

Proposal Evaluation Form

	EUROPEAN COMMISSION Horizon Europe Framework Programme (HORIZON)	Evaluation Summary Report - Doctoral Networks
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Call: HORIZON-MSCA-2022-DN-01
Type of action: HORIZON-TMA-MSCA-DN
Proposal number: 101119608
Proposal acronym: TOPOCOM
Duration (months): 48
Proposal title: Topological solitons in ferroics for unconventional computing
Activity: PHY

N.	Proposer name	Country	Total eligible costs	%	Grant Requested	%
1	NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU	NO	0	-	595,497.59	22.19%
2	JOHANNES GUTENBERG-UNIVERSITAT MAINZ	DE	0	-	521,078.4	19.41%
3	LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY	LU	0	-	262,620	9.78%
4	RIJKSUNIVERSITEIT GRONINGEN	NL	0	-	274,370.4	10.22%
5	UNIVERSITA DEGLI STUDI DI MESSINA	IT	0	-	259,437.6	9.67%
6	PANEPISTIMIO KRITIS	EL	0	-	240,098.39	8.95%
7	INFINEON TECHNOLOGIES AUSTRIA AG	AT	0	-	270,331.2	10.07%
8	Singulus Technologies AG	DE	0	-	260,539.2	9.71%
9	IBM RESEARCH GMBH	CH	0	-	0	0.00%
10	Monitoraggio Ambientale e Ricerca Innovativa Strategica Srl	IT	0	-	0	0.00%
11	SPRINGER NATURE LIMITED	UK	0	-	0	0.00%
12	TWENTE SOLID STATE TECHNOLOGY BV	NL	0	-	0	0.00%
13	ATTOCUBE SYSTEMS AG	DE	0	-	0	0.00%
14	VERBAND DEUTSCHER MASCHINEN- UND ANLAGENBAU (VDMA)	DE	0	-	0	0.00%
15	NANOSURF GMBH	DE	0	-	0	0.00%
16	inuTech GmbH	DE	0	-	0	0.00%
17	American Physical Society	US	0	-	0	0.00%
18	NANOLAYERS OU	EE	0	-	0	0.00%
19	Consorzio Italian SPINtronic Network	IT	0	-	0	0.00%
20	UNIVERSITE DU LUXEMBOURG	LU	0	-	0	0.00%
Total:			0		2,683,972.78	

Abstract:

TOPOCOM is a network of leading European groups from different disciplines and sectors selected to provide comprehensive training on the integrative concepts underlying the science of topological solitons in ferroic materials and their applications in unconventional computing. Topological solitons are a rich source of emergent physical phenomena and most promising nanoscale systems for future technology, enabling conceptually new pathways for low-energy information processing and sensing, as well as integrated data storage. Many of the developments in the field have occurred only in the past few years and it is clear that we have only scratched the tip of the iceberg concerning the topological solitons that form in electrically or magnetically ordered materials. To realize their potential, the consortium comprises the best groups in materials synthesis and modelling to stabilize such solitons, modelling and studying their dynamical responses to external stimuli, and designing and fabricating devices, where solitons carry out ultralow-power computing and sensing functions. While clearly a challenging topic, there are major benefits that result from a unified treatment of electric and magnetic solitons as realized in this TOPOCOM. The network spans the whole range from fundamental physics and applied materials science - linking both experimental and theoretical aspects - to industrial-scale production and evaluation. The scientific part ("Training through Research") is complemented by advanced transferable business and cultural skills training ("Training for Life"), providing Europe with a unique training programme at the forefront in unconventional computing based on electric and magnetic solitons. TOPOCOM will establish innovative solutions for more sustainable information technology and educate the next generation of experts, highly qualified to tackle the technological key challenges of growing complexity in an important sector for EU economic development.

Evaluation Summary Report

Evaluation Result

Total score: 100.00% (Threshold: 70/100.00)

Criterion 1 - Excellence

Score: 5.00 (Threshold: 3/5.00 , Weight: 50.00%)

- **Quality and pertinence of the project's research and innovation objectives (and the extent to which they are ambitious, and go beyond the state of the art).**
- **Soundness of the proposed methodology (including interdisciplinary approaches, consideration of the gender dimension and other diversity aspects if relevant for the research project, and the quality and appropriateness of open science practices).**
- **Quality and credibility of the training programme (including transferable skills, inter/multidisciplinary, inter-sectoral and gender as well as other diversity aspects).**
- **Quality of the supervision (including mandatory joint supervision for industrial and joint doctorate projects).**

Strengths:

- *The research and innovation objectives of the proposal are pertinent and of high quality. They are perfectly reflected in the research work packages and they promise real breakthroughs in different research directions. The proposed investigation is at the cutting edge of research on condensed matter. The objectives are ambitious as mostly uncharted materials with topological textures can support several new effects.*
- *The proposal is excellently outlined against the current state-of-art and, among the other objectives, it promises to develop a common theoretical framework for magnetic and ferroelectric topological materials with important implications in the field.*
- *The research projects are perfectly integrated in the work-programme and are very well suited for a highly qualified doctoral training, including exposure to the industrial sector, and valuable secondments and short visits.*
- *The strong feasibility of the research is built on the expertise and recent advances of the involved research groups.*
- *The proposed methodology is pertinent, excellently based on a multidisciplinary approach, and it corresponds very well to the objectives of the action. The concerted efforts in technology and experimental studies of novel model systems as well as the development of mathematical framework for electric and magnetic solitons maximise the chances to meet the challenges defined in the proposal.*
- *The proposed research is highly interdisciplinary, gathering together in an excellent manner physics, material science, engineering, and computing science, including artificial intelligence methods.*
- *The open science practices are convincingly presented as well as the commitment toward the FAIR principles. The open science practices are appropriate and of high quality.*
- *The training programme is well thought out, thoroughly described, and effective. Training resources at the beneficiaries, both available to the locally hired doctoral candidates and those offered more widely are properly detailed. The commitment to web-based training activities adds to the high quality and credibility of the programme.*
- *The network-wide training activities are well planned. Workshops and specialistic courses also delivered by experts in different fields of material science and computing and organised by several beneficiaries provide the doctoral candidates with relevant training opportunities in research and transferable skills.*
- *The training through research is very well supported by properly designed secondments. Their content is clearly and convincingly presented.*
- *The role of the non-academic partners is clearly explained and their commitment for the training activities is excellent.*
- *The academic track record of the supervisors is presented in great detail. Their experience in supervising early career researchers is well documented. Their research achievements are confirmed by their respective lists of publications and support their abilities to transfer knowledge at the highest possible level. The declared commitment of the supervisors to the action is appropriate. High quality supervision is expected.*
- *The arrangements for supervision, including co-supervision, staff tutoring, and frequent meetings, are excellent. The proposed external mentoring additionally strengthens the supervision quality by giving the doctoral candidates broader perspective.*

Criterion 2 - Impact

Score: **5.00** (Threshold: 3/5.00 , Weight: 30.00%)

● **Contribution to structuring doctoral training at the European level and to strengthening European innovation capacity, including the potential for:**

a) **meaningful contribution of the non-academic sector to the doctoral training, as appropriate to the implementation mode and research field**

b) **developing sustainable elements of doctoral programmes.**

● **Credibility of the measures to enhance the career perspectives and employability of researchers and contribution to their skills**

● **Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.development.**

● **The magnitude and importance of the project's contribution to the expected scientific, societal and economic impacts.**

Strengths:

- *The structuring effect on the doctoral training at the European level is convincingly demonstrated. The involvement of several beneficiaries scattered around European associated countries and member states will clearly result in stronger ties and substantial synergy effect on the training in advanced condensed matter.*

- *The development of fundamental understanding of novel materials supports possible applications for sensing and unconventional computing. The results of the action both in terms of meeting research and innovation objectives and the formation of highly trained researchers clearly contribute to strengthening European innovation capacity.*

- *The contribution of the non-academic sector to the training is excellent, including research-driven training, network-wide lecturing, secondments, and short visits to enhance the candidates' exposure to diverse professional environments and possibilities of networking.*

- *The industrial partners are well integrated in the proposal and their interest toward the research findings is evident. This contributes well to bridge the gap between industry and the academic sector.*

- *The proposal describes in a very convincing manner the impact of the proposal on the candidates' career prospects in both academia and industry, taking also into account the ambitious objectives of the proposal, the commitment of the beneficiaries toward excellent science, and their international visibility.*

- *The broad training opportunities offered by the network provide the doctoral training with considerable added value in terms of the doctoral candidates' skills development.*

- *The dissemination plan correctly includes all important means to maximise the expected outcome of the proposal and cover very well all the relevant targets, including industrial stakeholders, public at large, and scientific specialists. The reasonably chosen scientific conferences add to the high quality of the activities. There is also a clear commitment to produce high quality doctoral thesis that is a very valuable means of dissemination toward the scientific community. The strategy includes the submission of these theses to national competitions to enhance the visibility of the doctoral candidates' work.*

- *Communication activities are very well planned with target groups and expected impact clearly identified. A substantial effect on the public is expected.*

- *The strategy for the protection of intellectual property is well outlined. It is made highly credible by the experience of many beneficiaries in patenting relevant technological results.*

- *The strategy for commercial exploitation is clearly presented in the proposal.*

- *The magnitude and importance of the proposal's key outcomes is detailed for all individual research projects. Their contribution to the expected scientific, societal, and economic impacts is substantial, as the development of new pathways for low-energy information processing and data storage promises several solutions to support sustainable growth of information-based societies of future. Positive impact of the solutions on environment strengthens the relevance.*

Criterion 3 - implementation

Score: 5.00 (Threshold: 3/5.00 , Weight: 20.00%)

- **Quality and effectiveness of the work plan, assessment of risks and appropriateness of the effort assigned to work packages.**
- **Quality, capacity and role of each participant, including hosting arrangements and extent to which the consortium as a whole brings together the necessary expertise.**

Strengths:

- *The work programme is coherent and very well suited to the objectives.*
- *The work packages and the individual projects are very well described and scientifically and didactically relevant. They are very well integrated into the programme.*
- *The staff efforts are very well tailored to conduct efficiently the research work and the training.*
- *Deliverables and milestones are very well thought out for an efficient monitoring of the proposed developments. They excellently include means of verification.*
- *Risks are clearly identified. The proposed mitigation measures are pertinent.*
- *The governing structure of the network is clearly presented and effective. The tasks and responsibilities of the main actors involved, including the supervisory board, are properly distributed supporting high quality management of the action.*
- *The appointment of an ombudsman, a training manager, and the thesis committee demonstrates a special care towards the implementation of a successful doctoral path.*
- *The recruitment strategy is very well outlined and there is a very good attention to gender balance and other minority issues.*
- *The participants are fully committed to the research and training activities of the proposal. The roles of the participants are very well presented.*
- *All the involved institutions have the capacity to perform the proposed action both in terms of infrastructure and human potential. Necessary expertise is confirmed by the academic track record of key persons and institutional experience in managing research/training projects. The hosting arrangements are adequate.*
- *The consortium has very well assorted complementary expertise to cover all the aspects of the proposed research.*
- *The beneficiaries have fully demonstrated their commitment to open science with excellent examples like NTNU Open, MuMax3, and Petaspin.*

Scope of the proposal

Status: **Yes**

Comments (in case the proposal is out of scope)

Not provided

Exceptional funding

A third country participant/international organisation not listed in [the General Annex to the Main Work Programme](#) may exceptionally receive funding if their participation is essential for carrying out the project (for instance due to outstanding expertise, access to unique know-how, access to research infrastructure, access to particular geographical environments, possibility to involve key partners in emerging markets, access to data, etc.). (For more information, see the [HE programme guide](#))

Please list the concerned applicants and requested grant amount and explain the reasons why.

Based on the information provided, the following participants should receive exceptional funding:

Not provided

Based on the information provided, the following participants should NOT receive exceptional funding:

 Associated with document Ref. Ares(2023)1547369 - 03/03/2023

Not provided

Use of human embryonic stem cells (hESC)

Status: No

If YES, please state whether the use of hESC is, or is not, in your opinion, necessary to achieve the scientific objectives of the proposal and the reasons why. Alternatively, please state if it cannot be assessed whether the use of hESC is necessary or not because of a lack of information.

Not provided

Use of human embryos

Status: No

If YES, please state how the human embryos will be used in the project.

Not provided

Activities excluded from funding

Status: No

If YES, please explain.

Not provided

Do no significant harm principle

Status: Not applicable

If Partially/No/Cannot be assessed please explain

Not provided

Exclusive focus on civil applications

Status: Yes

If NO, please explain.

Not provided

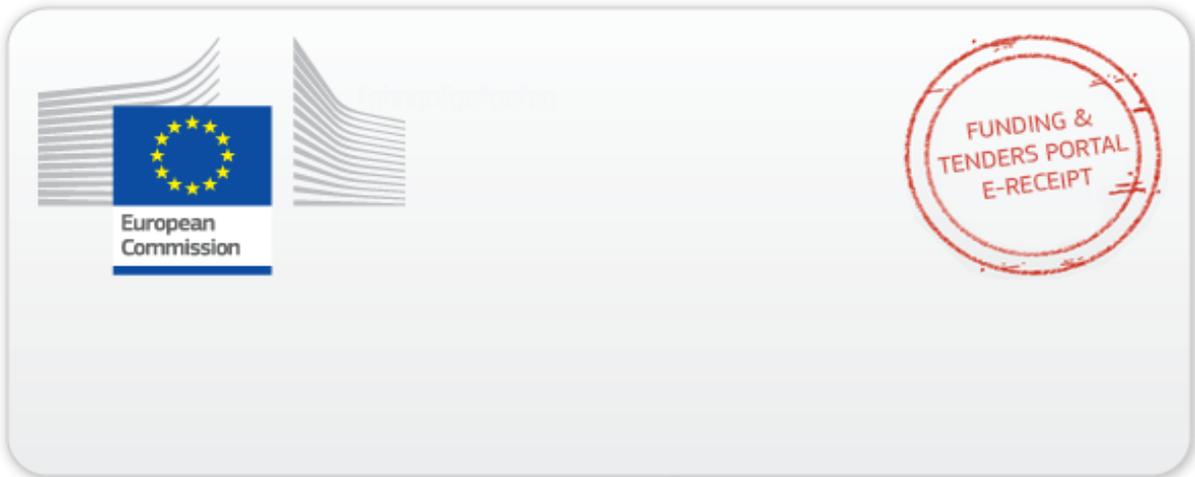
Artificial Intelligence

Status: No

If YES, the technical robustness of the proposed system must be evaluated under the appropriate (excellence?) criterion.

Overall comments

Not provided



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