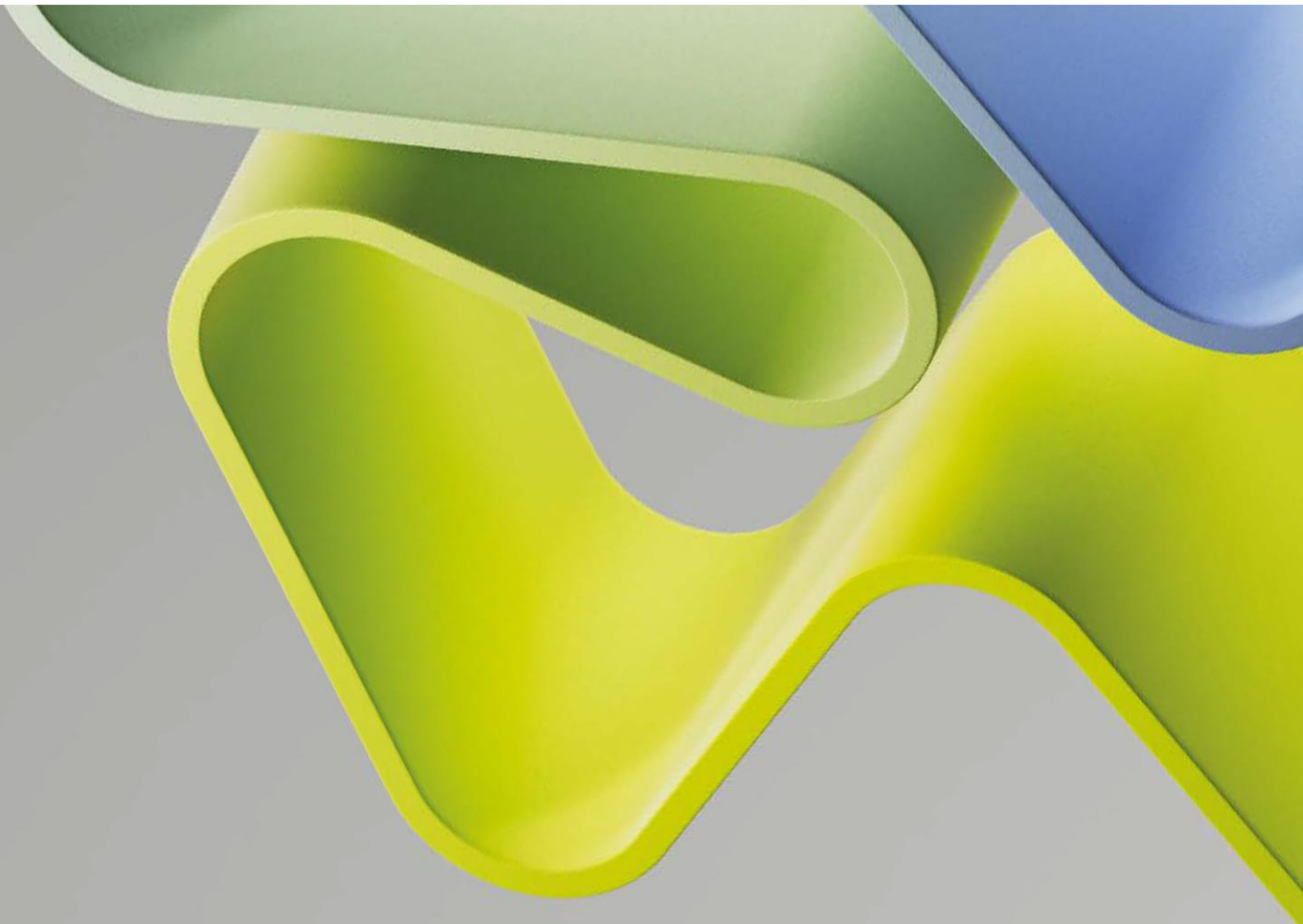


Evaluation of Natural Sciences 2022–2023

Soft and Complex Matter Lab

Department of Physics - NTNU

Panel 03



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Preface by the Research Council of Norway

The Research Council of Norway (RCN) is given the task by the Ministry of Education and Research to perform subject-specific evaluations. The primary aim of this evaluation of natural sciences 2022-2023 (EVALNAT) is to reveal and confirm the quality and relevance of research performed at Norwegian Higher Education institutions and by Research institutions (the Institute sector) in an international perspective. Such knowledge is useful for the institutions that participate in the evaluation, for the Research Council who advise the authorities on how research should be developed further, and for the authorities, who set targets and frameworks for research and higher education. Research groups submitted by their administrative unit will be assessed by 12 expert panels organized by research subjects or themes. The expert panels will assess research groups across institutions and sectors based on research group's self-assessments and examples of scholarly output. These research reports will be part of the evaluation of their belonging administrative units.

Executive summary

The Soft and Complex Matter Lab of NTNU's Department of Physics studies, mainly experimentally, a variety of soft matter and complex systems, ranging from clays to cellulose, zeolites, including more generally systems from the whole soft matter realm (colloids, surfactants, polymers). The research group is very active in investigating both fundamental problems, such as self-assembly of nano- or micro-sized building blocks or gas and fluid flow through porous media. They explore the potential of these novel meso- or nanostructured materials for applications, mainly focusing on CO₂ storage, structural colours and food science.

The research group is very strong in producing high quality research outputs, not only in terms of publications, but also concerning patents. The group has an excellent funding record since it attracts numerous competitive grants from national and European sources. In the soft matter and complex systems field, the group is very well-known internationally, also thanks to its intense organization of scientific events, including a Winter School in Geilo and annual workshops.

The research group has a strong interdisciplinary profile, which can certainly be classified of high international standing in the field of Soft and Complex Matter. Of course, the group also ranks very highly in the national research landscape.

Overall assessment

A key strength of the Soft and Complex Matter Lab research group is the interdisciplinary approach to the investigated topics and the ability to combine fundamental and applied research in soft matter and complex systems, dealing with hot topics in the field. For these reasons, the group is certainly a strong and original one in Norway and internationally.

Another important strength is the active collaboration between the different members of the group, which ensures a productive and successful way to progress in research. The group is also very good at establishing long-term stable international collaborations with leading research groups around the world.

Overall, the group deserves to be highlighted in the evaluation's national assessment of the area because it conducts high-standard research, it is competitive for prestigious funding and has the ambition to tackle innovative scientific questions at the boundary between fundamental and applied research, always ensuring collaboration and cross-fertilization of ideas among its members.

Grading

Dimensions	Score
Organisational dimension (<i>How adequate the organisational environment is in supporting the production of excellent research</i>).	5
Quality dimension (Research and publication quality/Research group's contribution)	4/4
Societal impact dimension (Research group's societal contribution/User involvement)	4/5

Recommendations

The panel recommends continuing to pursue the current strategy of performing interdisciplinary research at boundary between fundamental and applied research that has proven to be very successful in the last years. Keeping up the excellent practices of collaboration among group members, joint supervision of PhD students and facilitation of mobility of young researchers is also strongly encouraged. The remarkable success rate in attracting European funding should also be maintained through future applications, particularly for MSCA Doctoral Networks.

However, it is important to point out a concern for the future that was also identified by the group itself. Namely one of the professors, who now clearly is the true driving force in terms of scientific relationships, attracting funding and PhD students, approaches retirement. For the group to maintain its standing and productivity, there is a strong need for an optimal replacement, in order to continue the positive trend in the future. This will be crucial for the coming years and the recruitment will need to be done with great effort and care.

Special attention should also be paid to increase the diversity, so a female hire is particularly recommended.

Finally, the group has barely any ongoing activity on numerical simulations and theory. To strengthen this aspect, a dedicated hire or more extensive collaborations with leading theoretical/numerical groups would be desirable.

1. Strategy, resources and organisation

Introduction

The group is composed of 3 professors, 2 adjunct professors and 1 technical staff member, as permanent staff. It currently supervises 3 postdocs, 10 PhD students and 6 master students.

The group successfully adopts a collaborative approach, favouring fruitful interactions between its members. Indeed, the differences in background and research interests among the PIs warrant for the possibility of doing interdisciplinary research, while at the same time ensuring close interests, so that an efficient collaboration within the team is possible. The only minor weakness appears to be the fact that expertise in numerical simulations and theory is not enough developed in the group.

This would add an additional possibility for collaboration that may be important to strengthen in the future.

The group is well known and visible internationally, also thanks to its excellent funding record. This includes several ongoing projects, most frequently carried out in collaboration with international partners. Many of the projects are obtained through competitive programmes, including EU ones such as Initial Training Networks and collaborative schemes among different countries. Some of the funded projects are also performed in collaboration with industries.

Finally, the group makes ample and fruitful use of existing home resources as well as of international large-scale facilities.

1.1 Research group's organisation

The group involves a small number of permanent members with diverse and interdisciplinary expertise, encouraging cross-collaboration within the group, within the host institution and elsewhere. The group also involves a significant number of master and PhD students. Fewer postdocs are present. The group is well-equipped in terms of experimental facilities.

The collaborative strategy between the members of the group is particularly noteworthy. For example, collaborations not only take place between PIs (10 collaborative papers in the last 5 years) but also postdocs and PhD students often publish with PIs who are not their main supervisors. This clearly testifies to a cohesive strategy of research activities.

The group has a broad national and international network of collaborations, which allows for international experiences for the PhD students and whose members are involved in nearly all the publications of the group. Mobility is appropriately used within the group, also thanks to the numerous international projects and collaborations. Even their RCN projects include partners abroad.

It is laudable that the group is very active in organizing workshops, conferences and PhD schools, which enrich the research education of the young members of the group and maintain/ enlarge the group's international network.

1.2 Research group's resources

The group has an excellent funding record and successfully attracts grants also from national and international agencies, often involving international partners. We note ongoing projects with Brasil, Portugal, Czech Republic, Sweden, UK, Netherlands etc. This strongly favours mobility and international cooperation. However, it can be noticed that, among the permanent members of the group, one professor and one adjunct professor do not seem to have funded projects. It is auspicious to change this trend in the future.

Most of the projects are obtained through competitive programmes. Among these, several EU projects are listed, including multiple Marie Curie Initial Training Networks (ITNs). For one of them, devoted to food science, the group is the project Coordinator, implying a strong commitment both in funding acquisition and project management. The group is also active in projects with industrial partners.

The group greatly profits from the NTNU Nanolab, which is a national infrastructure. It has all the state-of-the-art equipment required for their type of research so the excellent support from their institution is evident. In addition to the home resources, the group also makes ample and fruitful use of international large -scale facilities (synchrotrons and neutron sources), and these beamtimes contribute to the high quality of the performed research.

1.3 Relevance to the institution

The group is important to the host institution (NTNU), because of its high-quality interdisciplinary research in physics and its important international network. Soft and complex matter are nowadays topics that span several disciplines, including chemistry, engineering and materials science, and to have an excellent group working in this field is surely important for a technical university.

The group participates and even coordinates ITNs, that are doctoral networks, whose main purpose is to train PhD students through collaborative research on important topics and also through interactions with partners outside academia. This reinforces the role of the institution in the education of future generations of young scientists for academia and elsewhere. In addition, the long-time regular organization of a Winter School, now at its 23rd Edition, which is quite well-known in the Soft Matter community, confirms the strong commitment of the group to the education of researchers.

Finally, the group also contributes to produce innovation as documented by its patent applications as well as by their projects involving national and international companies and applied research labs. The group's interest in sustainable materials and science sustainability is a key strength, overall reinforcing NTNU as a technical university.

2. Research quality and societal contribution

Introduction

The list of presented publications includes papers in top quality, interdisciplinary journals. Most papers have an impact in the field, as documented by the relatively large numbers of citations that they have attracted.

The breadth of the investigated topics is large and denotes the attitude of the group to tackle interesting problems at the intersection of different fields. For example, it is very interesting how a

classic and old topic such as clay minerals can be turned into a leading topic for a variety of different directions, also in applied fields such as CO₂ gas adsorption.

In addition to publications, the research outputs also include patent applications, which is a strength for a research group dealing with an interdisciplinary topic such as soft and complex matter. In addition, the group also contributes to the scientific knowledge with more technical outputs, aimed at developing novel sample environments for X-ray experiments.

The number of PhD theses defended in the period is also quite high and denotes appropriate high-quality education from the group.

Finally, the role of the group members in the publications is often prominent, actively contributing to the idea of the works and performing the experiments both at the group's home lab and at large-scale facilities.

2.1 Research group's scientific quality

As the listed publications illustrate, the group publishes very original contributions to the field, some of which find their way into very high impact journals and are quite well-received by the scientific community in terms of overall citations.

Special highlights in the period evaluated here were the exploitation of clays to generate structural colours or the use of electric fields to induce self-assembly of a colloidal shell around oil drops. The group is certainly an important player in clay science and the fact that they also regularly apply for patents and contribute to the development of special sample environments for research at large-scale facilities are special plusses.

In terms of quantity, the production is at the level expected for an internationally competitive group (60 publications in the last 5 years) but it is a bit worrisome that one of the professors has published only 2 papers in these last 5 years. A concern about viability arises when looking at the list of PhD theses: the supervision potential of the group does not seem fully utilized since two of the professors supervised a PhD student each, while the third professor was the supervisor of the other 6 PhD students and this trend continues with the current PhD students in the group, where half are supervised again by the same professor.

2.2 Research group's societal contribution

The group serves Norway's interests by educating highly qualified PhD students, who often continue their careers in prestigious institutions, including the Norwegian Radiation Protection Authority or the Norwegian Defence Research Establishment, as well as in academia.

At the international level the group actively promotes academic development in emergent nations. Indeed, it not only attracts students from there on NTNU PhD positions, but also offers an international experience to visiting and double degree PhD students, who in several cases pursue successful academic careers in their home countries.

The group is well visible internationally, which is facilitated by the frequent student and postdoc exchanges and by the many common projects with different countries (both in Europe and worldwide). The involvement in EU projects contributes to the international impact of the group.

The group is involved in many research projects with industry – not only in Norway but also inside and outside Europe. It also encourages secondments of young group members to these partners as well as, vice versa, hosting staff from partners as visitors in the group. Although the group mainly focuses on fundamental science questions, many of the ongoing projects have a foundational character and therefore contribute to the overall economic development.

List of appendices (separate document)

- Mandate for expert panels
- Expert panels description
- List of panel members
- Template of self- assessment for research group

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