

Response to the referee 1

Comments:

This is a very well written manuscript with very detailed methods and results, as well as supporting figures and diagrams. The reported work can be reproduced in some extent and I believe it is one of the goals of this manuscript, since these same authors have published in the past open-source blue-prints for other Xe-129 polarizers. The results are very interesting and definitely can advance the field of hyperpolarized Xe-129 gas magnetic resonance imaging. This reviewer has only a handful of minor changes that I believe will improve the manuscript and makes it easier to read.

Authors' Response: We thank the reviewer for his/her enthusiasm regarding our manuscript. We thank the reviewer for the comments/suggestions as they certainly improve the manuscript quality.

Abstract:

- State the gas mixture used (50% Xe-129 + 50% N₂), as per figure 1 and on page 17. It's only mentioned in the abstract 50% Xe fraction but at this point of the manuscript it's difficult to tell which other gas(es) make the other 50%.

Authors' Response: We agree.

Changes made to manuscript: We provided the requested information in the abstract as suggested by the reviewer.

- State the source of Xe-129 and N₂ (vendor, etc).

Authors' Response: We agree.

Changes made to manuscript: We provided the requested information in the Abstract (briefly) and the Methods (full details) section as suggested by the reviewer.

- State the percent enrichment of the Xe-129 gas or if its natural abundance (26%).

Authors' Response: We agree.

Changes made to manuscript: We provided the requested information in the Abstract and Methods section as suggested by the reviewer.

- State the volume of the SEOP cell.

Authors' Response: We agree that this information is needed. The SEOP cell volume is provided in Section 2.2.

Changes made to manuscript: We additionally provided this information in the abstract.

Introduction:

- When you mentioned that you did 700 SEOP cell refills, please clarify if the refills were partial or you emptied the cell completely before refilling it.

Authors' Response: We agree.

Changes made to manuscript: We provided the requested information in the Introduction section as suggested by the reviewer.

Materials & Methods:

- Figure 1D – It's difficult to understand the blue and green circles with different numbers inside, what do the different numbers represent? It seems that an "x" before the number represents a closed valve, but it's not clear what an "10", "11", "7" or "6" represent. Please explain in the legend.

Authors' Response: We agree.

Changes made to manuscript: We provided the requested information in the Introduction section as suggested by the reviewer in the Figure 1 caption. Note this information is need to understand Figure 5.

- Section 2.2 SEOP Cell Design – Please state the type of glass used for the SEOP cell. Did you use pyrex, aluminum-silicate or other type of glass?

Authors' Response: We agree. The cell is made of Pyrex.

Changes made to manuscript: We provided the requested information in the Methods section.

Conclusions:

- I understand this manuscript is about the 3rd generation Xe polarizer, its design and performance, but it would be interesting and would enhance this manuscript if you could show a Xe-129 MR image obtained with this gas, to demonstrate the high polarizations that you can achieve.

Authors' Response: We completely agree with the overall idea. However, due to COVID-19, we could not finish the installation of our MRI scanner to image Xe-129; as a result, it is impossible for us to image it at the moment or in the next two months.

Changes made to manuscript: None.

- It would help the field and enhance this manuscript if you make the Matlab control scripts available online and place the web link at the end of the manuscript, under the “associated content”.

Authors' Response: We completely agree. The code was actually fully shared in Ref. 67. We realize that it was not sufficiently clear to the reader.

Changes made to manuscript: We clarified in the Methods that the MATLAB code is already open-source and fully available.