

Philosophy 482: Suggested paper topics

Below are some suggestions for the final paper. That paper should be no more than ten (10) double spaced pages long (standard 12 point font and margins!). It is due in class on the last day of class: **Thursday, June 6. NO LATE PAPERS WILL BE ACCEPTED.** If you choose your own topic please check first with me. You can "talk" with me on email if that is convenient.

1. Based on a close reading of the original EPR paper and Bohr's reply, try to reconstruct the EPR argument and also Bohr's response. Who won, and why?
2. What is quantum nonlocality and does Bell's theorem imply it? If not, then what are proper conclusions from Bell's theorem?
3. In a famous lecture William James characterized determinism this way, "The future has no ambiguous possibilities hidden in its womb: the part we call the present is compatible with only one totality. Any other future complement than the one fixed from eternity is impossible." With this as your guiding conception, explain whether quantum mechanics is compatible with determinism.
4. Einstein wrote, "[T]he objective describability of individual macro-systems ... can not be renounced without the physical picture of the world, so to speak, decomposing into a fog." Or, as he pointedly put it, "Is the moon there when nobody looks?" Respond to this question by writing a critical appraisal of the Copenhagen interpretation, paying particular attention to the role of the observer in this interpretation of quantum mechanics and to the relationship Copenhagen presumes between classical and quantum physics.
5. According to Richard Feynman, the two-slit experiment for electrons is "a phenomenon which is impossible, absolutely impossible, to explain in any classical way, and which has in it the heart of quantum mechanics." This experiment "has been designed to contain all of the mystery of quantum mechanics, to put you up against the paradoxes and mysteries and peculiarities of nature one hundred per cent." As to the question, "How does it really work? What machinery is actually producing this thing? Nobody knows any machinery. Nobody can give you a deeper explanation of this phenomenon than I have given; that is, a description of it."
According to John Bell, "Is it not clear from the smallness of the scintillation on the screen that we have to do with a particle? And is it not clear, from the diffraction and interference patterns, that the motion of the particle is directed by a wave? De Broglie showed in detail how the motion of a particle, passing through just one of two holes in the screen, could be influenced by waves propagating through both holes. And so influenced that the particle does not go where the waves cancel out, but is attracted to where they cooperate. This idea seems to me so natural and simple, to resolve the wave-particle dilemma in such a clear and ordinary way, that it is a great mystery to me that it was so generally ignored."
Write an essay that sorts out what is going on here. Who is right?
6. Find a recent journal article (i.e., within the last few years) that treats an interpretive issue in quantum mechanics and write a critical appraisal of the article. Good journals to look at would be *Foundations of Physics*, *American Journal of Physics*, *Studies in the History & Philosophy of Modern Physics*, *Philosophy of Science*, *British Journal for the Philosophy of Science*. (If you go this route please check it out with me. Also be sure to include a photocopy of the article so I can read it too!)
7. There are many important and interesting topics that we have only touched on in this course. You could pick one and write a short research paper that explains and evaluates critically what is going on. For example, there are the "spontaneous localization" (a.k.a. "GRW-Pearle") and the quantum Bayesian interpretations of the theory. There is also decoherence and the "consistent histories" approach. There are fascinating applications in development like quantum computing, quantum teleportation and quantum cryptography. There are also some "paradoxes" like the "quantum eraser" that we have not explored thoroughly that you could take up. If you are interested in something like this please talk with me first so that we agree on a literature and a plot line.