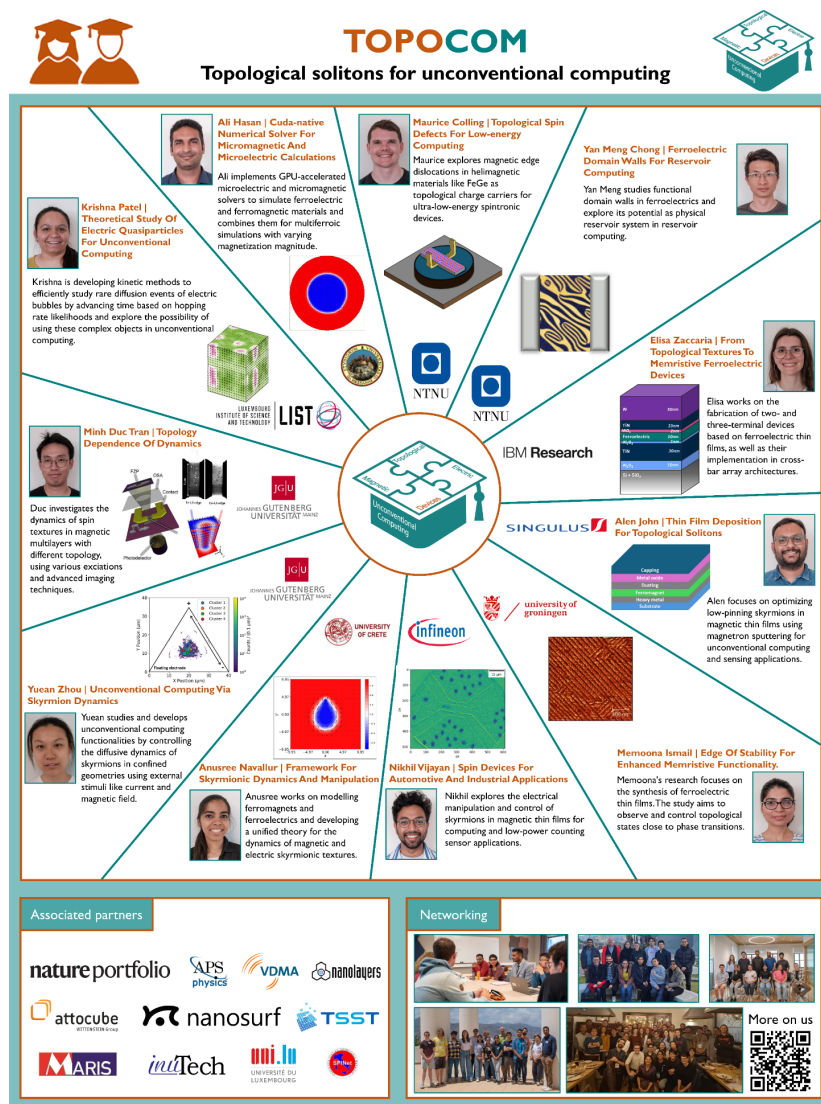
TOPOCOM Video and Poster

Watch, read and share



The video highlights the project's journey since its start, featuring our main activities and events, including training schools, workshops, and outreach initiatives. It offers a glimpse into the collaborative spirit of TOPOCOM and the network we are building across Europe.

drive.google.com/file/d/1ZgzZerdT8L1HfLbNmXqJLB1wP5t6QLS/view



This project has received funding from the European Union's Horizon Europe Programme Horizon.1.2 under the Marie Skłodowska-Curie Actions (MSCA), Grant agreement No. 101119608.

Funded by the European Union

The poster features the research focus of all our Doctoral Candidates, spanning magnetic textures, ferroelectric systems, and neuromorphic computing.

drive.google.com/file/d/1EMyOC5CCzcVW6Bfy_Xn4izFlgK2SrGzB/view

Upcoming Events

As the fifth TOPOCOM workshop approaches, We are eager to meet again at Johannes Gutenberg University of Mainz, Germany for what we believe will be another enriching and collaborative experience.



Follow Us

Stay in touch and keep up with the network — our website, LinkedIn and Bluesky are all one click away.

