Thank you for your report on AT12445

pra@aps.org <pra@aps.org>   Mon, Jul 29, 2024 at 6:45 PM
To: jenca@mat.savba.sk

Here is a copy of your report which you recently submitted via our web server:

Please do not worry if the formatting looks awry; fixed width fonts are required.

Referee: 943792 Dr. Anna Jencova
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MsCode: AT12445
Date: 29Jul2024

Enough significant new results? No
Sound and not misleading?   Yes
Well organized, clear?   Yes
Subject matter appropriate?   Yes
Length appropriate?   Yes

Quality of research: Average
Quality of presentation: Good

Recommendation:
   Do not publish; see report.

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begin_report

This paper introduces and studies some notions of incompatibility of sets of
quantum measurements, capturing the property that the measurements in the set
remain incompatible even after undergoing some classical transformations.
Namely, these transformations are coarse grainings and some specific convex
mixtures combined with permutations of the outcomes. Noise robustness of such
properties is considered and some operational witnesses are proposed,
both device independent and semi-device independent.

The introduced variants of incompatibility properties are quite natural and as
far as I know where not studied before in this form. A similar notion appearing
in the literature is incompatibility of some subsets of the given set of
measurements. The incompatibility w.r. to convex mixtures introduced here is a
generalization thereof. So the topic of the paper is timely and of interest.

Unfortunately, in my opinion, there is not much information gained about the
introduced notions. Already the choice of the two types of classical operations
is not sufficiently explained. As for the coarse grainings, it is clear that the
set of measurements with the specified property remains incompatible even if
some measurement outcomes are not distinguished, which is a good robustness
property to have. But one can think of other choices of post-processings of the
measurements. Similarly, one could consider more general convex mixtures of the
measurements, not just given by partitions of the measurement set. I think the
authors should include more comments about these choices.

For the defined notions, there are some rather trivial observations and partial
results in special cases or for specific examples, such as qubit measurements or
MUBs, but these are obtained by standard methods and it is not clear what
conclusion the reader is to make. For example, concerning the noise robustness,
two tables of results obtained by SDP for 3- and 4-dimensional MUBs are

presented, but no discussion or interpretation of these values is given. The operational witnesses suggested here are based on well known results for Bell experiments or RACs. Their applicability to the present notions is an interesting (albeit easy) observation made here, but the investigation of their performance is very limited. In any case, I do not think it is justified to write that "...we have developed a method of operationally witness different levels of measurement incompatibility...." as the authors claim in the concluding section.

In conclusion, the authors introduced interesting notions of incompatibility for a set of measurements, but their analysis of these notions is not yet sufficient for publication.

end_report

Comments for the Editors: