

Review report of “On mechanisms for HF pump-enhanced optical emissions at 557.7 and 630.0 nm from atomic oxygen in the high-latitude F-region ionosphere” by Leyser et al.

The main goal of this paper is to present the effects of HF pump-enhanced on optical emissions at 557.7 and 630.0 nm from atomic oxygen. The concept and analysis are sound and their results are important to the scientific community. However, the manuscript needs some improvements in order to clarify some point. Thus, I have some comments as follows:

Major Comments:

1. Just showing the results of only the effects of the pump-enhancement make it a bit difficult to follow. So I suggest the authors to include a control case, i.e., a case without pump-enhancement for all related results. In so doing the reader can see the visual differences between the ideal case and the enhanced case, thereby further clarifying the concept of the paper.
2. The introduction of the work is well written. However, it lacks the objective of the study, which obviously will give rise to the novelty of the work. I therefore suggest the authors clearly state the objectives of the work and the novelty of the research and how different this current work is from previous works. Therefore, the introduction and the conclusion should be updated.
3. I expect some information on the instruments to be given in the experimental setup section. It should not be assumed that the readers already know about the subject. Therefore, I encourage the authors to give a brief description of the instruments.

Minor Comments:

1. Introduction

Line 15-16: Why limiting the frequency f_o to below or near the ionospheric critical frequency and with left-handed circular polarization? Besides the strongest effects obtained from these two consideration, are there other benefits?

Line 102-104: The emission intensity did not weaken as f_o was decreased at about 16:50 UT. The images from the Kiruna site show even an increase in the emissions as f_o was decreased, despite a lower ERP. But again the altitude region of the emissions decreased as f_o was lowered.

Question: Are there any physical explanation to the characteristics of increasing emission but decreasing altitude with decreased f_o ?

2. Experiment setup

Kindly include instrumentation.

3. Experimental results

Line 115: Please remove “.” after “which” “..... , which. is

Line 115: Please add “of” between that and the in that the excitation

Note: I will suggest the entire sentence between Line 115 and 116 be rephrase.

4. Emission growth times

Line 144: Change “Further” to “Furthermore”

Line 168: Change “b oth” to “both”.

5. Discussion

Line 269: With $f_0 \lesssim 4f_e$. to With $f_0 \lesssim 4f_e$ (remove “.”)

6. Conclusion

Lines 320-321: Kindly rephrase this sentence: “This is consistent with that the O(¹D) state is excited mainly by electron heating”.

I suggest the authors give a look at the conclusion and rephrase some sentences for clarity.