$\mathbf{TC} + \mathbf{CON}(\mathbf{TC}^*) \vdash \boldsymbol{P} \neq \boldsymbol{NP}$

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Abstract. In this short article, we rephrase the results which were obtained in [8], [10], [11] in a more exact and logical language.

In [5], [8], [10], [11] we obtain some results that could be summarized as following:

1. $\mathbf{TC} + \mathbf{CON}(\mathbf{TC}^*) \vdash \boldsymbol{P} \neq \boldsymbol{NP}$ **[11]**
2. $\mathbf{TC}^* \vdash \boldsymbol{P}^* \neq \boldsymbol{NP}^*, \boldsymbol{P}^* = \boldsymbol{BPP}^*$ [5], [8]
3. $\neg\mathbf{CON}(\mathbf{TC})$ **[10]**

In above, by TC we mean the theorems in Theory of Computation and by $\mathbf{TC}^*$ the theorems in Theory of Computation when we consider the instants of time as fuzzy numbers [5], [8], [11].

Respectively, we define the classes $\boldsymbol{P}^*, \boldsymbol{NP}^*, \boldsymbol{BPP}^*$.

By CON (T) for a theory T we mean this theory is consistent and the existence of at least a model which theory holds in that.

If we consider QM as the collection of theorems in Quantum Mechanics, the following assertion seems true by [9]

4. **CON (QM**$) \rightarrow$**CON (TC*)** (The proof is not exact in detail yet)

In the related discussion, we have proven these four assertions [5], [8], [9], [11].

Remark. Because of 3, the importance of the first result (proved in the last chapter of [11]) would be under question, unless we consider Non –classical logics. Nevertheless, by 2 we observe that considering time as a fuzzy concept leads us to a convenient situation in Theory of Computation.

Time is a central concept in Physics. To consider it as a fuzzy concept leads us to some changes in Theory of Physics and introducing a new interpretation of Quantum Mechanics so called "Fuzzy time-Particle interpretation" of Quantum Mechanics [4], [6], [9].

Here, we should mention “Probabilistic Time” by C. Witterich [2] and a related work E.C. Ruiz et al. in [3].

Actually, to consider time as an operator in Physics doesn’t seem a new idea but somewhat they didn’t take it serious in a level to be considered as a central concept. Possibly, the problem is somewhat psychological. More exactly, psychologically, there is a large inertia to accept non classical time.

Historically, Brouwer and Husserl had a similar idea when they knew instants of time as engaged links of a chain [7], [13], [14].

By the way, Fuzzy Mathematics and Quantum Mechanics major commonality is “uncertainty”.

Based on this fact, there are attempts to consider the theories of “Fuzzy Time-space”, for Physics in general and Quantum Mechanics [1]. On contrast, in our approach we have a specific reason to consider time as a fuzzy concept [4], [7], [10]. Besides all, here the Fuzzy function associated to the instants of time are computable. As the third factor, we show not only Physics but also Theory of Computation and any Theory based on Classical time need to be reconsidered in order to be modified. Therefore, it is required to define a novel interpretation in Physics [4], [6], [9].

As a motto we have:

“We have sufficient evidences in Physics and Theory of Computation to accept time as a fuzzy concept”.

Conclusion. TC in Complexity Theory part and different subjects in cryptography has major problems. More exactly, there is a long list of unsolved problems in these subjects. As an example, even a problem like P=PSPACE has not been solved yet. We suggested the major difficulty of these problems is around the concept of time. By focusing on TC* instead of TC as we see in [11], seemingly we reach to a much better situation for Theory. In [11], the structure of the new theory is described.

References

1. B.G. Sidharth, The Fuzzy Space Time Paradigm, 2003 arxiv Physics/0311040

2. C. Wetterich, Probabilistic time, Foundations of Physics, 2012, Springer

3. E.C. Ruiz, F.g., C.Brukner, Entanglement of Quantum Clocks through Gravity, PNAS March 2017

4. F. Didehvar, About Fuzzy Time-Particle interpretation of Quantum Mechanics (It is not an innocent one), version one, Philpaper 2019

5. F. Didehvar, By Considering Fuzzy Time, P=BPP (P*=BPP*), Philpaper, Researchgate doi: 10.13140/RG.2.2.16257.07521, 2020

6. F.Didehvar, Double Slit Experiment About Fuzzy Time –Particle Interpretation of Quantum Mechanics, Philpaper 2019

7. F. DIDEHVAR, "Fuzzy time", a solution of Unexpected Hanging Paradox (a Fuzzy interpretation of Quantum Mechanics), Philpaper 2019

8. F. Didehvar, Fuzzy Time & NP Hardness (P*=BPP*, P*≠ NP*), Philpaper, 2020

9. F.Didehvar, "Fuzzy Time', From Paradox to Paradox (Does it solve the Contradiction Between Quantum Mechanics & General Relativity, Philpaper 2019

10. F. Didehvar, Is Classical Mathematics Appropriate for Theory of Computation?, Philpaper, 2018 (needs some modification in the last chapter)

11. F. Didehvar, $P \neq NP$, By accepting to make a shift in the Theory (Time as a fuzzy) The Structure of a Theory (TC*, Theory of Computation based on Fuzzy time), Philpaper, Researchgate DOI: 10.13140/RG.2.2.33549.97763, 2020

12. J. Madore, Gravity on Fuzzy Space-Time, 1997, arxiv gr-qc/9709002

13. Van Aten M, On Brouwer, Wadsworth Philosopher's Series, 2004 (Persian Translation by Ardeshir.M)

14.Van Stigt W.P., Brouwer Intuitionism, Studies in the History and Philosophy of Mathematics, Volume 2