Everett Interpretation as Assumption

by Sven Nilsen, 2019

In my approach of resolving paradoxes in the measure problem of cosmology, I believe that using the Everett interpretation of quantum mechanics in combination with eternal inflation is a key to understand high level features of fine tuning in the physical world.

The problem is to isolate those features from others that are merely side effects. This is difficult because it might not be certain that the theory is interpreted correctly to give predictions in one way or another. One might then ask why Everett interpretation is used as assumption, and not a wider class of interpretations that yield similar predictions.

For example, it might be only sufficient that observers are described relative to a Path Reference Class, in addition to the Exponential Reference Class due to eternal inflation. While the Everett interpretation might give raise to a Path Reference Class, there might also be many other interpretations that also give raise to a Path Reference Class.

Formally:

x : [path_reference_class] true

vs

x == EVERETT_INTERPRETATION

How does one know that assuming the Everett interpretation is reasonable?

The answer of course, is that I do not know.

Yet, choosing the Everett interpretation has some practical advantages:

- It builds on quantum mechanics without making further assumptions. Quantum mechanics has been tested a lot, so even if it might turn out to be wrong, the testable predictions might still hold for a large domain of the correct theory.
- If it is sufficient to pick one interpretation that give raise to a Path Reference Class, then one might as well choose the most familiar interpretation for physicists and mathematicians.
- By selecting a specific interpretation, one can avoid a lot of ambiguity that might slow down the work or increase number of obstacles due to lack of general theorems.
- One can reuse theorems that have been proved by mathematicians working on the Everett interpretation.
- The theory might provide a consistent picture to reason about experiments easily done.
- If it yields predictions specific to the Everett interpretation, then this is very valuable for the physics community, whether those predictions might turn out to be right or wrong. One gets overlapping benefits from testing an existing theory and testing a new phenomena never measured before. It is also less work to extend predictions for other theories, than redoing the work for both theories from a more general case.

I also believe that the Everett interpretation is a good assumption from a Zen Rational perspective. In Zen Rationality, if a zen rational agent believes that a smarter version of itself believes X, then it believes X, with the probability it believes the smarter version believes X.

One can think about this as predicting results of future experiments. So far, every single experiment has yielded results which are consistent with quantum mechanics. While it is not ruled out that future experiments might violate quantum mechanics, neither do we know how the new correct theory will be. So, since we must either think about all possible theories or choose a single one, it is easiest to choose a single one and follow its predictions to the conclusions. This means that the Everett interpretation is in favor above other theories, not as a predictor, but as a prior bias for making bets on predictions.

The basic thumb rule of Zen Rationality is to think about how a smarter version of ourselves would act. A smarter version might have access to more experiments, thus we should form our beliefs on the basis on what we would believe the smarter version believes. We do not know what the results of these experiments will be, but we might make our best guess according to the available information.

Assume that every future experiment is consistent with quantum mechanics. Then, the Everett interpretation will give correct predictions to those future experiments. In this case, there is no need to choose another interpretation in advance. Why not just stick to the Everett interpretation?

Is there any evidence that the Everett interpretation will not hold, or are we tempted to change the interpretation only because we think it is less suitable to fit our mental capacity?

A theory that modifies quantum mechanics one way or another, has to yield different predictions for some specific experiment in the future. However, we can not be certain that the specific experiment will deviate in the predicted way. Up to this point, every experiment has been consistent with quantum mechanics, and there seem no reason to believe that there is some special realm where quantum mechanics break down. There are multiple ways it could break down, so on average the prediction might be approximately correct if we assume the Everett interpretation.

This way of reasoning might seem to be a tautology, since quantum mechanics taken on face value implies the Everett interpretation. However, no such double-counting is taking place: The only bet is whether future experiments are consistent with quantum mechanics. The rest follows logically.

If one anticipates that some experiment will deviate in a specific way, the burden of proof rests on the shoulders of those who understand the alternative theory enough to design a proper experiment. The rest of the physics community might just expect that Everett interpretation is a reasonable assumption.

I think that for this reason in particular, the Everett interpretation is a promising candidate to use for resolving paradoxes in the measure problem of cosmology, besides practical benefits.