

Assignment #10: Many Worlds, Many Minds.

1. (2pt.) Suppose the transporter in (the original) *Star Trek* malfunctions: When Capt. (Jim) Kirk steps onto the ship-board pad, his body completely disintegrates. Down on Planet *X*, two copies of Kirk appear: call them Kirk#1 and Kirk#2 (they are even wearing "Kirk#1" and "Kirk#2" tee-shirts, just to tell them apart). Now consider the question: "What is the probability that Capt. Kirk appears on Planet *X* as Kirk#1?"

Mr. Spock says: "Since there are only two versions of the captain, by symmetry, logic dictates that the probability is $1/2$ ".

Dr. McCoy says: "That's hogwash! In order for there to be a *probability* that Jim appears as Kirk#1, it has to be *possible* for him to appear as Kirk#1. But he gets disintegrated on-board! The question makes no sense!"

(a) Which do you think makes the better argument? How does this relate to the problem of probabilities in the Many Worlds interpretation? (*Hint:* Is identity over time a pre-requisite for a meaningful notion of probability?)

(b) Suppose that Kirk's body disintegrates, but his mind remains whole (somehow) and subsequently is transported down to Planet *X* to re-inhabit one or the other of Kirks #1 or #2. Do you think this scenario would placate the (irascible) Dr. McCoy? Would he now agree with Spock?

2. (2pt.) Recall that Bell's thought experiment (as implemented in the lab) entails that any interpretation that makes the same predictions as the literal interpretation must be non-local. Since the Many Worlds interpretation makes the same predictions as the literal interpretation, this must mean the Many Worlds interpretation is non-local. Explain what this means in the language of Many Worlds.

3. (2pt.) Explain what it means in the Bare Theory to have "effective knowledge" about measurement outcomes, as opposed to definite beliefs about measurement outcomes.

4. (2pt.) How does the Many Minds Interpretation improve on the Bare Theory when it comes to being deluded in our beliefs about measurement outcomes? What is the cost of this improvement?

5. (2pt.) According to Eugene Wigner (famous physicist), physical states evolve *via* Schrödinger Evolution, and the Projection Postulate "kicks in" only when a conscious mind interacts with a measuring device. The Many Minds Interpretation also involves a dualism between physical states and mental states. How is it different from Wigner's view? In your opinion, what are the advantages of Many Minds over Wigner? What are the disadvantages?