

PHILOSOPHY OF MODERN PHYSICS III/IV

2nd Assignment Questions

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2004

All essays are due **To be Announced**. Late essays will be accepted up to 19th November without excuse, but marks will be deducted. Essays WILL NOT BE ACCEPTED after 19th November unless a satisfactory excuse is submitted. The only satisfactory excuses are illness or misadventure. Pressure of other work, or computer equipment failure, does not normally count as misadventure. For further information contact the II/III Coordinator, Dr M. McDermott. (Note: Dr McDermott is the only person who can give extensions.) Work must be placed in the box at the SOPHI office (in the Old Teachers College Bldng.), with the proper cover sheet attached. (Please make sure you keep an electronic copy of your essay.)

3000 words—answer one question only

1. Write an essay on the arguments against Hidden Variable Theories—concentrating on the Kochen-Specker theorem. How much do they establish and are there any plausible loopholes? In particular discuss contextualism and non-locality. (Note: you do not need to consider Bell's Theorem in any detail for this particular question.)
2. Discuss the Bell-Wigner inequalities and their violation by quantum mechanics. What does this tell us about the nature of reality—about determinism, locality and quantum mechanical holism. (Make sure you include some discussion of the non-classical quantum probabilities.)
3. Describe and discuss the Greenberger-Horne-Zeilinger theorem. Why is it an advance over Bell's theorem?
4. Discuss the significance and meaning of the Heisenberg Uncertainty Relations. How do they relate to ideas of complementarity and simultaneous measurability. Do they apply to ensembles of particles in identical states or to single particles?
5. "The Quantum Measurement problem is unsolvable in quantum mechanical terms." Discuss with reference to some of the proofs in the literature, and after considering Hughes' discussion of the matter.

Remember: IVth Year and PG students have their essay lengths determined by the PG coordinator, John Bacon. The essay topic should be closely related to the above.