IOP | Institute of Physics
Food Physics Group

**NEWSLETTER** **2024**

**Issue no. 7**

# Food Physics

*@Physicsoffood #Physicsoffood*

https://www.iop.org/physics-community/special-interest-groups/food-physics-group#gref

## Contents

## Chair's report

Welcome to the seventh newsletter of the Food Physics group!

In preparation for the introduction of our annual conference I reflected on what 'Food Physics' meant to me. Whilst the 'Food' part itself seems quite straightforward, as we can readily dissect, measure, analyse, categorise the multitudes of materials we consume. The reality is that whatever material impacts we Food Physicists have upon Food itself are significant, due to the fact that Food plays such a vital role beyond mere nutrition, it can be an indulgence, a date, a family occasion, a celebration. Food is culture. The global challenge to provide healthy, nutritious and delicious food for everyone must be done with reverence to the fact that role of food in society goes well beyond its material nature.

Pondering this non-trivial challenge alongside the role of 'Physics', I determined that as a first approximation what 'Physicists do' is to solve really complex problems. The theatrical cover of Physics World featuring Oppenheimer, sparked the thought that the work physicist were doing a century ago had an unthinkable impact on geopolitics throughout the second half of the 20th century. Providing improved food and water security for billions of people in the face of climate change, political instability and war is going to present many 'really complex problems' that we see year after year in our conferences our community has an important role in helping to solve.

At the end of January we held the eighth conference in the "Food Physics" series. For the first time in four years we were able to meet physically and enjoy benefits and interaction of an in-person event. The conference was held at the Institute of Physics in London, with special thanks to Sarah Evans from the IOP who coordinated the event. We enjoyed a very strong scientific program, with a diverse range of talks and a fantastic level of interaction throughout the two days. Read below for the full conference report. Following the conference we had our fourth AGM, details are below.

Food Physics 2025 will be held at the Jubilee Hotel and Conferences, University of Nottingham on the 3-5th February 2025 – so save the date now!

Zachary J. Glover, Chair

## Physics Group Purpose

Supporting research into areas of physics that impact the food sector, and encouraging collaborative research between academic and industrial physicists.

Promoting the role of physics in the food industry and ensuring that it is more widely understood that this is a field in which there are opportunities to conduct interesting and important research; promoting this fact to early career physicists and policy makers.

Providing a mechanism for physicists in the sector to feed into the IOP and have their views represented to funders and policy makers.

## Activities

Organise an annual conference

Engage with physics academia / other IOP groups e.g. host joint events

Bidirectional exchange of physics and problems between industry and academia

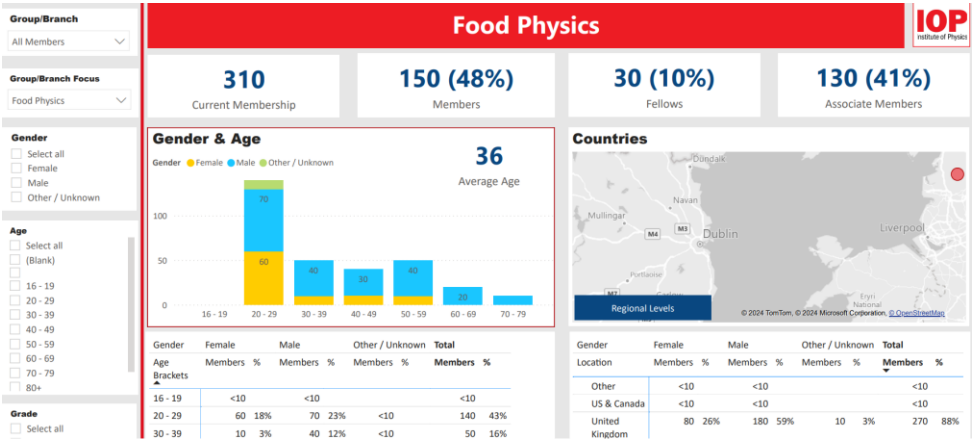
Engage beyond IOP (e.g. ProFSET, IChemE, RSC, STFC Food Network+, IUK)

Publish newsletters

Engage early careers physicists

Outreach to schools / STEM via food physics (note IOP Outreach Toolkit)

## Membership Overview as of April 2024




As of April 2024, there has been a drop off in membership of ~50 members in the last four months. As a committee we will be reflecting on how to better engage the members and increase the numbers within the group.

## Report from Food Physics Conference, Jan 31st -Feb 2nd 2024


Abstracts for keynote presentations are available at Keynote presentations, other oral presentations are at Oral presentation abstracts and poster abstracts are at Poster abstracts.

### *Day 1*

### Session A – Interfacial phenomena, foams & emulsions & rheology

#### Designing powder products: a new take on an old problem – Serafim Bakalis, University of Copenhagen, Kirsten Malmos, Arla Foods

This keynote presentation demonstrated the importance of Food Physics in a practical commercial context. Powdered milk enables milk to be delivered to a wider range of markets where fresh milk is in short supply. Arla Foods produce 200k tonnes of it per year. Shipping a dry product avoids the cost of transporting water, and the product is reconstituted by the user. This collaboration with the University of Copenhagen has helped to understand the factors affecting the quality of this process. When water is added, the process is not just solubilisation, but first involves capillary penetration of water into pores in the particles, causing them to disintegrate. Although products are shipped in temperature controlled conditions, temperature abuse can occur during periods when they are left outside, for example when clearing customs. Datalogger records show that, in some countries,

that can be up to 50 °C. This temperature abuse compromises the disintegration process. This is partly due to lactose crystallisation. Although the basic rate of crystallisation is well known, the process is more complex: it depends on the crystal size, how the crystals interact with proteins to make particles that disperse more poorly, and how lactose interacts with fat, which migrates to the surface during crystallisation.

**The elastic properties of soft solids characterised by acoustics and rheology and exemplified in anhydrous milk fat (AMF) – Megan Povey, University of Leeds**

Megan provided a nice overview of the physics of propagation of sound waves in soft solids. Acoustic measurements can potentially provide rapid, non-invasive, inline measurements of rheology. However, Megan cautioned that it is not trivial to relate high frequency (e.g. ultrasound) to low frequency (e.g. rheology) measurements. She presented an example of anhydrous milk fat, which she thoroughly characterized with multiple elastic and viscous moduli, density and viscosity over a range of temperatures. One of her conclusions was that bulk elastic and viscous terms are much larger than their shear counterparts.

**Origins of polysaccharide confirmation and viscoelasticity in miscible heterogeneous solvents – Gleb Yakubov, University of Nottingham**

Gleb noted that there are more sugar monomers than amino acids, so scope for a lot of diversity in polysaccharides. His student chose Okra for study and the team have extracted pectin and studied its extensional rheology in combination with glycerol and water. As the glycerol/water proportion increases, it transitions from semi-flexible to flexible to rigid. They simulated this behaviour using single chain molecular dynamics simulations. The glycerol molecules are extended at intermediate concentration and collapse at higher concentration. They studied a “solvation shell” using electrolyte migration and measuring the $\zeta$ potential. The application is that they can draw out the solution to make fibres and can make larger structures with those.

**From structure to function: In situ analysis of structural heterogeneities in multi-phase colloidal systems utilizing**

**microfluidics and chemical imaging technologies – Dionysius Neofytos, Aarhus University, Denmark**

Dionysius described a method to create individual droplets in a colloid and to position them precisely, enabling them to be studied in-situ by optical methods such as confocal raman imaging and FTIR microscopy. Examples include monitoring changes such as crystallisation in a single droplet when something is added to it or when the temperature is changed, or studying the point of contact between two droplets. He showed an example of FTIR imaging of the boundary region of a single oil droplet in a water and protein matrix and was able to map how the IR spectrum changed across the boundary. Dionysius concluded that the structure of the protein varies with proximity to the interface.

## *Session B: Food Systems & Processing*

**Microstructure engineering with plant proteins - Bettina Wolf, School of Chemical Engineering, University of Birmingham. U.K.**

This keynote talk reviewed the work by Prof. Wolf's group and others to develop fibrous microstructures from plant-based components. The aim is to find a structuring process which would texture food incorporating plant-based proteins to substitute for animal proteins. However, it is difficult to get the texture from just the proteins. Bettina reviewed the wide set of structuring strategies being reported in the literature from bottom-up methods such as mycoprotein, cellular agriculture, electrospinning and more top-down methods such as extrusion and shear. The talk presented results for their chosen strategy: a process based on sheared phase separating protein - polysaccharide mixtures. The initial problem is measuring the phase diagrams to find well-defined two-phase regions which may then structure under shear. Data was shown for quinoa protein isolate (QPI) in mixture with maltodextrins (MD). However clear 2-phase regions were hard to find. In this case complications included unexpected fractionation of the MD in the QPI phase, the phase were not so well defined and the binodals were atypical. This gave difficulties in the shear structuring. The teams more recent work was now looking at Pea protein with CMC (Carboxy-methyl-cellulose).

Campos Assumpcao De Amarante, M, Maccalman, T, Harding, SE, Spyropoulos, F, Gras, SL & Wolf, B 2022, 'Atypical phase behaviour of quinoa protein isolate in mixture with maltodextrin', Food Research International, vol. 162, no. Part B, 112064. https://doi.org/10.1016/j.foodres.2022.112064

**Solvent-driven food transformation of jellyfish hydrogel – Mia Pedersen, University Of Southern Denmark, SDU Biotechnology**

The talk was given by Mie Pedersen. Although eaten in some (mainly Asian) cuisines, this is not at scale. Jellyfish are yet and untapped source of food, moreover exploitation of this resource could be done sustainably. Although 96% water, their body is protein rich, but of low fat/energy; collagen is the main structuring protein. The challenge is to develop process that give desirable texture and mouthfeel. Current culinary techniques are salt curing. The talk reported a scientific study of a novel solvent soaking and evaporation to process jellyfish into a crisp like structure. Ethanol water and acetone water mixtures were the solvent. The process was examined with variety of rheological and imaging techniques. The key role of the low-polarity of the solvent was emphasised.

[1] Pedersen et al., On the gastrophysics of jellyfish preparation, Int. J of Gastronomy and Food Science, 9, 34-38, 2017.

**Co-extrusion Confusion: the Challenges of Sausage Manufacturing Using Plant-based Gels – Meg Zajac, Devro, Scotland,**

Sausage production by co-extrusion (casing and sausage together) can bring both costs savings and the use more sustainable polymers of the casing, sodium alginate (Na-Alg a polysaccharide) is commonly used. However, being a bio-sourced material there are several different grades of Na-Alg. The talk presented research into measuring the rheology (mainly storage and loss moduli from AC shear sweeps) of different grades and optimising for rheological performance in the extrusion performance. It gave a clear example of the use of rheology techniques to optimise a manufacturing process and guide product development.

**Using Multiphase CFD to Capture and Understand Retort Process Physics – Elliot Brown, Element Digital Engineering, UK offices Cambridge.**

"Element Digital Engineering utilize modelling, simulation, data science, and other digital solutions to help our customers solve complex problems."

The talk reported the building and application of a model of retorting of cans in a basket. It was a detailed model of a basket both in water immersion and water spraying. It used CFD techniques for the fluid (a simplified Volume of fluid VOF method was used in the case of spraying) and VOF techniques were used to model of the solid produce coupled o the water phase by heat transfer sub-models. Results for the model were shown; these illustrated how it could be used to optimise process (principally energy consumption) against sterilisation and cook targets.

**Invited Speaker – Andrew Martin, Advanced Manufacturing Research Centre**

We welcomed Andrew Martin from the Advanced Manufacturing Research Centre (AMRC), University of Sheffield, who presented an interesting an informative 'pre-dinner' talk on 'Inspiration from the Aerospace Industry'. Andrew gave an introduction to the AMRC and the work they do as part of the Catapult network. Andrew introduced the concept of the four Industrial Revolutions and the advancements that are taking place in Industry 4.0. Examples were shared on where the synergies in manufacturing from Aerospace could be applied to the food industry to facilitate faster adoption. Perspectives were shown from a case study of a bakery that has used advanced digital and modelling techniques to improve efficiencies and maximise outputs.

Andrew's talk provoked a lot of healthy discussions which were only partly encouraged by the preceding drinks reception.

## *Day 2*

**The current status of realising cultivated meat as an alternative protein- Prof Marianne Ellis University of Bath**

Marianne leads the EPSRC funded Cellular Agriculture Manufacturing Hub Cellular Agriculture Manufacturing Hub — the University of Bath's research portal ("CARMA"). This is developing approaches to develop cultivated/cultured meat (which are the same thing). The aim is to mimic meat from animal tissue by creating a protein structure made of muscle cells. Specific opportunities include military and space missions. For general application, this could help with food security to provide more protein for a growing global population.

The hub addresses the entire chemical engineering process needed to produce cultured meat. Individual projects focus on different aspects. These include the feedstocks of animal cells (animal, species, breed, kosher/halal…, the source of the cells – primary/immortalised, serum replacement, animal free, waste etc) and the scaffold on which cells will grow – relevant for texture. CAMRA also includes precision fermentation, tissue engineering, bioreactor technology, the downstream separation and purification.

Marianne gave an example of scaffold technology based on grass. The grass cells can be removed, leaving a striated surface on which meat cells can then be grown, resulting in a structured product.

Professor Ellis delivered an engaging talk around the current state of cultured meat as an alternative protein.

## *Session C: Oral Processing & Digestion*

**The oral cavity as a micro-rheometer - Elie Wandersman, Sorbonne Université**

Elie explored the mechanisms by which the oral cavity can be extremely sensitive for detecting and discriminating the texture of a food product. The group developed artificial tongues decorated with analogues of filiform

papillae. The movement of these structures could be detected by florescent microscopy. Analysis of the movements showed distinct patterns depending on the properties of model liquids tested. While homogenous liquids induced an average deflection related to their viscosity, emulsions or dispersions (as a model for food systems) showed that each individual passage of a particle induces a momentary fluctuation in deflection of the papilla. Using this 'particle detection system' gives access to the particle concentrations and sizes, which is information not separately accessible when measuring bulk rheology and might explain the unique sensitivity of our tongue.

**What impact does saliva have on the physical characteristics of the food bolus as it undergoes oral processing? - Alejandro Avila-sierra, INRAe**

Alejandro reported on work looking at the effect of different saliva characteristics on Bolus formation during mastication. Saliva facilitates food oral processing, bolus formation, swallowing, and sensory perception, in addition to contributing to oral health and phonation. Ageing as well as some health issues salivary production which in turns modifies its wetting characteristics for food, altering the characteristics of the bolus, swallowing, and quite possibly digestion. The findings showed that during mastication of bread the amount of saliva as well as the enzymatic activity of amylase did indeed change the primary particles size as well as the physical properties of the food bolus.

Particle transfer and bolus transformation during mastication flow

**Understanding the relationship between instrumental, sensory and consumer testing of dairy vs non-dairy yoghurt to predict 'creaminess' - Amy Voong, CampdenBRI**

Amy reported on a study where dairy and plant-based yoghourts were compared with the aim to understand key characteristics to mimic the textural properties experienced during oral processing of dairy yoghurts in pant-based products. The samples were analysed using sensory profiling, consumer and instrumental testing especially rheology and tribology. While some correlations of instrumental and sensory scores was observed, these

were in the end unable to predict the textural perception, especially creaminess. We like to highlight that despite the ultimately disappointing results, this talk was informative and well received and other insightful presentations of negative results (resulting from carefully executed and analysed studies) are encouraged.

## *Session D: Measurement and Modelling*

### Recent advances in optical food microstructure imaging - Mathias Clausen, University Of Southern Denmark

Mathias highlighted the developments in the application of Microscopy as a non-invasive tool to interrogate food system, which to date has been underutilised. The work focussed on the application of super-resolution fluorescence microscopy (SRM) techniques to image a variety of foods, from protein dominated gels, to high-fat emulsions. SRM techniques has a 5-10 fold spatial resolution improvement compared to conventional techniques. The talk reviewed applications of label-free microscopy techniques, requiring minimal sample preparation and the ability to follow dynamic processes. The use of machine learning for image processing and quantification was discussed enabling correlation to other material properties. Overall the capacity for microscopy to be used to provide unique insights across varying length scales was demonstrated.

### Potential for enhanced infrared spectroscopy of food using metamaterials - Professor Geoff Nash, The University Of Exeter

Geoff delivered a talk focusing on the use of metamaterials to enhance infrared spectroscopy of food. He discussed how infrared spectroscopy serves as a quick, label-free, and non-destructive method for chemical identification but falls short on sensitivity compared to other methods like gas chromatography.

Geoff explained that engineered metamaterials, with their unique properties, could amplify the sensitivity of infrared spectroscopy. Chiral optical metamaterials, in particular, can produce highly localized circularly

polarized light fields, which could significantly improve the detection and characterization of chiral molecules in foods.

This talk showed that chiral metamaterials have the potential to enhance the resolution and sensitivity of vibrational circular dichroism spectroscopy (VCD), vital for analysing chiral molecules' vibrational modes. Geoff highlighted that preliminary results using metamaterials allowed for distinct identification of alanine enantiomers, suggesting a path toward integrating these materials into cost-effective, sensitive analytic tools for ongoing food quality monitoring.

**Time-of-flight spin-echo SANS (SESANS) measurements of food hydrocolloids - Dr Gregory Smith, ISIS Neutron And Muon Source**

Gregory presented the potential of time-of-flight spin-echo SANS (SESANS) for analysing food hydrocolloids, emphasizing neutron scattering's sensitivity to hydrogen isotopes, which is critical in studying hydrated polymers.

This talk showed SESANS's effectiveness in probing colloidal structures like casein micelles in D2O, providing real space data that is easily interpretable. Gregory highlighted how the time-of-flight variant of SESANS, utilized at the ISIS Neutron and Muon Source, allows for high-sensitivity measurements with a reduced sample size, as showcased through studies on deuterated milk.

Gregory conveyed the technique's broader applicability to other food hydrocolloids, where only limited samples may be available, indicating SESANS as a versatile and efficient tool for food material research.

**Sugar replacement in foods via physical principles- Ruud Van Der Sman, Wageningen University & Research**

Ruud discussed a sugar replacement strategy to maintain textural properties in sweet bakery products while addressing health concerns like obesity. This talk showed that sugar's role as a plasticizer and humectant is crucial, and can be modelled using physical theories which describe these

properties in terms of hydrogen bond density and the Flory-Huggins interaction parameter.

The strategy involves calculating two key numbers reflecting the average density of intermolecular hydrogen bonds and the average Flory-Huggins parameter for humectants in the product. Replicating these numbers in sugar-reduced products achieves a similar texture to the original. Trials with biscuits confirmed the strong correlation between these numbers and texture, leading to successful sugar replacement formulations. The talks showed that these methods which are adaptable to other products such as cakes, offers potential for wider industry application.

## Interactions

It was, of course, fantastic to be at a Food Physics event in person again after so long! Overall conference attendance was a little lower than the peak of the prior couple of years, but this is to be expected to some extent with the flexibility afforded with an online format. Nonetheless, there were strong interactions following all the talks, and the inclusion of longer breaks and extended lunches on both days provided ample opportunities for networking and catching up within the community. There was positive feedback about the amount of time allocated to networking at the conference, and something that should be prioritised in future physical events.

## Flash poster and Exhibitor presentations

The scientific programme of first day continued with the flash poster presentations, introducing the studies presented in the poster session.

Manu Bala Krishnan explored innovative data recording methods for food ovens using NEMS technology. Carolina Gomez presented emulsion stabilization through in-situ crystallized lipid particles. Cambrin Kemble-Diaz used a combined computational and experimental approach to understand the cardioprotective benefits of cocoa-flavanols.

Lathika Vaniyan investigated the rheological properties of protein-polysaccharide crosslinked hydrogels improving fiber spinnability and Simon Lawton presented an innovative induction heating method to create frying like structure without oil.

Dr. Solomon Melides investigated the intriguing relationship between fat surface defects and wetting dynamics. Professor Megan Povey presented a study on non-cavitational acoustic control of crystallization. Dr. John Melrose shared insights into the impact of fines on coffee bed physics. Prof. Gleb Yakubov presented exciting results from Ms Panagiota Mouraka doctoral project on the influence of physical and mechanical properties of plant cell-walls on sensory attributes of fat-based suspensions.

Finally, Clyde Hyperspectral Imaging & Technology Ltd, represented by Jon Danskin, gave an exhibitor presenter overviewing hyperspectral imaging solutions for lab and production scale foreign body protection, meat grading, etc.

## *Prize Winners*

## Best Student Research Prizes

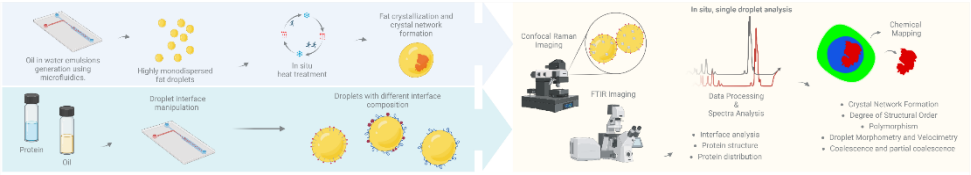
### From structure to function: In Situ Analysis of Structural Heterogeneities in Multi-phase Colloidal Systems Utilizing Microfluidics and Chemical Imaging Technologies.

Dionysios D. Neofytos[1], Sandra Beyer Gregersen[1], Ulf Andersen[2] and Milena Corredig[1]
[1]Department of Food Science, Aarhus University, Denmark
[2]Arla Foods Amba, Aarhus, Denmark

Dionysios is a second-year PhD candidate in the Milena Corredig Group at the Department of Food Science, Aarhus University, Denmark. His PhD research is funded by Villum Fonden, Denmark. Before pursuing his PhD, Dionysios obtained both a BSc and an MSc degree in Chemistry from the Department of Chemistry at the National and Kapodistrian University of Athens, Greece, where he specialized in enzymes and polymer interactions, with a focus on X-ray Protein Crystallography and Biophysics. His research interests revolve around the application of microfluidics technologies, coupled with classic and chemical imaging techniques (FTIR and Raman Imaging), intending to investigate the mesoscopic phenomena of soft matter and its implications on the relationship between food structure and function.

In his recent study, he utilized advanced microfluidics technologies to develop and manipulate colloidal systems comprising monodisperse oil droplets with various interface compositions. By integrating state-of-the-art imaging techniques such as Confocal Raman Microscopy and FT-IR Imaging, he was able to pinpoint, quantify, and in-depth study protein structures and interactions within oil-in-water emulsion systems. This methodology enables the investigation of the composition and dynamics of oil-water interfaces, as well as the assessment of their influence on phenomena such as lipid domain crystallization dynamics, providing insights in situ and with high spatial resolution.

His research highlights the potential of integrating advanced microfluidics and spectroscopic imaging methods to unravel structure formation within complex food matrices and in turn to better understand food structure and function relationship.




## Best Poster Presentation:

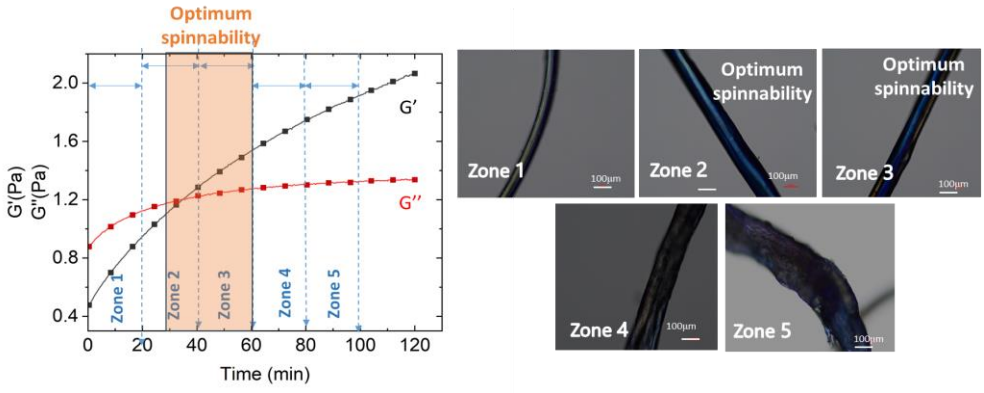
## Investigating Rheological Characteristics of Protein-Polysaccharide Crosslinked Hydrogels for Enhanced Spinnability of Fibres

*Lathika is a third-year doctoral candidate in the Soft Matter Biomaterials & Biointerfaces Group at the University of Nottingham, UK. Her research focuses on the development of anisotropic food structures for meat substitutes. Lathika's project is supported by the BBSRC DTP and Motif FoodWorks, MA, USA.*

The growing demand for sustainable, protein-rich foods requires the development of innovative technologies to produce plant- and fermentation-based meat analogues. These analogues should not only match the texture of traditional meat, perceived as superior by consumers, but also offer well-balanced nutritional profiles. However, creating analogous fibrous structures in plant-based protein substitutes poses a challenge, as most commercial plant proteins, such as those from soy or pea, lack this fibrous organisation. This work aims to explore the fundamental principles governing spinnability and polymer relaxation mechanisms in polysaccharide-protein systems to create anisotropic fibrous structures.

In this work, we propose an innovative use of polysaccharides as structuring aids. Polysaccharide-protein assemblies are designed to achieve structural effects that facilitate the creation of protein-loaded fibrous materials, mimicking the characteristics of meat fibres. Our hypothesis is that under specific spinning conditions, the extension of polysaccharide molecules will occur, resulting in fibres with an aligned, anisotropic structure similar to that of collagen or myofibrils. Simultaneously, we propose that cross-linking will stabilise this aligned structure, ensuring the stability of proteins within the composite. To explore the fundamental principles governing spinnability and polymer relaxation mechanisms in polysaccharide-protein systems, we developed a model system using carboxymethyl cellulose (CMC) as a representative polysaccharide and sodium caseinate as a model protein. This binary hydrocolloid system was transformed into a hydrogel through the use of EDC (1-Ethyl-3-[3-dimethylaminopropyl] carbodiimide hydrochloride) as a cross-linking agent.

Through careful adjustment of the conditions of the cross-linking reaction, we uncovered a dynamic balance between extension and relaxation conditions of weakly associated polymer networks. We demonstrate that for the optimum spinnability of hydrogels there is a window of tan δ and G' where uniform fibres are formed. The results of structural characterisation using XRD revealed possible emergence of a longer order structure.



## Food Physics AGM

AGM of IOP Food Physics SIG 2023
Thurs. 1st Feb 2024, following the 2024 conference close at IoP headquarters, London.

**MINUTES**

### *Present:*

Committee: Zachary Glover (Chair), John Melrose (Treasurer), Rob Farr (Secretary), Martin Whitworth, John Bows, Beccy Smith, Marco Ramaioli, Megan Povey, Peter Schuetz, Eddie Pelan, Gleb Yakubov (apologies from Arwen Tyler, Daniel Hodgson and Daniel Hefft). Other group members: 3 conference attendees.

The Chairman welcomed all to the AGM

### *1. Previous AGM mins*

The 2023 AGM minutes were approved (proposed Zachary Glover, seconded Rob Farr).

### *2. Chairperson's report.*

Zachary Glover thanked the participants and speakers for an excellent conference. The scientific content was varied and of a high standard.

Since this was the first in-person conference since 2020 it was great to get everyone together, the engagement level was very high, and all the breaks in the programme were filled with discussions and networking, which was much appreciated.

The Mexican lunch was tasty, if a bit of a challenge to eat delicately!

## *3. Reflections on the conference.*

Overall, the conference ran smoothly, although quite a lot of effort even during the days of the event were needed to make this happen. Possible points for attention in future include: The IoP mailing list seems to be unreliable, with some communications to group members going missing. Abstract and registration closed several times while we were advertising the conference, so it would have been better to keep these open, up to the last practical date. There were some issues with catering (pastries arriving late, and also it would have been useful to have a printed-out list of pre-orders for the conference dinner). A register of speakers would be useful, so we could track who could not make it, and fill in for missing session chairs. A delegate list would also be useful for networking.

Having the conference at the IoP brought both advantages and disadvantages. It was very easy to travel to; but not being associated with a university meant that we missed out on local students attending (perhaps informally), and especially on student posters. In future conferences at the IoP headquarters, we should direct communication to the big local London universities. We should also target key universities and companies to advertise the conference: Reading University and Nestlé were especially mentioned.

Despite these minor niggles, the conference was a success, with a high-quality programme and more than 60 attendees. The atmosphere was also very uplifting after such a long interval without face-to-face meetings: FP2024 felt like the community was truly re-connecting.

## *4. Future conferences: venues and format*

Future venues for the conference were discussed. It was seen as valuable to have a range of venues of the conference over time: academic, industrial, international locations and the IoP headquarters.

There is a strong proposal for Copenhagen in 2026, with the 2025 conference therefore probably taking place at a location to be decided in the UK.

The strong feeling in the room was that the conference should always be face-to-face, but it would be valuable to record the talks, if the logistical and confidentiality issues with this can be overcome. Online participation (for example by key speakers) should be by exception only.

Dr Meg Zajac raised the possibility that the AGM could be on-line for greater group participation, or that we should have a 2.5 day conference with the AGM at the end of the second day, rather than the last item after the conference.

There was also a suggestion to run some one-hour online workshops six months out of phase with the main conference. However, concern was expressed that these might draw speakers away from the main conference itself.

## *5. Food physics committee, activities & outreach*

In 2024 the committee has grown to 14 members. The mission and purpose of the group is as follows:

- "Supporting research into areas of physics that impact the food sector, and encouraging collaborative research between academic and industrial physicists.
- Promoting the role of physics in the food industry and ensuring that it is more widely understood that this is a field in which there are opportunities to conduct interesting and important research; promoting this fact to early career physicists and policy makers.
- Providing a mechanism for physicists in the sector to feed into the IOP and have their views represented to funders and policy makers."

The Food Physics special interest group has grown to 360 members, and has risen several places in the league table of group size. Food Physics continues to have strong participation from early career physicists, with the largest membership segment being the 20-29 age range, and has a relatively balanced gender distribution compared to most other groups, having a 29%:67%:3% split of female:male:other

The Food Physics group continues to interact and collaborate with other professional bodies and groups:

The Joint RSC/IoP online conference on the Chemical and Physical Modelling of Food will take place on the 15th April (2pm-5pm) and 16th April (9am-12 noon) 2024 UK time (BST). The conference is in its third season having been held successfully in 2020 and 2021.

Gleb Yakubov will organise the Food Tribology meeting on 24th April 2024 with the Tribology Special interest group. Megan suggested to take the opportunity to advertise these events in the newsletter.

John Bows gave an update on Food Physics' participation in ProFSET, the professional food science, engineering and technology body, which is a voluntary group of professional bodies brought together to lobby government about funding and support for food manufacturers; to inspire talent in the sector, and to speak to the public about the importance of this industry. A successful inaugural meeting & conference was held at the IoP headquarters on 23rd November 2023. They are looking to engage with FDF (the Food and Drink Federation) and DEFRA (Department for Environment, Food & Rural Affairs) to help with communicating key messages.

John Bows is also interested in setting up a discussion group around metamaterials in food, together with Exeter University, and will look to hold a workshop at Sheffield Hallam this year.

## *6. Treasurer's report.*

John Melrose presented the group's finances to the AGM, and took the action to check with the IoP that the joint events discussed above had been correctly accounted for.

The accounts were approved by the AGM (proposed by Rob Farr, seconded by Martin Whitworth).

## *7. AOB.*

Nominations for any open committee posts will be held on the usual IoP schedule in September.

Thanks were expressed to Zachary Glover as the principal conference coordinator from the committee this year, for his hard work in making the conference such a success.

Rob Farr

## Food Physics Committee at external events in the last year

Editorial content for newsletter:

One member of the committee, Megan Povey, has had an article published about her research in May's edition of Physics World, the link to which is here https://physicsworld.com/a/sound-and-vision-synchrotron-insights-illuminate-crystal-nucleation-and-growth/#. The research involves the use of very low power, non-caviational ultrasound for the processing of foods such as chocolate, fats and lactose.

The Annual European Rheology Conference (AERC 2024) was held in Leeds this April, attended by around 500 people. There was a significant representation of food applications and Technical Sessions were held on Colloids and Glasses, Polymeric Fluids, Emulsions, Foams and Interfacial Rheology, Microrheology and Microfluidics, Experimental Methods and New Rheometric Techniques, Suspensions and Granular Materials, Food Rheology, Non-Newtonian Fluid Mechanics and Flow Instabilities, Industrial Rheology, Sustainability and Additive Manufacturing, Bio-rheology, Living and Active Matter, Geo-rheology, Soft Solids and Viscoplastic Fluids.

The conference was attended by five IOP Food Physics committee members, all of whom had presentations demonstrating the scientific depth and significance of our committee. They were, in no particular order Gleb Yakubov (Origins of polysaccharide conformation and viscoelastic[1]ity in miscible heterogeneous solvent), Arwen Tyler (Time Resolved SAXS and Rheology Reveal Key Formation Mechanisms of Folded Protein Networks), John Melrose (Simulations of sheared frictional particles – rheology, contact networks and fluctuations), Marco Ramaioli (To which extent can food texture perception be explained in terms of food rheological and tribological properties?) and Megan Povey (Characterising the mechanical properties of soft solids through acoustics and rheology, exemplified by anhydrous milk fat., presented jointly with another committee member – Daniel Hefft).

## ProFSET Holds Successful Launch Event

The Professional Food Science, Engineering, and Technology Group (ProFSET) held its inaugural event titled ***"Transdisciplinary Solutions to Meet the UK Food System Challenges"*** on 23 November 2023 at the Institute of Physics in London.

Members of ProFSET include the Institute of Food Science & Technology (IFST), The Institute of Physics (IOP), The Institution of Chemical Engineers (IChemE), The Royal Society of Chemistry (RSC), The Institution of Agricultural Engineers (IAgrE), The Institution of Mechanical Engineers (IMechE), The Society of Chemical Industry (SCI), The Society for Applied Microbiology (SfAM), The Society of Dairy Technology (SDT), The Nutrition Society (NS).

Together, the groups represent over 12,000 professional scientists, engineers and technologists working in the food and drink sector. ProFSET was set-up to identify and propose actions in Science and Technology, to meet the future needs of an efficient UK Food Supply Chain in the rapidly changing global situation.

The conference kicked off with inspiring keynote presentations from Dr Kate Halliwell (Chief Scientific Officer of the FDF) and Prof Gideon Henderson (DEFRA Chief Scientific Advisor). ProFSET group presentations were split into the 3 themes outlined in the relaunch of the “Food industry priorities for a sustainable food system 2023” report: Net Zero, Healthy Living & Agriculture, and Technologies.

*82 registered delegates enjoyed inspiring keynote speakers*

The conference closed with a lively panel discussion facilitated by Ian Noble (Chair IUK Food Sector Group) with 6 ProFSET group representatives on the theme of "How can ProFSET support the vision of healthy, desirable, and affordable food for all?"


*Panel discussion*

Much of the discussion and debate has been taken back into the ProFSET committee to turn the positive engagement into action during 2024. ProFSET will launch a website in 2024 where this progress can be followed in more detail. In the meantime, join ProFSET's LinkedIn page to be kept up-to-date. Conference slides can be viewed via an IFST report.

The conference presentations were aligned to the wheel graphic from industry the “Food priorities for a sustainable food system 2023” report.

Source: Creating a Sustainable UK Food System 2023 - Innovate UK

The next event in 2024 is the ProFSET Food Workshops (26 Nov, University of Reading), focussed on an Informed Voice Workshop (what can and should be done to influence UK plc research direction) and Promoting the Food Industry as an exciting career path Workshop. Registration details at Eventbrite

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John Bows

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# Food Physics 2025

**3–5 February 2025**
The Jubilee Hotel and Conferences,
Nottingham, UK

CONFERENCE WEBSITE CLICK HERE

***Physical event!***

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https://physicsworld.com/a/sound-and-vision-synchrotron-insights-illuminate-crystal-nucleation-and-growth/

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# Spanning industry & academia

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