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This manuscript has been previously reviewed at another Nature Portfolio journal. This document only contains reviewer comments and rebuttal letters for versions considered at Communications Physics.

REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

My original review was positive with suggestions of a few modifications. The authors have satisfactorily addressed my concerns and therefore I unreservedly recommend this manuscript for publication.

Reviewer #2 (Remarks to the Author):

I will not repeat my previous comments about the subject and achievements reported in the paper.

I think the paper has been improved by the changes made in response to all the reviewers' comments. I do not have any remaining major issues but I do have some small suggestions that the authors should consider before submitting a final version for publication:

1. I don't know what "fascinated transition targets" means. The authors should re-express this to make its meaning clear
2. Throughout the paper it refers to "pulse laser" but it should always be "pulsed laser"
3. I asked for the unit cm^{-1} to be defined in SI units. The authors have given a statement of what it means but not a definition in SI units. It is essential that they include the equivalence of 1 cm^{-1} to 30 GHz in some way. I would prefer a simple statement along the lines of " 1 cm^{-1} is equivalent to a frequency of 30 GHz". I don't really see why they are using wavenumbers at all, since their results for A and B are given in GHz anyway. But I think it's OK so long as a definition in SI units is given.
4. It still says "hyperfine structures" in many places where "hyperfine structure" would be better. In particular, on page 1, "...which has no hyperfine structure, ..." would be an improvement.
5. The wavelength of the laser is only given in the figure. I think it is important that where the laser parameters are given (page 4) the wavelength is also given (in nm).
6. At the bottom of page 5 it says "essential important" and this should be corrected.

Otherwise I am happy with the revised version and I think it is suitable for this journal.

Dear reviewers,

We would like to thank you for your review and valuable comments, including at the previous journal stage. We are pleased to receive the positive opinion for publication in Communication Physics.

In order to make the revisions easier to identify, a PDF file is attached together with the revised manuscript, showing the changes in **blue**. In the attached file, other corrections requested by the editors are also shown in **magenta**.

In the following, we answer reviewer#2's comments one by one.

Comment: Reviewer #2 -1

1. I don't know what "fascinated transition targets" means. The authors should re-express this to make its meaning clear

Answer #2 -1

We revised the sentence as follows:

“For further HCI atomic clock development employing fascinated transitions highly sensitive to the α variation [15], it is necessary to gain a better understanding of hyperfine structure in many-electron heavy HCIs with a nuclear spin.”

Comment: Reviewer #2 -2

Throughout the paper it refers to "pulse laser" but it should always be "pulsed laser"

Answer #2 -2

They have been corrected.

Comment: Reviewer #2 -3

I asked for the unit cm^{-1} to be defined in SI units. The authors have given a statement of what it means but not a definition in SI units. It is essential that they include the equivalence of 1 cm^{-1} to 30 GHz in some way. I would prefer a simple statement along the lines of "(1 cm^{-1} is equivalent to a frequency of 30 GHz)". I don't really see why they are using wavenumbers at all, since their results for A and B are given in GHz anyway. But I think it's OK so long as a definition in SI units is given.

Answer #2 -3

We revised the sentence as follows:

“(1 cm⁻¹ = 2.99792 × 10¹⁰ Hz)”

Comment: Reviewer #2 -4

It still says "hyperfine structures" in many places where "hyperfine structure" would be better. In particular, on page 1, "...which has no hyperfine structure, ..." would be an improvement.

Answer #2 -4

They have been corrected.

Comment: Reviewer #2 -5

The wavelength of the laser is only given in the figure. I think it is important that where the laser parameters are given (page 4) the wavelength is also given (in nm).

Answer #2 -5

We added the laser wavelength information on page4.

Comment: Reviewer #2 -6

At the bottom of page 5 it says "essential important" and this should be corrected.

Answer #2 -6

We revise the sentence as follows: “essentially important”.

We believe that we have addressed the comments and are confident that the revised manuscript is acceptable for publication in Communications Physics.

Sincerely yours,

On behalf of all authors,

Naoki Kimura