Review of: "The correlation of classic and experimental measurement results with quantum measurement theory"

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The chief premise of the paper under review is that the language of measurement, which is central to metrology, plays a crucial role in resolving quantum foundational problems (quantum entanglement, Bell's inequalities, Schrödinger's cat thought experiment, just to name a few).

Unfortunately, such a premise is false.

To explain why, let us concentrate on physical constants for the reason that, from a formal point of view, all quantum mechanics (QM) does it introduces a new physical constant, namely, Planck constant, $\hbar$, absent in classical mechanics (CM).

The main assumption regarding physical constants is that they are physical quantities which are universal in nature and thus completely independent of the unit system used to evaluate them. This assumption alone makes a metrology-based approach to quantum foundational problems irrelevant.

Consider for example Heisenberg's uncertainty principle presented by the familiar expression $\Delta x \cdot \Delta p \geq \hbar/2$, in which the symbol Δ is used to denote the standard deviation of position x or momentum p.

To make this expression more dramatic, let us use the system in which Planck constant is a pure number having no units attached and having a numerical value of unity, i.e., $\hbar = 1$. In that case, we have $\Delta Q \cdot \Delta P \geq 1/2$, where Q and P stand for new (converted) quantities of position and momentum respectively.

The converted expression means that the variances of the quantities of Q and P cannot both be zero. The act of including calibration in measurement of Q and P may not change that fact. Moreover, in the system where $\hbar = 1$, the units of Q and P are perfectly anti-correlated, specifically,

$$[Q] = [P]^{-1}$$

making the unit equalization of Q and P totally unnecessary.

In CM, by contrast, the variance of action $S = Q \cdot P$ is given by the expression $\Delta S = \Delta Q \cdot \Delta P \geq 0$ implying that the variances of the quantities of Q and P can simultaneously be zero.

Hence, the problem is not the calibration of a standard quantity against which action *S* is measured, but the magnitude of *S* which is turned out to be limited from below by a number ½.

Again, from the formal point of view, CM may be regarded as the limiting case of QM when $\hbar$ tends to zero. And therein lies the problem: As there is no mathematical process which can transform ½ into zero without also transforming other real numbers to null, the question is: What forces the Nature to make choice among possibilities for a single result of experiment? This is the crux of all the difficulties with QM.

In the broader sense, QM – together with any other field of theoretical physic – focuses not on accuracy or precision of experimental observations of a physical quantity but on that quantity's true value. From this perspective, QM does not care that a given physical value may never be known exactly. It is therefore metrology – i.e., the study of measurement that establishes a common understanding of units – has no role in quantum mechanical correlations, paradoxes and theorems.

On the technical side, the paper under review is composed very poorly. Suffice it to say that it is impossible to understand its material without reading two previously published author's papers (I suspect the only reason to write the presented paper was to let those two papers be known to the wider public).

Overall, I regret to say that the paper under review makes no contribution to our present understanding of QM (as well any other field of theoretical physics).