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### **Practice Committee's case 74**

On behalf of the authors (the "Authors") of the article "Flux-induced topological superconductivity in full-shell nanowires" (the "Article"), I have the following responses to your letter of 27 October 2023. Underlining in quotations is mine.

#### **1. PROCEDURAL ISSUES**

In order to ensure that there is a common understanding of the timeline, I will below set out the most important dates in the view of the Authors.

27 March 2020. The Article was published in Science.

28 June 2021. Science Editor Jake S. Yeston contacted the Niels Bohr Institute requesting an evaluation in response to Frolov and Mourik requests.

26 July 2021. The investigation committee convened by the Niels Bohr Institute dismissed the Frolov and Mourik complaint in full.

15 October 2021. Frolov and Mourik again submitted their complaint to the

Practice Committee at the University of Copenhagen through Jake S. Yeston.

The complainants summarized their complaint as follows,

*"The case is detailed thoroughly in the appended analysis by Profs. Frolov and Mourik. Essentially, the question is whether the data presented in the original paper accurately represented the outcome of the experiments undertaken. Journal editors and reviewers can only assess data to which they have access. If data that did not support the claims in the paper were with-held or suppressed, then the paper submitted to the journal implied greater statistical support for the conclusions than the experiments in fact bore out.*

*The specifics, once again, are detailed in the appended analysis, but the source of greatest concern is the range of voltages and number of independently tested devices that were represented in the paper's second figure. The editors at Science believe that an independent, transparent investigation by experts in this subfield of Majorana physics is necessary to ascertain whether or not the authors unethically with-held data that undermined the conclusions of their paper."*

8 November 2021. The Practice Committee notified Charles Marcus on behalf of the Authors of its decision to process the complaint as a matter alleging "questionable research practice",

*"Whereas the Danish Committee on Research Misconduct has the competence to hear cases concerning research misconduct, cf. section 4(1) of Act no. 383 of 26 April 2017 on Research Misconduct etc., the Practice Committee is competent to hear cases of questionable research practices, cf. section 19(1).*

*According to the complaint, the full dataset behind your paper "Flux-induced topological superconductivity in full-shell nanowires" from "Science", Volume 367, no. 64865 available online co-authored with several others significantly undermines support for the scientific conclusions in said paper.*

*The Practice Committee will now take steps to consider whether the alleged claim constitutes questionable research practice."*

20 November 2021. Charles Marcus on behalf of the Authors submitted comments to the Practice Committee.

27 June 2022. The Practice Committee appointed Profs. Sophie Gueron, Pertti Hakonen, Allan MacDonald and Alfredo Levi Yeyati as an expert panel (the “Expert Panel”) with the following terms of reference,

*“Upon deliberation, the Practice Committee has invited a panel of experts to consider the basis of the questions raised by the said Editorial Expression of Concern.*

*In particular, the panel is invited to consider the following two main questions*

- 1. Whether the data presented in the Science Magazine article accurately represented the outcome of the experiments undertaken, and*
- 2. Whether the authors deliberately or due to gross negligence withheld data that undermined the conclusions of their paper.*

*The mandate of the experts is confined to the said scientific article and does not include any other complaint made towards the teams of authors of the disputed work.”*

15 July 2023. The Expert Panel submitted their report (the “Report”) in which they concluded (p. 27),

*“We thus arrived at the following conclusions:*

- The presented data do, for the most part, represent the outcome of the experiments: the authors have exercised scientific judgement in selecting which data to share using criteria whose application was partially subjective. Although data selection did, in our view, result in conclusions that did not adequately capture the variability of outcomes, the excluded data did not undermine the paper’s main conclusions.*
- The shortcomings we have noted in this manuscript do not constitute gross negligence.*
- We do not view the authors’ behavior in connection with this paper as an instance of scientific misconduct.”*

The Expert Panel further expanded the conclusion (p. 28),

*"Within this familiar landscape that surrounds our daily work as scientists, we judge that Vaitiekėnas et al. have not crossed the line that separates scientific discourse and debate from scientific misconduct."*

7 September 2023. The Practice Committee requested Charles Marcus on behalf of the Authors and Jake S. Yeston to submit any further comments which they may have to the Expert Panel's report which were submitted on behalf of Charles Marcus on behalf of the Authors on 28 September 2023 and 4 October 2023.

27 October 2023. Charles Marcus on behalf of the Authors was informed by the Practice Committee that it now was of the opinion that,

*"Based upon the conclusions of expert report, it is the preliminary view of the Practice Committee that it is not entirely excluded that case 74 involves aspects that the Danish Board of Research Misconduct might want to consider as a case of "research misconduct" for further investigation."*

The wording *"that it is not entirely excluded that case 74 involves aspects that the Danish Board of Research Misconduct might want to consider as a case of "research misconduct"* indicates that the Practice Committee is of the opinion that it is for the Authors to fully exonerate themselves in respect of the unclear charges.

Reference is made to section 11(2) of the Danish Act on Research Misconduct (the "Act"), in which it is stated,

*"If the notification contains the information specified in subsection (1), following consultation with the Danish Committee on Research Misconduct, the research institution shall prepare an account of the specific circumstances of the case and remit the case to the Committee by no later than three months after receiving the notification."*

and to section 10(4) of The University of Copenhagen's rules for handling cases of questionable research practice and research misconduct (the "Practice Committee Rules"), in which it is stated,

*"The Practice Committee does not submit a case to the Committee on Research Misconduct if it finds that the case does not concern research misconduct."*

In my view, the decision that the matter should be handled as an allegation of “questionable research practice” in the purview of the Practice Committee in accordance with section 10(4) of the Practice Committee Rules was made and conveyed to Charles Marcus on behalf of the Authors by the Committee on 8 November 2021. The Authors deserve a reasonable and understandable explanation of the basis of the Practice Committee’s revocation of their decision conveyed on 8 November 2021. The Authors do not find that they have been presented with any reasonable basis for the revocation of the said decision.

It should further be noted that section 11(2) of the Act and section 10 of the Practice Committee Rules prescribe that any matters of research misconduct shall be submitted to the Danish Committee on Research Misconduct no later than 3 months after a notification in accordance with section 11(1) has been received.

The notification was submitted on 15 October 2021 and was decided by the Practice Committee on 8 November 2021 in which the Practice Committee stated that they would now consider whether the alleged claim constitutes questionable research practice.

Taking into account that the Authors have now been waiting for a decision for more than 2 years and that Mr Frolov and Mr Mourik have been pursuing all avenues regarding their complaints for more than 3 years – a pursuit that has been in vain – it now appears that the conclusion of the matter is of the essence. In this respect, reference is made to the Code of Conduct for Responsible Research 2023, p. 15,

*“In specific cases of suspicion, The University of Copenhagen’s Code of Conduct for Responsible Research should be applied. Following the Danish Code of Conduct the Research Integrity this means that*

...

*Cases should be concluded efficiently, so that no person is part of an investigation longer than strictly necessary.”*

To summarize the procedural issues in connection with this matter, I think it is fair to state that:

- a) On 8 November 2021, the Practice Committee decided that the matter was not a matter that should be referred to the Danish Committee on Research Misconduct, but rather was a matter alleging “questionable re-search practice”.
- b) The Practice Committee has not identified sufficient factual reasons to re-voke its decision of 8 November 2021.
- c) The Practice Committee has not identified the legal basis for the revoca-tion of its decision of 8 November 2021.
- d) The Practice Committee has not respected the 3-month deadline set out in the Act, or the Rules for the Practice Committee.
- e) The Authors have been subject to an investigation longer than reasona-ble and certainly longer than strictly necessary.

## **2. HANDLING OF THE EXPERTS’ REPORT**

- 2.1. The issue of publishing a correction to the text and figures of the Science article (the Article) is, in the view of the Authors, not a matter to be decided neither by the Practice Committee nor by the Danish Board on Research Misconduct. This issue will be dealt with directly with the relevant editorial bodies of the publication, as the Practice Committee does not control the publication or the actions of authors not associated with the university.

The Authors do not object to the publication of the Report as they find that the Report fully exonerates them in respect of the charges raised by Sergei Frolov and Vincent Mourik’s complaint. The Authors, however, find that the publica-tion of the Report must await the final decision of Case 74.

The Authors reiterate that they will implement the Expert Panel’s recommenda-tions.

**3. FURTHER STEPS OF CASE 74**

**3.1. Introductory remarks**

3.1.1. When dealing with this case, it is important to bear in mind that two independent bodies have exonerated the Authors. First the Niels Bohr Institute, who dismissed the Frolov and Mourik complaint on 26 July 2021 with the following conclusion,

*“(a) We find no problems with the paper, nor with the conclusions in the paper, nor with the data supporting the claims of the paper.*

*(b) We find the complains of Mr Frolov and Mr Mourik unjustified.*

*(c) All data concerned with the present paper has – according to demand – been transmitted rightfully to third parties. No additional data is left out.”*

and secondly, the Expert Panel in their conclusion in their report, p. 27, quoted below.

It is clear that we have two independent bodies that have now totally exonerated the Authors in respect of any claims regarding research Misconduct.

The Practice Committee should, in our view, consider whether a third evaluation of the Article and its scientific data could lead to another conclusion than the two first evaluations and whether the Practice Committee or the Danish Board on Research Misconduct has the necessary qualifications to make such an evaluation.

3.2. Before the Practice Committee makes a final decision on referring the matter to the Danish Board on Research Misconduct, we wish to reiterate the background of this case.

The complaint made by Jake S. Yeston, Sergei Frolov and Vincent Mourik was basically that the Authors, in the view of Yeston, Frolov and Mourik, *“unethically withheld data that undermined the conclusions of the their paper”* (Report, p. 29, Appendix 1)<sup>i</sup>

In the Practice Committee's decision of 8 November 2021, the Practice Committee summarized the charges raised against the Authors as follows,

*"According to the complaint, the full dataset behind your paper "Flux-induced topological superconductivity in full-shell nanowires" from "Science", Volume 367, no 6485 available online co-authored with several others significantly undermines support for the scientific conclusions in said paper."*

The Practice Committee appointed the Expert Panel on 27 June 2022 pursuant to section 14 of The University of Copenhagen *Rules of Procedure for Cases regarding Questionable Research Practices and Research Misconduct*, with this mandate,

*"In particular, the panel is invited to consider the following two main questions:*

- 1. whether the data presented in the Science Magazine article accurately represented the outcome of the experiments undertaken, and*
- 2. whether the authors deliberately or due to gross negligence withheld data that undermined the conclusions of their paper."*

In respect of 1., the Expert Panel stated in their conclusion, p. 27,

*"The presented data do, for the most part, represent the outcome of the experiments: the authors have exercised scientific judgement in selecting which data to share using criteria whose application was partially subjective. Although data selection did, in our view, result in conclusions that did not adequately capture the variability of outcomes, the excluded data did not undermine the paper's main conclusions."*

In respect of 2., the Experts stated in their conclusion, p. 27,

*"Although data selection did, in our view, result in conclusions that did not adequately capture the variability of outcomes, the excluded data did not undermine the paper's main conclusions."*

*The shortcomings we have noted in this manuscript do not constitute gross negligence.*

*We do not view the authors' behavior in connection with this paper as an instance of scientific misconduct.*

The charges made by Jake S. Yeston, Sergei Frolov and Vincent Mourik in their complaint of 15 October 2021,

*"The editors at Science believe that an independent, transparent investigation by experts in this subfield of Majorana physics is necessary to ascertain whether or not the authors unethically with-held data that undermined the conclusions of their paper."*

are unequivocally rejected by the Expert Panel and by the Niels Bohr Institute.

The experts further state in the remarks on the conclusion, p. 27,

*"We have examined all that data and its analysis and have concluded that the experimental and theoretical findings were not grossly misrepresented in the Science publication."*

During the Expert Panel's investigation, the Authors have fully cooperated with the Expert Panel and made all data requested by the Expert Panel available to the Panel. I refer to the Expert Panel's conclusive remarks on p. 27,

*"We are confident that no data was fabricated and that we have seen all the data."*

We understand that the Practice Committee finds that the Expert Panel's report contains information that could indicate that the authors of the Article have omitted data thus making the research result misleading. However, the Practice Committee has not specified which data should have been included in the Article, nor have you specified which parts of the Report that support this view. We strongly repudiate that any data has been omitted which could make the research result misleading or "*that undermined the conclusions of their paper*".

The Expert Panel decisively states that there is no research misconduct in connection with the Article. However, you have not identified information that pro-

vides a reasonable basis for deviating from the conclusions and recommendations from the Expert Panel to you.

The basis for your preliminary decision is two isolated sentences in the Report, “*using criteria whose application was partly subjective*” and “*in conclusions that did not adequately capture the variability of outcomes*”.

We would like to emphasize that these two sentences are drawn from the first of the experts’ conclusions which in its entirety states,

*“The presented data do, for the most part, represent the outcome of the experiments: the authors have exercised scientific judgement in selecting which data to share using criteria whose application was partially subjective. Although data selection did, in our view, result in conclusions that did not adequately capture the variability of outcomes, the excluded data did not undermine the paper’s main conclusions.”*

In this instance, it is important to note that the experts also state in the same sentence, “*The presented data do, for the most part, represent the outcome of the experiments.*” and “*The excluded data did not undermine the paper’s main conclusions.*”

The selection of data is, in the view of the Authors, when working in this field, based on a judgment call from the involved scientists. I wish to direct your attention to the judgment calls in respect of data selection made by the Expert Panel in the Report:

(p. 4)

*“After reexamining all available data and using our independent judgement to classify data sets, we found that out of sixty measured devices from multiple wire batches, fifteen had successful NIS tunneling spectroscopy, and of these, seven exhibited evidence of Majorana physics.”*

(p. 22)

*“It is unfortunately impossible to reinstate that state of mind of the involved experts two to three years after the review process. Therefore, the judgement of the importance of conflicting details in the paper becomes a subjective matter. Nevertheless, the panel has considered some of the conflicting matters in the manuscript.”*

(p. 28)

*"We acknowledge that data selection is problematical in this paper, as in many studies of nano-electronic devices, because of their exquisite sensitivity to atomic scale disorder."*

The Authors agree with the Expert Panel's view that the matter of how an experiment is conducted and reported is necessarily subjective. In the current context, the Article reports the discovery of an important new signature of Majorana physics in a new type of device. The Authors then showed that the feature was consistent with a theoretical model developed in response to the observation. The Authors reproduced the effect a reasonable number of times to convince themselves it was not a one-off occurrence, that number being a judgement call. There is no established standard for this. To test the emerging interpretation, the Authors then examined the phenomenon in various other situations, including using other wire batches covering a wide range of parameters. The Authors then reported the effect, claiming only that it can occur, with the theory showing that it should only be present in a limited range of parameters around where the working devices were, along with an instance where the effect does not occur.

One can ask, if a particular wire batch does not show the new effect when it is not expected theoretically to (as in Fig. S7), is that counted as a success? The Expert Panel comments (p. 21) that the absence of features in different wire batches could reasonably be interpreted as a confirmation. How to report such outcomes is necessarily subjective. The Authors' choice of which of the 11,000 data sets to present in the paper to illustrate the newly discovered effect is also necessarily subjective.

The Expert Panel notes instances where they would have made different choices in presenting the variety of outcomes, while clearly indicating that the Authors' necessarily subjective choices were within community standards and did not cast doubt on the conclusions.

In the interest of clarity, and to ensure that the Authors precisely know the foundation for the Committee's concern, we kindly **request** that the Committee

precisely identifies the sections in the Report stating that the Article is scientifically misleading, cf. section 3(1), no. 3, of the Act.

When understanding the intention of the experts, we find it to be of particular interest that they have further stated, p. 27,

*"We have examined all that data and its analysis and have concluded that the experimental and scientific findings were not grossly misrepresented in the Science publication. We are confident that no data was fabricated, and we have seen all the data.*

.....

*The MZM success statistics are not quite as compelling in our independent reexamination of the full data set as suggested in the Science paper, but still consistent with theory. (p27)*

.....

*In this sense, this Science paper does not differ from many others that we encounter in the nanoscience field and in science more generally. (p. 28)*

.....

*Within this familiar landscape that surrounds our daily work as scientists, we judge that Vaitiekėnas et al. have not crossed the line that separates scientific discourse and debate from scientific misconduct." (p. 28)*

In respect of the issue regarding the devices made available to the Expert Panel but not to the editors of Science, the panel discusses this issue on p. 20-22. From this discussion, chapter 3.B.2 "NIS devices not uploaded on Zenodo after the request of the scientific editor, but made available to the panel", we note:

The experts discuss the significance of the data from the excluded devices. It is important to note the following statements in the Report,

*"The panel found that the majority of these additional devices did not "work", meaning that they did not satisfy the criterion of good tunneling regime, and were therefore discarded.*

.....

*The panel agrees with the authors that these failed and inconclusive experiments, which were not discussed explicitly, do not weaken conclusions based on the behavior of the samples with sound tunneling characteristics." (p. 20)*

The experts then continue that they also found devices that displayed good tunneling characteristics, data from which was not accounted for in the Article because it was not the focus of the Article. In respect of these devices, the Expert Panel concludes (p. 21),

*“The panel believes that the fact that devices with good tunneling characteristics from entire batches fail to display the zero bias peak is not per se an invalidation of the idea that topological superconductivity is possible in core-shell nanowires. Rather, the panel views this as confirmation of the theoretical result of the paper, which predicts a complex topological phase diagram in its wire-parameter model space, as summarized in Fig. 4 D of the paper, reproduced below.”*

This statement from the Expert Panel is of crucial importance as it states that the data not made available to the public actually supports the Authors theoretical result- directly contrary to the unfounded accusation by Yeston, Frolov and Mourik *“the authors unethically with-held data that undermined the conclusions of their paper.”*

The main conclusion of the Article, stated in the introduction and conclusion, was that this discovered phenomenon can occur. Once discovered and observed repeatedly, measurements on other wire batches should not be regarded as contributing to “unsuccessful” statistics. They in no way can invalidate the discovery.

However, when reviewing the Report in its entirety, it is the opinion of the Authors that the Report is only mildly critical of the data selection method used by the Authors when writing the Article. This is emphasized by the experts’ recommendations (p. 28),

- *“A statement explaining the set of criteria used to select acceptable nanowire devices, and a statistical summary of the success rate for growth and fabrication of devices deemed acceptable by these criteria, should be appended to the Vaitiekėnas et.al. paper as a note added. The number of NIS devices that did not have successful tunneling spectroscopy should be stated, along with the number of devices with successful tunneling spectroscopy exhibiting ZBPs in the LP1 lobe and the number not exhibiting the*

ZBPs.

- *The full set (25+56) of Coulomb blockade data files be uploaded to Zenodo, along with the descriptive table explaining why some datasets were excluded and the 2023 analysis."*

These recommendations capture the essence of the Expert Panel's critical remarks in respect of the Article.

We urge the Practice Committee to consider whether these recommendations would be appropriate to rectify the situation if the Expert Panel had found that the Authors have exercised scientific misconduct.

In the other chapters of the Report, the issue is not whether the scientific data and scientific conclusions were based on falsified research material as it is clearly not. This issue is really a matter of whether the number of unsuccessful devices should have been reported and, as the Authors have repeatedly stated, they are in agreement with the experts that they should now have reported the number of unsuccessful devices. However, it must be reiterated that the main conclusions of the Article are not questioned by the experts, and therefore there is no case of research misconduct in this matter.

Reference is made to the experts' conclusive general remarks (p. 28):

*"In high impact journals, papers are often written in a manner that provides an account of the experiments that is both polished and optimistic. A positive tone is natural in papers describing work that is regarded as groundbreaking by its authors. In this sense, this Science paper does not differ from many others that we encounter in the nanoscience field and in science more generally. The tendency of enthusiastic authors to have inflated expectations is perhaps as much a part of the normal scientific process as the tendency of readers and referees to be skeptical and ever alert to errors in logic or judgment. Within this familiar landscape that surrounds our daily work as scientists, we judge that Vaitiekėnas et al. have not crossed the line that separates scientific discourse and debate from scientific misconduct."*

Finally, I wish to point out to the Committee that the Authors have not breached any of the recommendations in respect of responsible research stated in the Code of Conduct for Responsible Research, University of Copenhagen, 13

June 2018, nor the European Code of Conduct for Research Integrity March 2011, or the Danish Code of Conduct for Research Integrity November 2014.

These codes do not prescribe in detail the requirements for uploading background data on research when publishing research results, cf. below under 4.

The Report has totally dismissed Yeston's, Frolov's and Mourik's unfounded accusation that the dataset behind the Article, if made available, significantly undermines the support for the scientific conclusions in the Article.

In this inquiry about questionable research practices, we believe the conduct of the Authors in connection with this paper is neither misconduct nor questionable practice, but rather a matter of judgment, and to this end the Authors urge the Practice Committee to conclude that in this matter the best interests of science and of the University would be best served by having the Authors implement the recommendations of the Expert Panel and then closing this matter with such a finding.

Finally we wish to point out to you that the charges brought forward by Yeston, Frolov and Mourik, in the complaint p. 2:

*With respect to data as shown in Figure 2, multiple statements throughout the paper are irreproducible or misleading. These statements concern both the description of the data, as well as the interpretation of the data as relevant to 'flux-induced topological superconductivity' - the topic of the paper. Thus the core conclusions of the paper are invalidated. We do not see how this paper can remain in the present form, nor how the problem can be addressed by publishing any form of clarification such as a correction.*

is not true and has twice been repudiated by the most outstanding peers in the field.

#### **4. UPLOADING OF DATA ON ZENODO**

- 4.1. In the autumn of 2020, the Authors had a longer correspondence with the editor, Jelena Stajic, from Science, regarding the uploading of data on the Zenodo Repository. During this correspondence, the parties agreed to which extent the

data should be uploaded to the Zenodo archive. At this point in time, the editors of Science did not express any desire to have any further data uploaded to the Zenodo archive other than what had been agreed. I attach the correspondence regarding this issue as Exhibit 1.

In respect of the uploaded data the experts state, p. 13,

*"The data released on Zenodo at the request of the responsible Science editor included results from measurements over a wider gate range than shown in the article. Figure 9 and Figure 10 above, displaying slides 53 and 55 from the authors' "summary.pdf" file uploaded on Zenodo, display differential conductance over 1 and 2 V gate voltage ranges respectively, much larger than the 0.4 V range of the article's Figs. 2C and 2.....Since the high bias conductance over the wider voltage range is of the same order as in the narrower regime displayed in the main figure, one wonders why this region, which was not shown in the paper, was apparently deemed by the authors to be outside their "tunneling regime".*

*In discussions with the authors, the panel dug into their operational definition of "tunneling regime", and the protocol used to identify whether or not a specific device was in this regime at a specific back gate voltage*

.....

*In the judgment of the committee the authors' criteria for a proper tunneling regime make physical sense."*

The Danish Code of Conduct for Research Integrity, 2014, states regarding researchers' obligations in respect of storing data,

*"i. **Researchers** are responsible for storing their primary materials and data.*

*ii. **Researchers** are – unless otherwise regulated – responsible for deciding the extent to and duration for which primary material is to be retained. When deciding this, **researchers** should consider the value of the primary materials for assessing the results of the research and the physical and technical possibility of storage at the institution."*

The Danish Code of Conduct for Research Integrity, 2014, offers these definitions,

*"Primary material is any material (e.g. biological material, notes, interviews, texts and literature, digital raw data, recordings, etc.) that forms the basis of the research.*

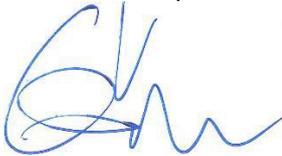
*Data are detailed records of the primary materials that comprise the basis for the analysis that generates the results."*

The Authors are well within the rules regarding making data available to colleagues.

**5. FURTHER STEPS IN CASE 77**

- 5.1. I will, in a separate letter, address the issues regarding Case 77 which we understand the Practice Committee will keep pending until a decision has been made in Case 74.

Yours sincerely



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Lars Kjeldsen