

We are very grateful to the referees for his/her pertinent comments and useful suggestions which indeed help us to improve the quality of our paper. According to referees' suggestions, we have revised our manuscript.

# **1 *Reply to Referee***

## **1.1 *Reply to Reviewer 1***

We thank referee for his/her helpful remarks.

**Question:** The Authors' use of the term "experimental" seems misleading; as far as I could see, they merely performed "computer experiments." There are also many typos.

**Our reply:** Our work is real NMR experiments similar to [ *New. J. Phys.* **10**, 033020 (2008) ], but not "computer experiments". In [ *New. J. Phys.* **10**, 033020 (2008)], Souza *et al* implemented an experiment to simulate the violation of CHSH inequality in a 2-qubit NMR system. And we implemented such a simulation in 3-qubit NMR system. The difference is Souza *et al* only implemented on 2-qubit Bell state, but we carried out the simulation of two different Bell-type inequalities for nonmaximal entangled states (3-qubit entangled states). Our experimental data were shown by the blue squares in Fig.3 and Fig.4 in the text.

As to typos, we apologized to make you misread caused by them. We have tried our best to revise the typos of our manuscript and make it more easily read. Furthermore, we also found a native English speaker to check our manuscript.

## **1.2 *Reply to Reviewer 2***

We thank referee considered that our work is certainly worthwhile and appears to have been successful. Furthermore, We also appreciate referee for his/her helpful remarks which make us avoid some confusion. We give the explanations about referee's questions.

[1]. **Question:** The main confusion for me arises from the usage of "simulation" both in the title and content of the paper. Is the inequality violated or not? Is it only a simulation?

Or is this word used because the state is highly mixed? Or is it used because there can be no violation of Local Realism in the experiment?

**Our reply:** Our work is real NMR experiments to simulate the violation of Bell-type inequalities similar to [ *New. J. Phys.* **10**, 033020 (2008)]. As mentioned in [ *New. J. Phys.* **10**, 033020 (2008)], the reason that we used the word “simulation” is that these experiments were carried out in NMR system. The initial state in NMR is prepared from the thermal equilibrium into a highly mixed state called pseudo-pure state (PPS)[Proc. R. Soc. Lond. A **454**, 447 (1998)]

$$\rho_{pps} = \frac{(1 - \varepsilon)}{2^n} I_{2^n} + \varepsilon |\psi\rangle \langle \psi|, \quad (1)$$

where  $\varepsilon \approx 10^{-5}$  is the polarization at room temperature. Braunstein *et al* [ *Phys. Rev. Lett.* **83**, 1054 (1999)] pointed out that any state of the form (1) is not entangled whenever  $\varepsilon \leq \frac{1}{(1+2^{2n-1})}$ . However, with respect to scale-independent NMR observations and unitary evolution, a pseudopure state is equivalent to the corresponding pure state [quant-ph/0207172 (2002) ]. NMR is only sensible for the deviation part of (1), which behaves like a “pure entangled state”. Hence, NMR experiment can still exhibit quantum properties. Although NMR system is local, it really implement a simulation of the violation of Bell-type can inequalities, Souza *et al* have simulated the violation of 2-qubit CHSH inequality on NMR [ *New. J. Phys.* **10**, 033020 (2008)]. At the same time, as to distinguish from the true experiment of exhibiting non-local effects, such as in quantum optics *et al*, we use the word “simulation”.

[2]. **Question:** These latter two questions also seem to be intermixed in the conclusions; it is unclear, to say the least. The mixed part has in principle nothing to do with the question of local realism, it is quite a different issue. Many of the conclusions at the end are questionable and not supported by theory or experiment in the rest of the paper.

**Our reply:** The referee’s view, “The mixed part has in principle nothing to do with the question of local realism”, is correct. We realized our conclusion, “ That is to say, our results are also consistent with the classical theory, depending on whether we have considered the mixed part  $I_{2^n}$ ”, is not strict. In order to avoid misunderstanding and make the conclusion

clear, we delete this sentence .

[3]. **Question:** The inequalities need to be better specified: what does the comma stand for in  $E(A1,B2,C2)$  (equation (2) and others)? Multiplication? Usually these entities are expectation values of a product of experimental outcomes, but this is completely unclear in the present paper.

**Our reply:** Following the referee's suggestion, we give a clear specified about inequalities in the revised text.

[4]. **Question:** There are other things that are unclear, like what "several sets of observers" signify just below equation (7). Or what "sorts of unexpected properties" have been found recently at the start of section III. There are also lots of language errors of different kinds.

**Our reply:** We have tried our best to revise the language errors of our manuscript and make it more easily read. Such as, we replaced the sentence below Eq.(8) " We took several sets of observers to do..." as " We took the observers mentioned above ( $\sigma_{n_1}, \sigma_{n_2}$ ) to do... ". Another example, the sentence " Recently, sorts of unexpected properties about non-maximal entangled states have been shown " has been replaced as " Recently, much work about non-maximal entangled states has been done ".

We have also changed many sentences and words to conform to the need of document in the journal pages.

## 2 *List of the Changes*

[1]. We added the equation  $E(A_i, B_j, C_k) = \langle A_i B_j C_k \rangle_{avg}$  above the original Eq.(2) in section II.

[2]. We replaced the sentence below Eq.(8) " We took several sets of observers to do..." as " We took the observers mentioned above ( $\sigma_{n_1}, \sigma_{n_2}$ ) to do... ".

[3]. In the beginning of Section III, the sentence " Recently, sorts of unexpected properties about non-maximal entangled states have been shown " has replaced as " Recently,

much work about non-maximal entangled states have been done ”.

[4]. In the second paragraph of Section V, the sentence “ That is to say, our results are also consistent with the classical theory, depending on whether we have considered the mixed part  $I_{2^n}$  ” was deleted.

[5] . In the end of second paragraph of Section II, we added such sentence “ In other words, the two dichotomic observables allowed to be chosen for A,B,C are  $\sigma_{n_1}$  and  $\sigma_{n_2}$ . ”.

[6] . We have also changed a lot of typos, the style of writing in many sentences and words to conform to the need of document in the journal pages.

We sincerely hope that the revised version will now be acceptable for publication in Physics Letters A.

Sincerely yours,

Ren Changliang