Open Review

( ) I would not like to sign my review report

(x) I would like to sign my review report

English language and style

( ) Extensive editing of English language and style required

( ) Moderate English changes required

( ) English language and style are fine/minor spell check required

(x) I don't feel qualified to judge about the English language and style

	Yes	Can be improved	Must be improved	Not applicable
Does the introduction provide sufficient background and include all relevant references?	(x)	( )	( )	( )
Are all the cited references relevant to the research?	(x)	( )	( )	( )
Is the research design appropriate?	(x)	( )	( )	( )
Are the methods adequately described?	(x)	( )	( )	( )
Are the results clearly presented?	( )	(x)	( )	( )
Are the conclusions supported by the results?	(x)	( )	( )	( )

Comments and Suggestions for Authors

I find this paper very interesting, and I find the final discussion about the origin of life based on the remark that repetition makes easier the invention of life very attractive.

Reply: We sincerely thank the reviewer for this comment and appreciation.

However, having devoted a part of my research work on the use of Kolmogorov concept of complexity, I have doubts on the part of the paper devoted to the detection of extraterrestrial life. The authors use the example of the message

ACXLGICXGOXEMZBRCNKXACXLPICXEMZBRCNKX.

They notice that EMZBRCNKX appears twice. Which is the probability that a combination of 9 letters appears twice in a sequence 37 characters? Yes, I imagine that it is very small. However,

which is the source of this message? If the message is only one, it is not difficult to guess that there is intelligence behind him. What about the case when there is a virtually infinite number of messages of the same length? In that case also this message may be the result of randomness. I invite the authors to make comments on this issue.

Reply: Thank the reviewer very much for this comment, and this is a critical point indeed. If this message only appears once, we would consider it as an isolated system and calculate/analyze its own ladderpath, and then conclude the possibility of intelligence/life. We can see that the reviewer would agree with us on this point.

But, as for the question raised by the reviewer, what about there is a virtually infinite number of messages of the same length? In this case, we have to consider this message and all of the other messages we have received as a united/non-isolated system, and then we need to analyze the ladderpath of the whole united system (whose size-index is evidently very high). If in the end we found that EMZBRCNKX is the only substring that has been repeated, the ladderpath-index would be very close to the size-index (both very high) and the order-index very low, and then we would conclude that it's just due to randomness (because only when both the ladderpath-index and order-index are high, the possibility of intelligence/life would be high, as we discussed in Section 2.5 and Appendix E). We discussed this aspect about isolated and non-isolated/united system in Section 4.1 and 4.2 in details.

But note that if we only received this message once and didn't receive any other message (even if there could be an infinite number of messages in principle), we have to accept the fact that we can only consider this message alone as an isolated system, which may lead to a wrong or over-extrapolated conclusion (so extra evidence may be needed, e.g., as said by the reviewer, what is the source). To emphasize the reviewer's question, we added a paragraph sentences in Section 4.2.

The authors conclude their manuscript stressing that much more work is necessary to establish a connection between their tinkering approach and the widely accepted conviction that life involve negentropy. I like these comments.

I am inclined to recommend this paper for publication with the invitation to make some improvements. In addition to the above illustrated doubt, I have to say that I find not easy to follow their Sections 2.2 and 2.3. However, I imagine that that the readers interested in using their method will be able to apply their prescription.

Reply: Thank the reviewer very much for this comment and appreciation. We were trying to introduce our approach from scratch, so, Section 2.2 and 2.3 indeed involve quite a few definitions and operations. To address the reviewer's concern and make things easier, we added a new appendix section Appendix B for more examples to illustrate how to construct a ladderpath of a target block, by strictly following the rules elaborated in Section 2.2 and 2.3.

In section 2.7, we elaborated an algorithm to calculate the ladderpath (with detailed examples in Appendix D), and we also provided an open sourced Python code to calculate the shortest ladderpath of a target block (or a target system in general). This code can handle short strings within

a reasonably short time (the more efficient algorithm with approximation and optimization will be provided in a forthcoming paper). The readers could use it to check if their calculation by hand is correct. We hope the definitions and descriptions in Section 2.2, 2.3 (with examples in Appendix B that is newly added), and the description of the algorithm and the open sourced code in Section 2.7 (with examples in Appendix D) could help the readers comprehend the concept of ladderpath.

Thanks again for your time.