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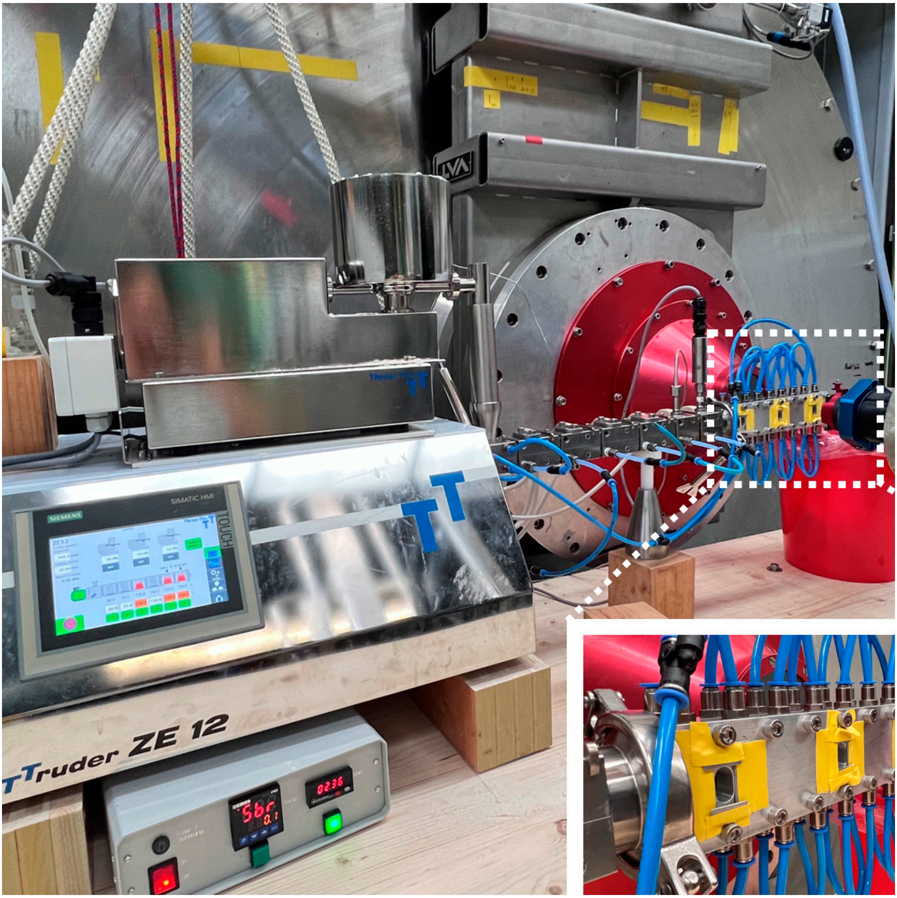

SWISS NEUTRON SCIENCE SOCIETY

Schweizerische Gesellschaft für Neutronenforschung
Société Suisse de la Science Neutronique
Società Svizzera di Scienza dei Neutroni

On the cover

In situ studies of fiber evolution of plant-based meat analogs within a custom-designed extruder cooling die by in situ small-angle neutron scattering at SANS-I/PSI.

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Contents

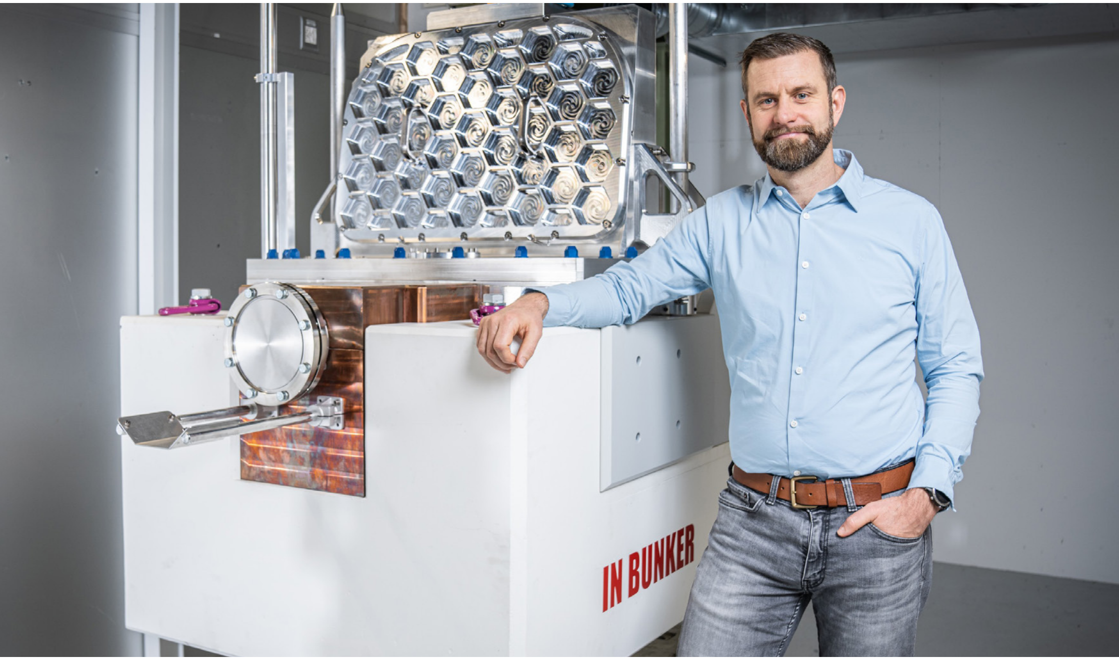
The President's Page

Dear fellow neutron scientists,

We are going towards the end of another year. Before it ends, I would like to welcome a new member of our executive board. Prof. Dr. Andrea Carminati from ETH Zurich joined our board in May 2024, after our yearly general assembly. We are happy for this new addition and find his brief bio on page 6. The last two years has been a period of growth for our society, with more than 100 new members. As a result, SNSS currently counts with 325 members. We are looking forward to adding more members in the future. In this context I would like to add that anyone using or interested in using neutrons for their research or applications in Switzerland can become a member. As an external bibliographic study performed by LINXS (Swedish Institute of Advanced Neutron and X-ray Science) just found out (https://www.linxs.se/news/article-series-i/size-of-the-global-light-and-neutron-source-communities), you would be joining the most successful neutron science community world-wide in terms of publication output!

Swiss achievements in neutron science are also regularly recognized in the form of awards. This year was no exception. Daniel Mazzone from PSI has been awarded with the 13th Erwin Félix Lewy Bertaut prize by the European Crystallographic Association (ECA). He received the prize for his "outstanding contributions in the field of quantum effects in strongly correlated electron materials, employing cutting-edge X-ray and neutron scattering techniques". Here, I want to highlight that out of the 13 awardees who received this prize since its creation, six are members of the Swiss neutron science community. Our own society recognized the outstanding PhD work of Boyang Zhou, under the supervision of Dr. Urs Gasser, on the "Effect of Softness and Charges on the Volume Phase Transition of Colloidal Microgels and Macrogels" with this year's Young Scientist prize. Please join me in congratulating both Daniel and Boyang. You can read more about the work for which they received their prizes on pages 7 and 10, respectively.

I would like to highlight that the success of our community is not casual, but part of careful strategy involving three key elements: i) Switzerland operates two competitive Swiss neutron sources, SINQ and UCN, at the Paul Scherrer Institut, ii) These institutes host a strong community of experts, carrying out state-of-the-art experiments and developing pioneering new instrumentation, and iii) Switzerland invests substantially into international flagship facilities such as the Institute Laue Langevin (ILL) and the European Spallation Source (ESS). The latter investments consist both of financial contributions and use of Swiss expertise at these facilities. In 2024, the neutron science community had the fortunate opportunity to communicate our needs to further refine this strategy, which will allow us to innovate at a high level in the future. Working with Swiss Academy of Sciences (SCNAT), which formally led this process, we have just finished the 2024 update of the Neutron Science Roadmap as mandated by the State Secretariat for Education, Research and Innovation (SERI). This roadmap update will be published on December 18, 2024. This feedback in our roadmap update constitutes feedback that will flow into Swiss



roadmap for research infrastructures that will be published by SERI in 2027. In the update of our roadmap, we recommend that work at PSI to produce a conceptual design report for a project codenamed **SINQ++** will continue over the next four years. This exciting new project aims to replace and upgrade SINQ's cold source, add 5 more state-of-the instruments and create new experimental facilities for the production of medical radionuclides, the testing and certification of advanced nuclear materials, as well as for electronics for aerospace applications. A pre-project at PSI carried out over the last two years shows that the replacement of the SINQ cold moderator will result in gains of at least a factor-2 for all cold SINQ instruments. The goal is to be ready for executing this plan in 2033. In addition, the analysis presented in the roadmap shows that continued Swiss investment in both the ILL and the ESS remains of critical importance. I invite all of you to have a look at the full roadmap.

Finally, I am proud to announce that working with Neil Smith (https://neilsmith-illustration.co.uk), we have created a new logo for our society, which you likely already discovered on the cover of this edition of Swiss Neutron News. Working with our editor Mahir Dzambegovic, we took this opportunity to update the layout and design of Swiss Neutron News providing a fresher and more contemporary look. We hope that you enjoy the result, but we are convinced that this new look is fitting for our community and representative of our vision for the future. We are also working on an update of our webpage. So please stay tuned for this.

I wish all of you the best for the remainder of the year and hope to see many of you at our next general assembly in spring 2025 at PSI.

Marc Janoschek

New Board member

A warm welcome to SNSS's new board member: Prof. Dr. Andrea Carminati

Andrea Carminati is professor of Physics of Soils and Terrestrial Ecosystems at the ETH Zürich. He investigates the fundamental aspects physics of soil water and the implications for root water uptake, transpiration and photosynthesis. The key research topic of Carminati's group is root water uptake, how it is affected by root and rhizosphere hydraulic properties, the feedback with stomatal regulation and the implications for terrestrial water and carbon cycle.

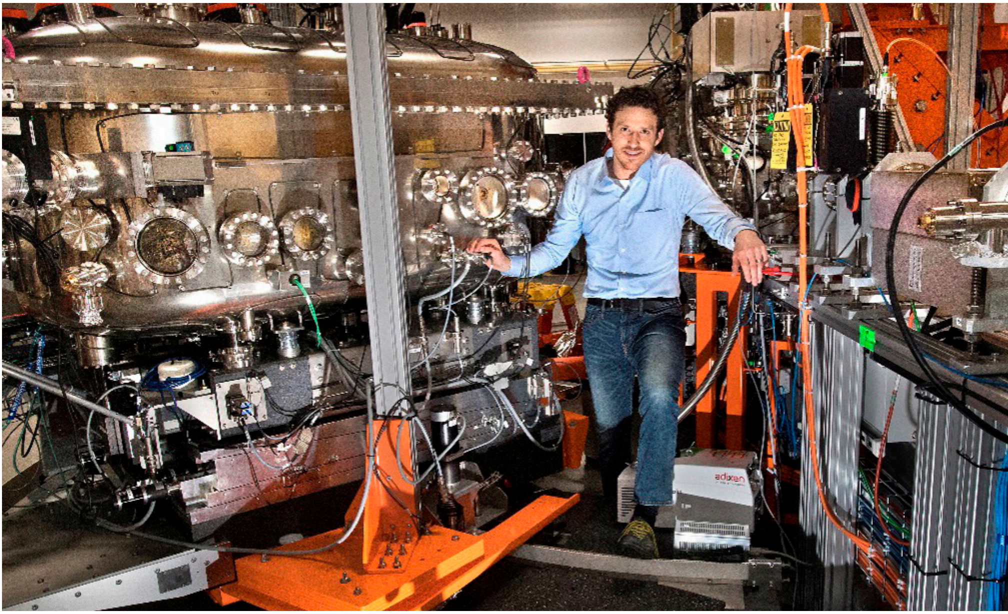
There is still a lot of physics of soil water that has not been understood and its impact on transpiration and photosynthesis is highly needed for predicting the effects of climate change and drought on terrestrial fluxes. Carminati and co-workers developed and use experimental and modelling methods to tackle these questions at different scales, from the pore scale to the pedon scale, and his future research interest is to include the effects of soil drying on transpiration into larger scale models in a mechanistic and tractable way.

Key experimental methods in Carminati's group are imaging methods, in particular neutron radiography and tomography, applied to visualize roots in soil. Carminati and co-workers developed a method to visualize water fluxes in soil and roots by combining deuterated water injection with neutron radiography and with a diffusion-convection model of water flow across the plant tissues. The methods enable to visualize the locations of root water uptake for varying soil conditions.

The SNSS board welcomes Andrea as a new member, and is looking forward to working together in the upcoming years.

13th Erwin Félix Lewy Bertaut Prize

Dr. Daniel Mazzone



Daniel Mazzone, PSI (LNS laboratory, CNM) has been awarded the 13th Erwin Félix Lewy Bertaut Prize for "his outstanding contributions in the field of quantum effects in strongly correlated electron materials, employing cutting-edge X-ray and neutron scattering techniques". The Bertaut Prize created by the European Crystallographic Association (ECA) and the European Neutron Scattering Association (ENSA) is awarded to young scientists in recognition of notable experimental, methodological or theoretical contributions to the investigation of matter using crystallographic or neutron scattering methods.

Mazzone's PhD was in the Laboratory for Neutron Scattering and Imaging, studying the interplay between unconventional superconductivity and itinerant and localized magnetic order in a series of $Nd_{1-x}Ce_xCoIn_5$ crystals. Utilizing neutron scattering Mazzone's experiments revealed the astonishing result that under application of an external magnetic field a quantum transition emerges, which cannot arise from magnetic fluctuations alone, because the same magnetic structure reappears at even higher magnetic fields. The emerging order is signified by a magneto-superconducting coupling, which is established by a spatially modulated superconducting order parameter that is conducive to a cooperate magneto-superconducting ground state.

Mazzone then expanded his technical and scientific repertoire at the Brookhaven National Laboratory in Upton, USA. He was associated to the soft X-ray resonant inelastic scattering instrument (SIX) and contributed greatly to the commissioning of this novel and advanced spectrometer. By studying the electronic properties of Y doped SmS, in a series of careful experiments Daniel and his colleagues have validated that the coupling between electronic and lattice degrees of freedom in a Kondo material can lead to the observed intriguing large negative thermal expansion and that this expansion is tunable via Y doping, results of high importance that could pave the way for new technologies. Daniel also conducted research on Iridates, in which onsite Coulomb repulsion, spin-orbit coupling and the crystal-field splitting all act on equal footings. Using static and time resolved resonant inelastic X-ray scattering, Daniel and his colleagues provided evidence for a longitudinal mode in $Sr_3Ir_2O_7$ that involves electron-hole excitations and that becomes soft at the antiferromagnetic transition. This strongly suggests that the compound is a realization of an antiferromagnetic excitonic insulator state that emerges close to an Ising-like quantum critical point. The team also demonstrated that an optical pump excites transient magnons at large wave vectors in gapped antiferromagnets, that persist for several picoseconds across the entire Brioullin zone. This result was interpreted in a spin-bottleneck scenario in which the transient behavior is dictated by the presence of an efficient decay channel.

In May 2020, Daniel joined the Laboratory for Neutron Scattering and Imaging at the Paul Scherrer Institute. As scientist in the Solid State Dynamics group he became responsible for the operation and development of the spectrometer CAMEA. CAMEA stands for Continuous Angle Multiple Energy Analysis and is a multiplexing spectrometer optimized for efficient and rapid mapping of excitations. Daniel and his colleagues have undertaken tremendous efforts in improving the capabilities of the instrument in terms of both software development for data reduction and analysis and technical implementations to improve the neutron flux and the signal to noise ratio of the instrument. The scope of the software and a comprehensive account of the specifications of the instrument can be found in several publications. Since 2022 Daniel is also responsible for the Swiss contribution of the BIFROST instrumentation project at the European Spallation Source in Sweden, which will be a multiplexing spectrometer with a time-of-flight front end.

Mazzone is an active member of the scientific community. In the past he served in several review panels at different large-scale facilities. He is part of the Swiss Physical Society board and Auditor for the Swiss Neutron Society. Over the last years Daniel was active in organizing the Young Talents Day of the Swiss Physical Society, and supervised several Semester, Bachelor, Master, PhD students and Postdoctoral researchers.

From January 2025, Mazzone will become the leader of the Solid State Dynamics Group at the PSI Center for Neutrons and Muon Sciences.

List of publications

Field-induced magnetic instability within a superconducting condensate
D. G. Mazzone, S. Raymond, J. L. Gavilano, E. Ressouche, C. Niedermayer, J. O. Birk, B. Ouladdiaf, G. Bastien, G. Knebel, D. Aoki, G. Lapertot, and M. Kenzelmann.
Sci. Adv. 3, e1602055 (2017)

Spin resonance and magnetic order in an unconventional superconductor
D. G. Mazzone, S. Raymond, J. L. Gavilano, P. Steffens, A. Schneidewind, G. Lapertot, and M. Kenzelmann.
Phys. Rev. Lett. 119, 187002 (2017). Also found in open source: arXiv:1705.01255 (2017)

Kondo-induced giant isotropic negative thermal expansion
D. G. Mazzone, M. Dzero, M. Abeykoon, H. Yamaoka, H. Ishii, N. Hiraoka, J.-P. Rueff, J. Ablett, K. Imura, H. S. Suzuki, J. N. Hancock, and I. Jarrige
Phys. Rev. Lett. 124, 125701 (2020). Also found in open source: arXiv:1905.03090 (2019)

Antiferromagnetic excitonic insulator state in $Sr_3Ir_2O_7$
D. G. Mazzone, Y. Shen, H. Suwa, G. Fabbris, J. Yang, S-S. Zhang, H. Miao, J. Sears, Ke Jia, Y. Shi, M. H. Upton, D. M. Casa, X. Liu, J. Liu, C. F. Batista, M. P. M. Dean.
Nature Commun. 13, 913 (2022). Also found in open source: arXiv:2201.04030 (2022)

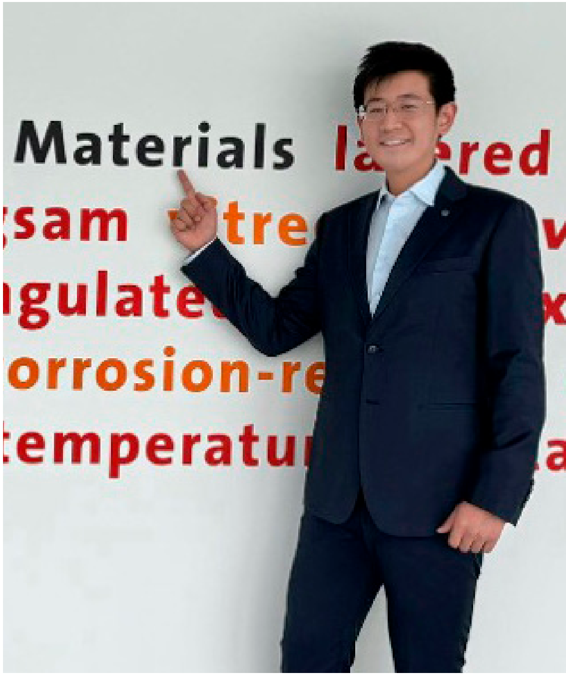
Laser-Induced Transient Magnons in Sr3Ir2O7 Throughout the Brillouin Zone
D. G. Mazzone, D. Meyers, Y. Cao, J. Vale, C. Dashwood, J. Q. Lin, V. Thampy, Y. Tanaka, A. Johnson, H. Miao, R. Wang, J. Kim, D. Casa, R. Mankosky, D. Zhu, R. Alonso-Mori, S. Song, H. Yavas, T. Katayama, M. Yabashi, Y. Kutoba, S. Owada, J. Liu, J. Yang, J. P. Hill, D. F. McMorrow, M. Först, S. Wall, X. Liu, and M. P. M. Dean.
Proc. Natl. Acad. Sci. U.S.A. 118, e2103696118 (2021)

MJOLNIR: A Software Package for Multiplexing Neutron Instruments
J. Lass, H. Jacobsen, D. G. Mazzone, and K. Lefmann.
SoftwareX 12, 100600 (2020) Also found in open source: arXiv:2007.14816 (2020)

Performance of the novel Continuous Angle Multi-Energy Analysis Spectrometer at the Paul Scherrer Institut
J. Lass, H. Jacobsen, K. M. Krighaar, D. Graf, F. Groitl, F. Herzog, M. Yamada, C. Kägi, R. Müller, R, Bürge, M. Schild, M. S. Lehmann, A. Bollhalder, P. Keller, M. Bartkowiak, U. Filges, U. Greuter, G. Theidel, H. M. Rønnow, C. Niedermayer, and D. G. Mazzone.
Rev. Sci. Inst. 94, 023302 (2023) Also found in open source: arXiv:2007.14896 (2022)

2024 Young Scientist Prize of the Swiss Neutron Science Society

The Young Scientist Prize is awarded every year from SNSS to young scientists in recognition of the impactful use of neutrons during their PhD thesis. The prize amounts to a gratification of 1000 CHF and is sponsored by SwissNeutronics. New nominations can be made for 2025. More information will come in the next edition of the Swiss Neutron News.



Dr. Boyang Zhou

Boyang Zhou studied soft matter physics and materials science at Paul Scherrer Institute (PSI) and ETH Zurich, receiving his doctorate from ETH Zurich in 2024. During his PhD, he worked in the "Soft matter group" at PSI, led by Dr. Urs Gasser, where he investigated the novel swelling behavior of polymer microgel and hydrogel via various techniques. A highlight of his thesis includes the first direct measurement of the spatial distribution of the rarefied counterion cloud of the microgels, which pushes the measuring technique SANS to its limit and showcases the power of it in the soft matter study. The results served a major role in solving a long-standing mystery, 'telepathy of microgels', by providing solid evidence to conclude the origin of the spontaneous deswelling behavior of microgels is triggered by the elevated osmotic pressure caused by the percolation of counterion clouds. This study opens new ways in materials research, and instrumentation methods. His PhD thesis was awarded the Young Scientist Prize by the Swiss Neutron Science Society, sponsored by Swiss Neutronics, in recognition his outstanding contribution to the field. After completing his PhD, Boyang began working as a postdoctoral fellow at the University of Fribourg, where he investigates the mechanism of stress storage and dissipation involved in imprinting memory in soft glassy materials.

Effect of Softness and Charges on the Volume Phase Transition of Colloidal Microgels and Macrogels

Colloids are mesoscopic particles in a solvent that undergo Brownian motion with an energy scale of k_BT.
They are prevalent in daily life and found in blood, milk, paint, cosmetics, and various foods. Colloids can be classified into hard and soft types, with soft colloids being more complex due to their deformable structure, especially at high concentrations. Their rich swelling behavior makes them valuable for scientific research and industrial applications, including drug delivery, smart coatings, adhesives, and sensors. This work delves into investigating pNIPAM microgels in fluid and crystalline phases, aiming to connect single-particle behavior to that of the suspensions.

A puzzling mystery in the field is that soft microgels start to spontaneous deswelling at the volume fraction way below the random close packing density, as if they can communicate with each other. For the case of microgels, larger particles can spontaneously deswell to a size comparable to that of smaller ones, which is an unusual behavior not known from other types of particulate systems. This deswelling is triggered by an increased osmotic pressure due to ions in the suspension. pNIPAM is an uncharged polymer. However, it is difficult to synthesize totally uncharged pNIPAM particles because of the use of ionic initiators in microgel synthesis. Sulfate groups from the ammonium persulfate (APS) initiator with negative charges remain at the ends of the NIPAM polymer chains, and the associated ammonium counterions ensure charge neutrality. For electrostatic reasons, the sulfate groups are expected to locate at the periphery of the microgel and because of the fuzzy-sphere structure of the microgel, the ammonium counterions that surround the sulfate groups form a spherical-shell cloud. At sufficiently high concentrations, the counterion clouds begin to overlap, allowing counterions bound to the microgel with an energy scale $<k_BT$ to explore the suspension volume and contribute to the suspension osmotic pressure. When the osmotic pressure outside the particle is comparable or greater than the bulk modulus of the particle, the particle is isotropically compressed. The ion density is low, yet it plays a crucial role in dictating the microgel swelling behavior, influencing the polydispersity and, consequently, the phase behavior of the suspension. Understanding the ion cloud is essential for understanding microgel suspensions, particularly at high concentrations. However, a direct characterization of counterion clouds of microgels was lacking.

In this thesis, the configuration of the microgel counterion cloud is studied using small-angle neutron scattering (SANS). The form factor can be expanded as $P(q)=F_p^2(q)+2F_p(q)F_c(q)+F_c^2(q)$, where $F_p(q)$ is the scattering amplitude of the pNIPAM polymer, including the crosslinkers and charged groups due to the initiator, and $F_c(q)$, is the scattering amplitude of the counterion cloud. We prepared two suspensions, one with Na^+ ions and the other with NH_4^+ ions. The difference in scattering length density of these ions is utilized to augment scattering signal, providing structural information about the ion cloud and the arrangement of charged groups in a microgel. Our results indicate that the counterion cloud is indeed located at the particle periphery, as expected from particle synthesis. This result also supports the previously established theory for microgel deswelling at high concentrations, which relates particle softness and surface charges to phase behavior. The spontaneous deswelling behavior of microgels with different softness, controlled by the amount of cross-linker are subsequently investigated. we found microgels synthesized with 5wt.% crosslinkers deformed at high concentrations, as the elevated osmotic pressure can no longer overcome the bulk modulus of the microgel to compress the particle. On the other hand, microgels contain fewer crosslinks can deswell isotropically below the random close packing density. Furthermore, a consistent decrease in suspension polydispersity is observed with increasing ζ for all samples, demonstrating that larger particles shrink to match the size of smaller microgels, which makes the suspension more monodisperse. This enables the formation of a crystalline phase, even with an initially high polydispersity of up to 19%. For hard colloids, however, crystallization is suppressed when polydispersity exceeds 12%. Hence, polydispersity significantly impacts the phase behavior of both hard and soft colloids. However, it plays a different role for soft colloids because polydispersity can change with concentration, and as a result, swelling can affect the suspension phase behavior. Therefore, it is essential to consider polydispersity in both the form factor *P(q)* and the structure factor *S(q)* to obtain reliable results.

The impact of the counterion clouds is investigated further in the crystalline phase of the microgel suspension. The interactions between the atoms of a material are reflected in its macroscopic properties, including all elastic properties. Consequently, it is anticipated that the ion cloud that surrounds the microgel can influence the behavior of the suspension, especially for the crystalline state at sufficiently high concentrations, with microgels acting as the 'atoms' forming the crystal. We employ confocal microscopy with fluorescently labeled microgels to investigate lattice vibrations within colloidal microgel crystals, capturing repeated snapshots of ~5000 microgels in a face-centered cubic microgel crystal. By analyzing the vibrational modes, we construct dispersion relations using the equipartition theorem and fit these to a dynamic matrix to determine force constants above and below the isoelectric point of AAC, representing fully and semi charged states, respectively. From the long-wavelength limit *(q → 0)*, we derive the crystal elastic constants. Our findings reveal that Cauchy relation is not satisfied, indicating non-central and many-body interactions, akin to those observed in atomic metals and colloidal crystals of charged, hard colloids. Furthermore, the bulk modulus of the crystal is shown to depend on the charging state of the AAC groups, which correlates directly with the counterion density in the suspension in the dense state. These results highlight the critical role of counterion clouds and the dislocation of the free counterions in dictating microgel-microgel interactions at high concentrations, thereby enhancing our understanding of electrostatic contributions in these systems.

The last part of this work shifts attention to the microgel's counterpart, macro-hydrogel. Although hydrogels share similar internal structure of the polymer microgel, macroscopic hydrogels typically take much longer time to reach the equilibrium state in response to changes in the external stimuli, such as temperature. As a result, when heating is sufficiently rapid, the thermodynamic instability of the hydrogel is observed, manifested by the formation of the surface polymer-dense skin and swollen interior. Such behavior has been observed to lead to surface instabilities, buckling of the toroidal gels, and of gels with curved geometries. However, the details of the skin remain unknown until now. In this work, we use neutron scattering, neutron imaging, and rheology, for the first time, to observe and characterize the internal structure of the skin and its thickness. More interestingly, we notice the so-believed impermeable skin is nevertheless permeable to solvent molecules, suggesting the constrained volume is maintained by the mechanical properties of the skin. Thus, understanding of the phase coexistence in hydrogel requires explicitly considering both solvent diffusion in and out of the polymer networks and the mechanical properties of the skin. Finally, the thermodynamic instability of the hydrogel can be harnessed to design shape actuators for haptic devices, smart sensors, and heat stiffening gears. Our results shed light on hydrogel skin formed under rapid heating, which is essential to understand the thermodynamic instability of the gel under such conditions.

Shed light into black box: In situ SANS study on plant-based meat analogs

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[1] Department of Health Science and Technology, ETH Zürich
[2] Large Scale Structures Group, Institut Laue-Langevin

Synopsis

Plant-based meat analogs are the rising stars of the food industry as they promise to mimic the experience of eating meat without animals. They are popular due to their meat-like fibrous structures and typically obtained via high-moisture extrusion cooking. Texturization is believed to mainly take place during the solidification in a cooling die attached to the end of the extruder. However, the mechanisms behind this texturization are not fully elucidated yet. This work presents in situ studies of fiber evolution within a custom-designed extruder cooling die by small-angle neutron scattering on SANS-I instrument. The article was published in Food Hydrocolloids 155 (p. 110215 in 2024), under copyright CC BY 4.0 by the authors.

Keywords
High-moisture extrusion cooking, plant-based meat analogs, custom-made cooling die, in situ small-angle neutron scattering, fiber formation mechanism

I
Challenges in the production of plant-based meat analogs

Global meat consumption has significantly increased over the last several decades (Parlasca and Qaim, 2022), and is inevitably linked to environmental, healthy, and ethical issues (Guan et al., 2024). Thus, people increasingly turn to vegetarian or flexitarian diets, gradually making meat substitutes more mainstream (Boukid, 2021). Among vegetarian food choices, plant-based meat analogs (PBMAs) nowadays hold an important share of the global meat substitutes market due to their resemblance to animal meat, including the texture, appearance, flavor, and taste. Although significant efforts have been made to improve the imitation of animal meat, an exact replicate of the sensory experience of animal meat is still a challenge for the food industry. Thus, pushing the boundaries to mimic meat experience as closely as possible will continue into the foreseeable future of PBMAs. The PBMA products that most closely resemble animal meat are characterized by their prominent fibrous structures similar to the muscle structures of animal meat. This fibrous structure can be achieved by several structuring processes. Here, we focus on the high-moisture extrusion cooking (HMEC) technique (Guan et al., 2024). In HMEC, plant protein and water are heated to 130-170°C and kneaded in extruder, then cooled below 100°C in a cooling die to solidify.

II
A new understanding of fiber formation

The structure of extrudate has been well studied on the milli- and microscale as well as by analyzing their chemical bonds. Nevertheless, the mechanisms behind the structure formation and the bearing structure of the fibers are not clearly identified yet. The established properties of raw materials and extrudate structure and the three most common hypotheses explaining the structure development are illustrated at different length scales in Fig. 1. The challenge of studying the mechanisms of the fibrous structure formation is caused by the 'black-box' nature of extruder and cooling die, which impedes the application of in-line detection techniques during extrusion. It can only be best addressed by in situ structure analysis. Thus, in this work, we present a custom-designed cooling die with three neutron-transparent

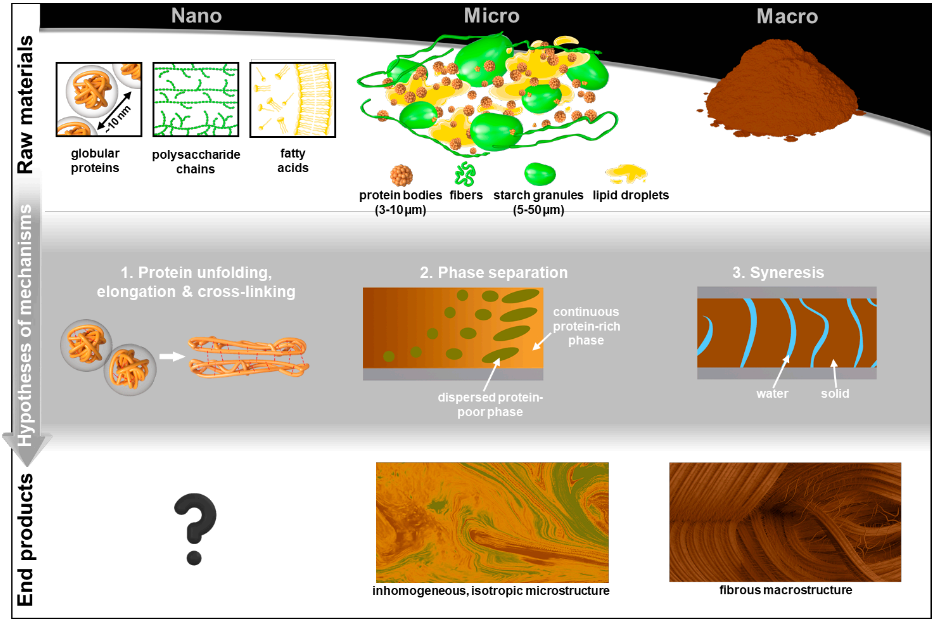

FIG. 1
From plant protein extract to meat analog. Illustration of structural raw material properties, prevalent structure formation hypotheses: 1. Protein unfolding, elongation & cross-linking, 2. Phase separation and 3. Syneresis, and known properties of PBMA from nano- to macroscale.

windows. Its design allows to perform in situ SANS measurements along the cooling die, thereby studying the texturization mechanism of the PBMA at the nanoscale. Additionally, the different interaction of neutrons with hydrogen and its isotope deuterium allows to selectively study the PBMA components (proteins, dietary fiber, and lipids) via so-called contrast variation (Castellanos, Mcauley, and Curtis, 2017). With this, we can demonstrate that no molecular elongation and orientation occurs in the cooling die but protein nano-aggregates of 40 nm size are present throughout the cooling die. Based on that we proposed three underlying mechanisms for structure formation within the cooling die.

III
Experiment setup at SANS-I Beamline

The in situ small-angle neutron scattering (SANS) measurements were performed at SANS-I beamline in SINQ at Paul Scherrer Institut (PSI) in Villigen, Switzerland. A co-rotating twin-screw extruder with a length-to-diameter (L/D) ratio of 40 was used (see Fig. 2a).

The custom-made cooling die mounted on the extruder has a channel cross-section of 15 x 4 mm^2 and a length of 250 mm as shown in Fig. 2b. The cooling die consists of aluminium and has three neutron-transparent windows along its length to observe the structure development during the cooling process. Titanium was chosen as the window material due to its high neutron-transparency. The scattering from the titanium windows was found to be negligible compared to the scattering from the samples. Furthermore, its thermal conductivity of approximately 20 W/(m·K) is closer to the one of conventional cooling dies (normally consist of steel) compared to other neutron-transparent materials such as glass and aluminium. The windows were designed to minimize cooling disruption while allowing observation of edge and middle flow regions of the cooling die channel. The exit side of the window frame is angled by 15° as shown in Fig. 2c to allow to collect scattering signals. Titanium is used to cover the whole length of the cooling to avoid flow disturbances at the die surface. In contrast to conventional dies, it is tilted by 90° to orient the whole channel width to the beam.

IV
Result

SANS measurements were performed at three windows of the neutron-transparent cooling die while producing extrudates with 100% D_2O. At each window, the middle and edge positions were measured as illustrated in Fig. 3. The radially averaged 1D SANS scattering curves are also shown in Fig. 3. The 1D curves were fitted with the empirical 'broad peak' model (Tian *et al.*, 2020). The fitting implies the presence of nano-aggregates of roughly 40nm assembled from polymers with a diameter of around 9 nm as illustrated in Fig. 3. The slope of 2.5 - 3.2 at low-q indicates that this system is densely packed at larger length scale (Hammouda, 2008). The similarity of the fitting parameters from each of the three windows at middle and edge positions demonstrates that, from the 1st window to the 3rd window in the cooling die, there is no pronounced structural development on the length scale observed.

Since minor anisotropies were found in the 2D patterns at both middle and edge positions at the 3rd window, the 2D patterns of the 3rd window were further analyzed in sectors. The highest anisotropic scattering intensities were found at 61 and 141° in the middle and at the edge of the cooling die, respectively. And the edge and middle positions have slightly different fitting parameters.

Contrast variation was applied to elucidate the role of each component separately. We found the described polymers and their agglomerates above are proteins. Besides, static measurements on pre-made extrudates were intended to compare the structural differences of the fully extruded material and in situ measurements. Overall, the results of the static and in situ measurements are comparable. This does not only reveal the nano-structural similarity of the solidifying mass in the cooling die to the fully extruded material, but it also evidences the successful execution of in situ experiments with the self-designed neutron-transparent cooling die.

V
Discussion

To elucidate the structural development of plant-based meat analogs (PBMAs) in the cooling die during high-moisture extrusion cooking (HMEC), we designed a cooling die with three neutron-transparent windows. This allowed for the in situ observation of PBMA structural development on the nanoscale along the cooling die by small-angle neutron scattering (SANS) without

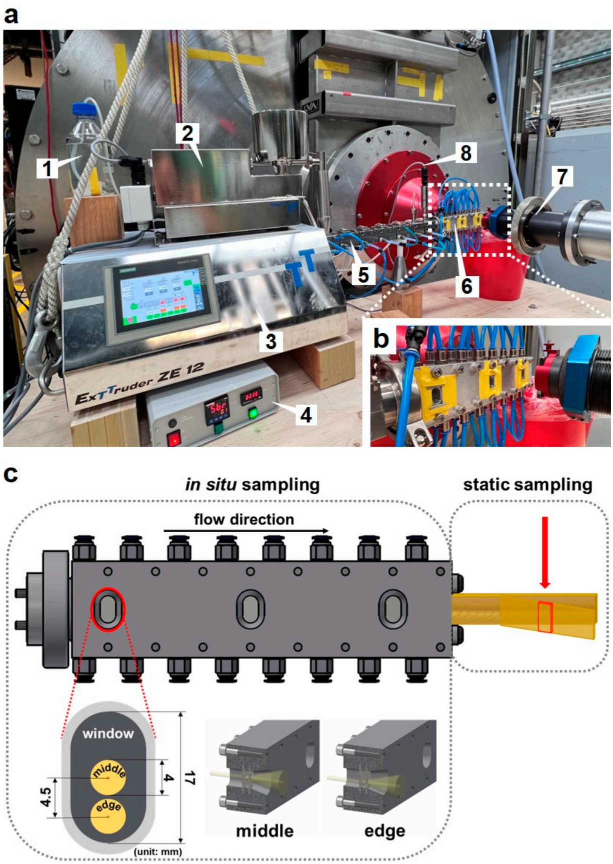

FIG. 2
In situ setup at the beamline and schematic illustration of sampling.

(a) The twin-screw extruder ZE12 from Three-Tec mounted on SANS-I at PSI (1: D_2O bottle, 2: powder feeder, 3: extruder, 4: pump, 5: barrel, 6: cooling die, 7: incoming neutron beam, 8: detector vacuum tube).

(b) Zoom of the custom-made cooling die mounted on the extruder placed at the beamline, the peripheries of windows were covered by cadmium pieces.

(c) In situ sampling: at each window, two positions were measured. Static sampling: The extrudate was cut longitudinal to the flow direction with half of the thickness.

compromising thermal performance or interfering with the extrusion process.

The described protein nano-aggregates are formed either during protein extraction or HMEC. Within the cooling die, no structuring on the nanoscale was observed. Thus, structure development must take place at larger length scales. However, no clear anisotropy was observed by scanning electron microscopy (SEM) in a fracture plane on the micrometer scale either. This is in accordance with literature as, to date, no scientific observation elucidated the anisotropic properties of plant-based meat analog structures. Taking these observations into account, three hypotheses are proposed regarding the formation of the fibrous macro-structure: Protein nano-aggregate chains, viscoelastic mass fracture, and distinct solidification.

Protein nano-aggregate chains

Protein nano-aggregates form chain-like fibers likely in laminar flow during cooling, similar to how calcium caseinate aggregates create cylindrical fibers in shear fields (Tian *et al.*, 2020). No anisotropy was detected at the detected scale in our study. Thus, nano-aggregate chains of our system must have bigger dimensions and be visible only above 436 nm, out of the measurement range.

Viscoelastic mass fracture

Fibers are the result of fractures in the viscoelastic mass, mainly by melt fracture (Cogswell, 2003). Shark skin-like surface distortions at the die entry result in propagating cracks while bulk distortions such as discrete fragments are stretched into fibers in the flow field of the cooling die. Prerequisites for fractures in a flowing mass are its viscoelastic properties. Further research is needed to fully understand the underlying mechanisms. However, the formation of a cohesive melt that contains components which exert normal stress upon tensile stress is clearly relevant. The protein nano-aggregates which we observe take this role in our system.

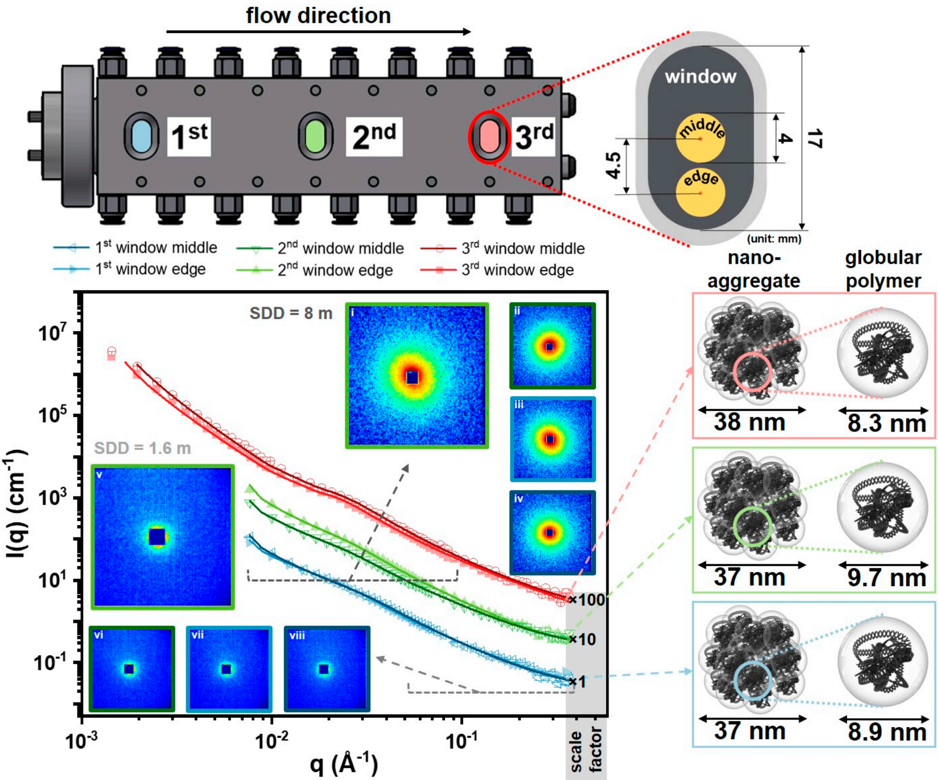

FIG. 3

1D SANS curves of measurements at all three windows with insets of 2D patterns measured at second and first windows and schematic illustration of nano-aggregate organization derived from curve fitting. The position of three windows in the cooling die and the middle and edge positions of each window are shown in the cooling die illustration. The 1D curves of the different windows are offset by scale factors for better readability. 2D patterns measured at SDD = 8 m ((i) and (ii): The edge and middle position of the second window, (iii) and (iv): The edge and middle position of the first window) and SDD = 1.6 m ((v) and (vi): the edge and middle position of the second window, (vii) and (viii) the edge and middle position of the first window).

Distinct solidification
Fibers result from distinct local solidification triggered by a sharp solidification temperature of the matrix. Due to cooling under flow, a temperature gradient between different mass fractions emerges along the flow field and the matrix solidifies successively into fibrous fragments.

VI
Future implications for the food industry

Comprehension of the mechanisms underlying fibrous structure formation enables targeted structure engineering and holds potential to design tailored machinery explicitly suited to produce meat-like structures and thereby transform industrial processes and prospects. We suggest that protein nano-aggregate chains, viscoelastic mass fracture and/or distinct solidification contribute to fibrous structure formation in meat analogs. Thus, it appears appropriate to further study viscoelastic behaviour of raw materials under HMEC-like conditions to better elaborate underlying dynamics as viscoelastic properties are relevant in all proposed mechanisms. Moreover, studies of the formation of nano-aggregates is imperative as they might well be the pivotal feature for the structuring. Understanding whether nano-aggregates are already present in the HMEC raw materials or if they develop during extrusion is critical. These insights could elucidate how to appropriately pre-process raw materials that have not yet been successfully high-moisture-extruded.

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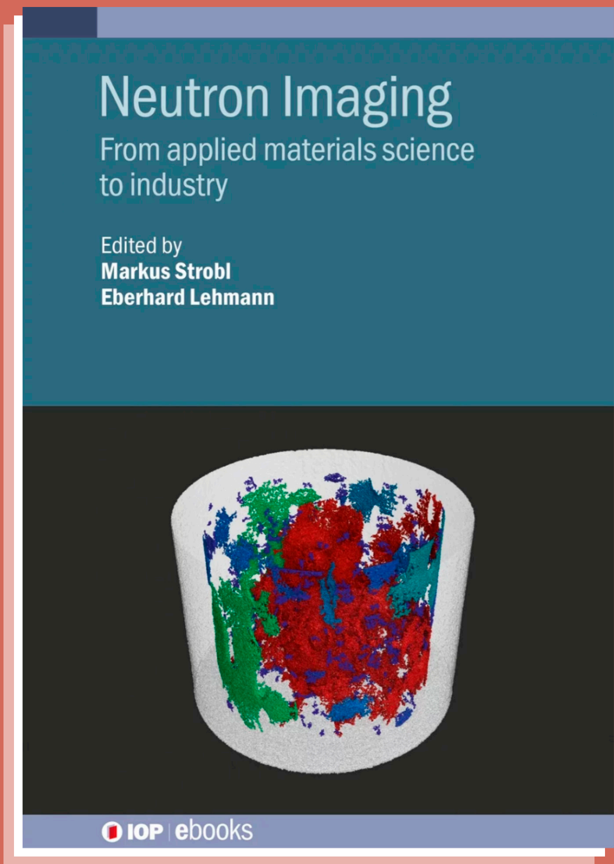
Introduction to new book

“Neutron Imaging: From applied materials science to industry”



Neutron imaging is a thriving technique widely applied in materials science and beyond that enables the observation of structures and processes deep in the bulk of materials and functional devices. This book presents an up-to-date review of the field of neutron imaging as an advanced characterization method in science and industry. It focusses on its applications across disciplines from condensed matter research to cultural heritage, from energy research to advanced manufacturing, from environment to mobility, and in general contributions that neutron imaging makes and can make to tackle the pressing issues of today.

Before the rich capabilities of neutron imaging are laid out, the reader is introduced to the particular and relevant features of neutrons alongside neutron imaging in the context of other characterization techniques, while also covering the history of neutron imaging and, most importantly, state-of-the-art capabilities and contrast modalities. The book closes with a more technical part on instrumentation, methods and software and data analyses for those readers with an interest not only in practical and scientific applications but also in required instruments and techniques. This book is addressed to an audience curious about what neutron imaging can do for them and their research or product R&D, while also providing practical information on what is required and how to perform neutron imaging, particularly advanced neutron imaging at large-scale neutron sources.

The book is structured into eight parts covering the 19 different chapters about the relevant topics of modern neutron imaging applications and implementations. The authors are members of the "Advanced Material Group" within the "Laboratory for Neutron Scattering & Imaging" at the Paul Scherrer Institute in Switzerland – and their collaborators. The editors (M. Strobl, E. Lehmann) are the present and the former leaders of this team. This broad authorship enables to cover a wide range of scientific and industrial relevant projects, successfully completed at leading facilities within the international neutron imaging community. Further links to original papers is enabled by the many references in the lists at each chapter.

Potential readers of the book get an impression what results can be obtained with modern neutron imaging techniques in the different research and application fields. In this way, it presents a guideline for further similar applications, e.g. as complement to the more common X-ray investigations. Also, the overlap to neutron scattering techniques is highlighted in some of the chapters within the book.

In this way, the book can be considered as a guideline for future implementations at neutron sources how to build, used and optimized facilities for neutron imaging and what will be the focus of their utilization. This is of particular interest of the upcoming sources like the European Spallation Source (ESS) and modern compact accelerator driven sources, which are under consideration.

The book was published by IOP Publishing mainly as an ebook to enable an easy and worldwide access by the user community, following the current trend of spreading information. It can be ordered easily via the link http://doi.org/10.1088/978-0-7503-3495-2 - or even as a printed book on demand.

Announcements

SGN/SSDN Members

Presently the SGN/SNSS has 325 members. New members can register online on the SGN/SNSS website: http://sgn.web.psi.ch

SGN/SSSN Annual Member Fee

The SGN/SNSS members are kindly asked to pay their annual member fees. At the general assembly 2013 of the society, the fee has been increased from CHF 10 to **CHF 20**. It can be paid either by bank transfer, Twint or in cash during your next visit at PSI. The bank account of the society is accessible for both Swiss national and international bank transfers: Postfinance: 50-70723-6 (BIC: POFICHBE), IBAN: CH39 0900 0000 5007 0723 6.

The SGN/SSSN is an organisation with tax charitable status. All fees and donations paid to the SGN/SSSN are **tax deductible**.

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Confirm amount and payment

PSI Facility News

Recent news and scientific highlights of the three major PSI user facilities SLS, SINQ and SμS can be found in the **quarterly electronic newsletter** available online under: https://www.psi.ch/science/facility-newsletter

News from SINQ

Please visit the page https://www.psi.ch/sinq/call-for-proposals to obtain the latest information about beam cycles and the availability of the neutron instruments.

Registration of publications

Please remember to **register all publications either based on data taken at SINQ, SLS, SμS or having a PSI co-author** to the Digital Object Repository at PSI (DORA): www.dora.lib4ri.ch/psi/
Follow the link 'Add Publication'.

Open Positions at SINQ and ILL

Open positions at SINQ or ILL are advertised on the following webpages:
https://www.psi.ch/pa/stellenangebote
https://www.ill.eu/careers/all-our-vacancies/?L=0

PhD positions at ILL

The PhD program of the Institut Laue-Langevin, ILL, is open to researchers in Switzerland. Consult the page:
https://www.ill.eu/careers/all-our-vacancies/phd-recruitment

For information on the PhD program of ILL or get in contact with the managers of the program using the email address phd@ill.fr.

The Swiss agreement with the ILL includes that ILL funds and hosts one PhD student from Switzerland.

Conferences and Workshops

An updated list with online links can be found here: **http://www.psi.ch/useroffice/conference-calendar**

January 2025

Small Angle Scattering Data Clinic IV
January 10, 2025
Lund, Sweden

MaNEP Winter school 2025
January 12-17, 2025
Saas-Fee, Switzerland

Preparing for Beamtime: LINXS Webinar Series - ECL and Heritage Science Themes
January 22, 2024
online

February 2025

14th International Conference on Industrial Computed Tomography
February 4-7, 2025
Antwerp, Belgium

Transfer Workshop: ErUM-Scientists and Industry in Dialogue
February 6-7, 2025
Aachen, Germany

H2MSE 2025: 1st Conference on Hydrogen Related Innovations
February 11-13, 2025
Siegburg and Bonn, Germany

PNCMI 2025: 15th Conference on Polarized Neutrons for Condensed-Matter Investigations
February 23-28, 2025
Dongguan, China

March 2025

HERCULES European School: Neutrons and Synchrotron Radiation for Science
March 9 - April 12, 2025
Grenoble, France

33rd Annual Meeting of the German of the German Crystallographic Society
March 10-13, 2025
Hannover, Germany

Spring Meeting of the German Physical Society: Condensed Matter Section
March 16-21, 2025
Regensburg, Germany

MATRAC 1 School: Application of Neutrons and Synchrotron Radiation in Engineering Materials Science
March 23-28, 2025
Hamburg (Germany) and Lund (Sweden)

April 2025

Materials Week 2025: Advances in Characterization
April 2-4, 2025
Frankfurt/M, Germany

May 2025

BioMAT 2025: 8th European Symposium on Biomaterials and Related Areas
May 14-15
Weimar, Germany and online

MATRAC 1 School Application of Neutrons and Synchrotron Radiation in Engineering Materials Science
May 23-28
Hamburg, Germany and Lund, Sweden

XVI International School and Symposium on Synchrotron Radiation in Natural Science
May 25-30
tba, Poland

International School on Quantum Crystallography 2025
May 30 - June 7
Erice, Italy

International School on Electron Crystallography 2025
May 30 - June 7
Erice, Italy

June 2025

IPAC'25: 16th International Particle Accelerator Conference
June 1-6, 2025
Taipei, Taiwan

SWEPROT: 28th Swedish Conference on Macromolecular Structure & Function
June 13-16, 2025
Tällberg, Sweden

Diffusion Fundamentals XI: Spreading in Nature, Technolgy and Society
June 30 - July 2, 2025
Evanston, IL, USA

July 2025

ICNS 2025: International Conference on Neutron Scattering
July 6-10, 2025
Copenhagen and Lund, Denmark/Sweden

September 2025

MEDSI2025: 13th International Conference on Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation
September 15-19, 2025
Lund, Sweden

Minutes of the SGN/SNSS GA 2024

Hybrid meeting in the Auditorium at PSI and via Zoom

Date:	May 27, 2024, 15:00
Participants:	23 in Person and 11 online, in total 34

1
Welcome

Marc Janoschek, president of the Swiss Neutron Science Society, welcomes the participants to the general assembly 2024. The date was moved from autumn to spring, into the SINQ shutdown period, therefore the reporting time period is unusual short. The Agenda of the Meeting was accepted unanimously.

2
Minutes of the General Assembly 2022

The minutes of the general assembly of the SNSS/SGN from 23.11.2023, published at the Webpage of the Society (https://sgn.web.psi.ch/sgn/minutes2023.pdf) were accepted without any dissenting vote.

3
Annual Report of the Chairman

Marc Janoschek reports on the activities of the SNSS/SGN since the last GA:

a) News and Changes:

- SNSS is formally a member society of SCNAT as of January 1, 2024. Notably, being part of SCNAT results in synergies with other member societies that have common goals and interests (such as CHIPP, SPS, SGK/SSCr), for example, for the national roadmap process. We will also be able apply for funding from SCNAT to promote our society via activities such as summer schools/workshops, travel funds for members, and educational measures.
- In March, we received a formal mandate to provide an update of the Neutron Science Roadmap published in 2021. We will provide details later today. This is an opportunity to refine our plans for the future.
- Daniel Mazzone from PSI (and one of the SNSS Auditors) has been awarded with the 2024 Erwin Félix Lewy Bertaut for his outstanding contributions in the field of quantum effects in strongly correlated electron materials, employing cutting-edge X-ray and neutron scattering techniques. Congratulations!
- Since January 1, 2024, we have two new board members: Fanni Juranyi and Romain Sibille (both from PSI), and one seat vacant (see later).
- 1 new issues of Swiss Neutron News was published recently, the 2nd will be sent out in Fall. Thanks to Viviane Lütz Bueno! The Community provides deviating feedback from “I enjoy to read it” to “please do not send it anymore”. Maybe the format should be changed in the future.

b) Membership and payment:
Presently we have 285 members, 10% increase by 24 members in 5 months and 45% increase over the last 1.5 years! The large increase is due to our new membership model. Nevertheless, there are many more benefiting from neutron science in Switzerland. We are now making a push with regards to soft matter, radionuclides (radiochemistry+ medical research) and nuclear research. Members are asked to help recruiting. The number of authors with CH affiliation on neutron science publications between 2015-2020 is over 500. As advertised previously, SNSS now offers the possibility to pay the membership for all members of a group/department/institute. New members (individuals and groups) can register by expressing their interest in E-mail (sgn@psi.ch), see our Website. Furthermore, individual members

can now conveniently pay now the membership also using TWINT (code is provided on our Webpage and in the Swiss Neutron News). The membership is free for Bachelor-, Master-, and PhD-students.

c) SNSS Young Scientist Prize 2024:
This year the SNSS Young Scientist Prize is awarded for a notable scientific achievement in the form of a PhD thesis. Next year, biannually, the call will be open also for PostDocs, i.e. for an exceptional track record in neutron science established within 5 years after the PhD. The Prize is kindly sponsored by Swiss Neutronics. It is now tradition that the prize will be formally awarded at the Annual Meeting of the Swiss Physical Society, which this year will take place at ETH Zurich from September 9-13, 2024. This provides the awardees with the opportunity to present their work to a large audience.

Now, **Dr. Boyang Zhou (PhD @ PSI & ETHZ)** receives the SNSS Young Scientist Price for his Thesis **'Effect of Softness and Charges on the Volume Phase Transition of Colloidal Microgels and Macrogels'**. Congratulations!

Nominations for the prize 2025 should be submitted to the Swiss Neutron Science Society (sgn@psi.ch) until March 1, 2025 (exact date may still change).
https://sgn.web.psi.ch/sgn/young_scientist_prize.html

4
Report of the Treasurer

The annual balance sheet for 2023 is presented: Assets SNSS/SGN on 1.1.2023: **CHF 9'287.18**

	Revenues[CHF]	Expenses [CHF]
Membership-fees, donations (cash box)	0.00	
Membership-fees (postal check acc.)	3'180.00	
Membership over-payments (postal check acc.)	60.00	
Membership over-payments return (postal check acc.)		60.00
Donations (postal check acc.)	160.00	
Deposit (cash box)	0.00	
Expense (cash box, Braun-Shea, M.)		200.00
Expenses Postfinance account		82.00
Other Expenses		977.29
Deposit Young Scientist Prize (Swiss Neutronics)	1'000.00	
Young Scientist Prize (Schulthess, I.)		500.00
Young Scientist Prize (Nocerino, E.)		500.00
Total	**4'400.00**	**2'319.29**

Net earnings 2023	**2'080.71**	

Balance sheet 2023	**Assets [CHF]**	**Liabilities [CHF]**
Postfinance account	11'347.89	
Cash box	20.00	
Assets on 31.12.2023	**11'367.89**	

5
Report of the Auditors

Both Auditors (Dr. M. Zolliker and Dr. Daniel Mazzone, both from PSI) have examined the bookkeeping and the balance sheet for 2023. They have accepted it without objection. The participants unanimously vote for the release of the SNSS Board.

6
Budget 2025

The present members accept the budget proposal without objection.

	Receipts [CHF]	Expenditures [CHF]
Membership-fees	3'400.00	
Interests	0.00	
Young Scientist Prize (in/out)	1'000.00	1'000.00
Expenses Postfinance account		63.00
Fee ClubDesk Software for Membership Management		432.00
Fee webdomain		15.00
Fees SCNAT Membership (285*7 CHF)		1'995.00
Financing of poster awards/workshop aperos		2'000.00
Total	**4'400.00**	**5'505.00**
Net earnings 2024	**-1'105.00**	
Estimated Assets on 31.12.2025	**10'695.00**	

7
Open seat in the SNSS Executive Board

The current board members for the period (2024-2026) are:

- Marc Janoschek (PSI + UZH, president)
- Fanni Juranyi (PSI, member and secretary)
- Florian Piegsa (Uni Bern, member)
- Romain Sibille (PSI, member)
- Markus Strobl (PSI member).

Further functions:

- Viviane Lütz Bueno (PSI, Editor Swiss Neutron News)

Our by-laws state that the executive board is made up by the president and a maximum of five further members (https://sgn.web.psi.ch/sgn/regulations.html).

Andrea Carminati (ETHZ) was proposed for the open seat. He acknowledged this and accepted the nomination. Due to the short notice he could not attend the meeting in person, but prepared a slide to introduce himself. Andrea Carminati is Professor of Physics of Soils and Terrestrial Ecosystems Department of Environmental Systems Science (D-USYS) at ETHZ. His research is focused on root water update. He is a regular SINQ user (ICON and BOA) since 2003. 21 persons participated in the online voting, all voted with 'yes', nobody voted 'no' and there was no 'abstention' vote. Additionally, 3 persons voted with 'yes' in person.

As a result, the vacant place could be filled with Andrea Carminati. Congratulations!

8
News from

a) UCN
New degaussing sequence of 6 shields provides a significant improvement and achieves magnetic fields below 300 pT over the 1.4 m3 of the shielded volume of the N2EDM experiment.

UCN-EZE project is working on upgrading the ultra-cold neutron source insert to achieve even higher flux (it is already world-leading) and increase life-time. It is making good progress, and it is expected to be implemented until the end of 2026.

b) SINQ
(report by John White standing in for Michel Kenzelmann, Head of LNS, PSI):
SINQ was running from early May 2023 to Christmas with 12 Instruments (2 at 50% and some downtime on FOCUS, TASP and POLDI due to aging). Amor entered the proposal round. HIPA operation was very successful, with again > 90% availability. Stable high number of proposals, although other facilities are back in operation. SANS-I and HRPT had the highest number of proposals. [A. Braun: "Who is using SANS-I" J. White: A broad community, SANS-LLB is in the commissioning and will release the pressure on SANS-I.] It would be desirable to increase the portion of non-PSI Swiss users and to obtain financial contribution from countries, which get significant amount of beam time, like Germany or Sweden.

Fortunately, the number of publications recovered from lower numbers in 2021 and 2022 and now corresponds again to the number of publications reported on average before the SINQ Guide upgrade. Likely the low in publications was due to the time required to restart user program after the upgrade. Highlights from the four LNS groups have been briefly shown. There are two EU Programs for user access at SINQ: REMADE (Materials development for recycling, financing also 1 PostDoc at LNS) and NEPHEWS (twinning action between new and experienced user groups). LNS is engaged in education in various ways and held 3 workshops in 2024. There are 2 tenure-track positions in the hiring phase (Spectroscopy and Soft-Matter groups, respectively) and two further ones are expected (instrument scientists at DMC and EIGER).

c) ENSA
(Report by M. Janoschek):
Last meeting was in person in Garching, Germany in April 2024, where Finnland became a member. ENSA reported that the NEPHEWS program (Neutrons and Photons Elevating World-Wide Science) is taking place. It is a program to pair potential users from countries that do not use neutrons with existing expert groups. 7 countries including Ukraine selected to receive support. Kickoff meeting was held in February 2024 at SOLARIS Synchrotron in Poland. Jon White remarks that NEPHEWS give support for travel. The Danish delegate to ENSA, Kim Lefmann reported good progress with the organization of the ICNS 2025, which will take place in Copenhagen and Lund. SNSS and PSI will apply to carry out ECNS 2027 in Basel.

d) ILL
(Report by M. Janoschek):
ILL membership contract for 2024 is negotiated between SERI and ILL, with possible extension until 2030 or 2033 (expected shutdown of ILL). Approval of the final contract is expected soon.

Decision about ILL closure is expected in 2 years. ILL Membership is very important for the CH neutron science community, especially for the time before the full start of ESS.

e) ESS
(Report by M. Janoschek):
Swiss in-kind contributions progress very well. ESS's next challenges are the circulator for the accelerator cooling and the license to start neutron production. Timeline and project progress is presented. Beam on target is expected in June 2025.

9
Update on the Swiss Neutron Science Roadmap

In 2021, SNSS published the Neutron Science Roadmap for the first time. It is a document that summarize the needs of the neutron science community to SCNAT and SERI and is thought to feed into the national roadmap 2027 for funding of national and international large-scale facilities (https://www.sbfi.admin.ch/sbfi/en/home/services/publications/data-base-publications/roadmap_research_infrastructures_2023.html). Funding is not guaranteed, but only those projects have a chance, which are in the document. Prioritization of the proposals are also based on the Roadmap. The timeline for preparation is tight due to delays in the process. Feedback and inputs from the neutron community are requested, preferably by end of June. Publication is expected at the end of 2024. Need for neutrons is still increasing, the overload is permanently above the healthy factor of 2 over the past years, the availability of other sources in Europe is limited, therefore appropriate financial support for the swiss neutron science is crucial.

10
Progress of the new Webpage and Logo

At the last GA decision was made to make new web-page. It will be soon available under a new address:
http://www.neutronscience.ch/.

Logo is designed by Neil Smith from https://neilsmithillustration.co.uk/. Exemplary pages were shown. M. Janoschek pointed out that the next issue of Swiss Neutron News will appear soon and thanked to Viviane Lutz-Bueno for editing it.

11
Varia

John White asked about the transition of Swiss beam time from ILL to ESS.

M. Janoschek: SERI expected ESS to start earlier and is aware of the problem caused by the ESS delay. SERI is working on extending funding for the ILL, allowing a Swiss membership at ILL until 2030 or maybe even 2033. A contract draft is available but is pending approval of the required extra funds from the Federal Council. It is also clear that 15 Instruments at ESS will not be a replacement for 45 Instruments at ILL, a fact to be pointed out in the update of the Neutron Science Roadmap. However, it seems to be more difficult to convince UK, Germany and France about the necessity of an extended run of ILL. But even if ESS turns into full operation, for sure there are major differences, e.g. particle physics is not offered. This is something to monitor.

Marc Janoschek thanks for attending and opens the Apero.

Notes

Editorial

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Board for the Period 2024 - 2026

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