# Review of: "Mathematics Is Physical"

Apostolos Syropoulos

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This is an interesting paper that explores the notion of computation. The basic argument is that computation is not something that depends on mathematics only. On the contrary, computation is something that depends on the physical properties of the device that performs it. In my own opinion, this is a very reasonable approach to the nation of computation. To "prove" the validity of this idea, the author employs Goedel’s incompleteness theorem. His interpretation of the theorem is that axiomatic
systems are incomplete mainly because we do not have infinite resources to prove every single statement. I do not really agree with this idea. I think that for incomplete systems there true yet unprovable statements because the construction of such systems is flawed. Whether we can fix this “problem” is something I cannot say. Most probably, it is a "defect" of our cosmos just like the speed of the light is the fastest we can go (at least theoretically). The author correctly points out that Turing machines are Newtonian computing devices, however, a Turing machine cannot simulate a quantum system and this idea is the one that prompted Richard Feynman to propose computers that can harness the quantum properties of matter.

Hilbert spaces have been proposed by mathematicians to solve their own problems. However, the column vector notation, which is is common in linear algebra, it's often cumbersome in quantum computing, in particular, and quantum mechanics, in general. This is why Paul Dirac introduced his ket-bra notation. Thus, the language of mathematics had to adapt to better express the physical world.However, the author advocates the idea that "the advent of quantum computers shows that physics can give mathematics a richer content and make it more powerful", which is not correct. Mathematician are free to create whatever structure they want, but physicists can propose only structures that have some physical interpretation. Clearly, the set of the former structures is a proper superset of the later structures.

The author claims that he and his colleagues proposed a "novel type of information that cannot be cloned and part of which can never be observed". I had a look at the paper they cite and which is available from the arXiv. In this paper, the authors propose something they call Lorentz systems, where the inner product of vectors is defined a bit different. My question: Do these mathematical structures describe anything physical? If not, then these system and the proposed model of computation are pure fantasy. Of course, if they have a physical interpretation that does not "refute" the Standard Model, then this work is quite interesting.

As I stated above this is paper is quite interesting and I think it deserves to be read by many people. However, the author must address the points raised in this review.