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A2_6 Do not shut down the LHC!

R. Evill, C. Johnson, S. Rolfe, M. Wilson

Department of Physics and Astronomy, University of Leicester, Leicester, LE1 7RH.

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Abstract

An experiment proposed by H. B. Nielson and M. Ninomiya is performed. We used a random number generator to perform their 'card game' proposal, which the respected duo claim should put restrictions on the functionality of the LHC or even shut down the multi-billion pound experiment in the extreme case. We found that their card game conforms to elementary probability theory and thus we conclude that the LHC should continue in its endeavour to further our understanding of some of the most fundamental aspects of nature.

Introduction

Classically, it is easily inferred from the unidirectional path of time that causality is maintained for all events that occur in the universe. That is, an event can only be influenced by events that have occurred prior to it, i.e the cause of an event always lies in its past. H. B. Nielson and M. Ninomiya have suggested however, that reverse causality could in fact be possible, i.e. events from the future, can directly affect events in the present [1]. Further to this, they propose that this may actually be evident in the non-discovery of the Higgs boson [1]. The discovery of the Higgs boson is the ultimate goal of high energy particle physics and the LHC, and would go a long way to verifying the current theory of the Standard Model of Particle Physics. The only previous attempt to construct a particle accelerator with a beam energy high enough thought to enable this discovery (the SSC) was abandoned. Nielson and Ninomiya claim it is possible that this was a result of reverse causality [1]. Essentially, a simplified summary of their theory is that the Higgs boson may actually be preventing its own discovery at the present time through reverse causality.

The experiment

As a proposal to both test their hypothesis and potentially save more money being spent in vain, they suggest that a 'card game' be carried out which involves drawing a random card from a deck where certain cards are allocated with various recommendations for the operation of the LHC [2]. In their proposal, they assign a seemingly arbitrary probability to the various types of cards that represent restrictions to be imposed on the LHC. The extreme case of closure is assigned a probability of 10^{-6} [2]. They are not explicit about the probability of beam energy restriction cards (though they imply some arbitrary probability larger than that for closure) so we assume a probability of 10^{-5}. Through this experiment, they claim their reverse causality hypothesis can be proven if any of the restriction cards are drawn. Our thoughts about reverse causality aside, we performed this experiment.

In order to perform the experiment, we compiled a computer program to act as a random number generator to simulate drawing the cards. We constructed a two-dimensional array consisting of one million squares, where each square was assigned with a specific recommendation for the operation of the LHC. These recommendations were taken directly from Nielson and Ninomiya's paper; 'limit beam energy' and 'close the LHC' were assigned the probabilities outlined previously, and 'use LHC freely' was assigned to all the other cards and thus comprised the remainder of the probability. Two random number generators provided 'x' and 'y' coordinates to define a specific point in the array, which in turn corresponded to a particular card.

The ability to construct a truly random number generator by means of a computer program is perhaps questionable. However, the method used was Park and Miller's 'Minimal Standard' which is widely regarded as producing the most random known results, and is commonly used for many applications which require such a device [3]. This method requires a seed number, which is a programming element required to kickstart the process. The seeds we used for the numerous runs of this experiment were various numbers associated with the LHC (no. of employees, no. of contributing nations, circumference of the accelerator in meters, etc). To try and give as much notice to the Higgs as possible, we made it clear in the program which 'cards' were associated with the restrictions simply by adding comments in the code and printing statements upon execution (prior to generating the numbers).

We performed this experiment a total of twenty million times. That is, we drew a total of twenty million cards. With each set of seeds we ran the program one million times so that in theory every card could be drawn at least once in one run. We point out that we did not record the tally for every card drawn; only card types were tallied. We expected that if reverse causality was occurring in the manner that Nielson and Ninomiya have suggested then the 'close the LHC' card would likely show a tally significantly greater than twenty. This was not the case. Similarly we would have expected the 'limit beam energy' cards to show a tally significantly greater than the probabilistic average. Again this was not the case. A list of results is shown in table 1.

Results

Card/restriction	Tally	Average according to probability
Close the LHC	17	20
Limit beam energy	195	200
Use LHC freely	19999788	19999780

Table 1

The first obvious thing to point out is that the restriction cards were in fact drawn less frequently than even probability suggests. One might argue, with Nielson and Ninomiya's reasoning, that the Higgs boson is actually encouraging our efforts to discover it! However we do not concur to such reasoning. While twenty million runs sounds like a lot, the truth is that these tallies are closer to the average than we expected; this close correlation between the tally and the probability could potentially be due to the limited random capability of the computer program. However we would expect that if the Higgs boson was attempting to favour a restriction card via reverse causality then the restriction cards would be drawn a great deal more over the course of twenty million trials.

Conclusion

We have demonstrated that this 'card game' proposal does not defy probability, and we suggest that the LHC continues to operate at full capacity (when it finally becomes fully operational). We appreciate the limited randomness that a computer program can provide, and we suggest that further tests be carried out using truly random processes, possibly using a quantum number generator if one is ever made possible. However until then do not shut down the LHC!

References

[1] H. B. Nielson & M. Ninomiya, "Search for Effect of Influence from Future in Large Hadron Collider", arXiv:0707.1919v3 **(2007).**

[2] H. B. Nielson & M. Ninomiya, "Card game restriction in LHC can only be successful!", arXiv:0910.0359v1 **(2009).**

[3] W. H. Press et al. *Numerical Recipes in C, 2nd ed.* (CUP, 1992), chapter 7.