

Subject: Plasma Science and Technology – Decision on Manuscript ID PST-2023-0199

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Date: 28/07/2023, 4:04

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28-Jul-2023

Dear Dr. Micozzi:

Thank you for your submission!

Manuscript ID PST-2023-0199 entitled "Final results of the first phase of the PROTO-SPHERA experiment: obtainment of the full current stable Screw Pinch and first evidences of the jet + torus combined plasma configuration" which you submitted to the Plasma Science and Technology, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter.

The reviewer(s) have recommended that you make some minor revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s)' comments and revise your manuscript.

To revise your manuscript, log into <https://mc03.manuscriptcentral.com/pst> and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision.

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Once again, thank you for submitting your manuscript to the Plasma Science and Technology and I look forward to receiving your revision.

Sincerely yours,
 Editor: Dr. Cheng Yang
 Editorial Office of Plasma Science and Technology
yangc@ipp.ac.cn

Reviewer(s)' Comments to Author:

Reviewer: 1

Comments to the Author

In this manuscript, the authors successfully obtained a 1 sec lasting plasma centerpost at full plasma current and therefore a stationary plasma confining torus in the PROTO-SPHERA machine during its phase-1 operation. This work provides new insights into the sustainment of the innovative “jet + torus” plasma configuration by preventing the unwanted spurious plasma current path. The manuscript is well-organized and clearly stated. I would suggest accepting it after the following minor concerns are addressed.

General:

1. Some words/phrases are used incorrectly: 1). “i.e.” should be “i.e.,”; 2). The first letter of terms including argon, hydrogen and aluminium need not be capitalized.

Other Comments:

1. Page 3, “...but also the the air rings that are created and supported underwater by playful cetaceans [10] ...”.

The word “the” is repeated.

2. Page 6, “...reaching a total eighth of 2.5 m...”.

The word “eighth” should be “height”?

3. Page 7, Figure 2, “...(b) The 4 PExt coils (green-blue) wound around the vacuum vessel and...”.

The word “PExt” should be “PFExt”.

4. Page 12, Figure 6.

The illustration is so blurred.

5. Page 14, “...the Argon plasma centerpost current could not yet overcome the current $IPC=3.5$ kA (the target current being $IPC=10$ kA) ...”.

What does the “IPC” mean? Maybe the “ICP”?

6. Page 14, Figure 9, “...(a) Waveforms of Argon centerpost plasma current, evidencing a slow decrease of plasma centerpost current $I_{e...}$ ”.

What is the difference between the “ICP” and the “ I_e ”?

7. Page 16, Figure 12 (a).

One can not distinguish the traces between “Hall” and “RG_PF2_I” in Figure 12(a).

8. Page 17, “...The E_{PB} drift of the plasma...”.

What does the “ E_{PB} ” mean? $E \times B$?

9. Page 19, “...if the rotational transform of the plasma centerpost (from anode to cathode) was lower than...which roughly corresponds to $ICP > 8$ kA...”.

1). The rotational transform of the plasma centerpost should be lower than a certain value rather than a simple relation. 2). What is the relationship between the rotational transform and plasma current ICP? The authors need to provide a brief explanation.

10. Page 19, Figure 14.

The illustrations need to be re-labelled; it is not possible to distinguish the illustrations between c) and d).

Reviewer: 2

Comments to the Author

The manuscript 'Final results of the first phase of the PROTO-SPHERA experiment: obtainment of the full current stable Screw Pinch and first evidences of the jet + torus combined plasma configuration' by Micozzi et al. describes an alternative fusion concept and its development. There are not many new innovative concepts for fusion, and it is particularly rare that they are realized. Experiments like PROTO-SPHERA expand our understanding of magnetic confinement. Since the main directions in this research are first the tokamak and second the stellarator, such innovative concepts have few resources and therefore the progress described in this paper cannot be compared to those. The authors show the obstacles that had to be overcome on the way to create a first free-standing torus. This is important to go further in this direction. Overall, I find the work interesting and I think the readers in Plasma Science and Technology could also enjoy some variety. This can be a very nice publication.

There are a few minor points to improve the readability

page 5: dubbed CP → dubbed center post (CP)

dubbed ST → dubbed spherical torus (ST)

page 6: The PFInt-B group are on top PF2, PF3, PF4.1, PF4.2 and on bottom PF2, PF3.1, PF4.1, PF4.2, is this correct?

Why there is PF3 and PF3.1 ?

page 7: 'Later (2018), in order to attempt the formation of the first confined tori, four magnetic vertical field coils, the PFExt coils...' Why are these vertical field coils important? Are they like in the tokamak to radially constrain the torus? How large must the magnetic field be?

Figure 9a would benefit from a better resolution

page 16: what is the edge? at which radial distance has been measured, inside the torus? The image quality of Fig. 12 is poor. The legend cannot be read.

page 18: On the predictive equilibrium calculation: Is there a reference to the code? Is this ideal or resistive MHD?

page 18: exhibiting two circles of of ordinary -> exhibiting two circles of ordinary

page 19 How do you calculate $i_{\text{ota_bar}}$?

—Attachments:

The Comments to PROTO-SPHERA_experiment_submisson.pdf

53.4 kB