

Quantum heterodoxy – realism at Plank length

This paper has overtly philosophical aims – Realism is to be defended from the Idealism prevalent in understanding and teaching quantum mechanics. Philosophical argument opens and closes the paper, with a much more interesting discussion of quantum theory in between.

The measurement problem is the central theme. Conceptual and formal issues are presented initially a clear, lively manner. The representation of pure and mixed states in Hilbert Space is discussed, along with an interesting discussion of “negative-outcome measurements”, measurements that fail to find an observable’s value within a certain subset. He makes the point that these, like “positive” measurements, result in a change in quantum state that will be confirmed if the measurement is repeated. He notes that “exotic” wave functions with “holes” result from such measurements and that it becomes harder to argue that these changes in state result from physical interactions with measurement instruments.

The projection operators associated with observable operators are considered the key to understanding measurement. He argues that proper understanding of these projections leads to a far more pathological version of the Uncertainty relations than is usually accepted. From the Paley-Wiener theorem he concludes for example that: “If the position wave function is localised, even if the area of its localisation is extremely large – the momentum wave function is *infinitely* unlocalised.” (his stress, p518). This leads to a distinction between “pointwise location” and having “particle-like properties”, and discussion of the need to distinguish carefully between features of probabilities and of the systems they describe. The lack of a unique decomposition of mixtures into pure states makes an “ignorance interpretation” of mixed states untenable, and the violation of Bell’s inequalities is considered “empirical confirmation” of this.

In the final section the clarity and care of earlier discussions is increasingly abandoned. Idealism is presented in caricature as the view that “everything is subjective” (p525), or “the moon is definitely not there when we are not looking at it” (p 524). Realism will save us from such absurdity simply by claiming that a quantum state is “the perfectly objective, mind-independent, aspect of the external world that explains why we have the experimental results that we have.” (p 524) The simplistic polemic castigates others for straying from this view with no acknowledgement of further issues. A final attack on Kuhn and the Copenhagen physicists in an appendix completes the downward slide. The paper includes copious footnotes but no bibliography.