

Principle and constructive theories of physical probability, and Bell inequalities - Simon Saunders

Abstract:

I propose simple postulates for physical probability, of which only one is new: a generalised locality postulate. Call this theory PP. I define a constructive theory that satisfies PP, the ‘microstate-counting rule’ proposed in arXiv:2404.12954, but now generalised to apply to microstates that do not necessarily decohere. I prove a simple theorem: PP implies that microstates have equal probability. On this basis the Born rule is derived. Both theories are applied to the EPRB setup. If retrocausation is excluded, and if remote experiments have unique outcomes (UNIQUE), the result is: $PP \rightarrow (UNIQUE \rightarrow BELL)$. Similar claims have been made before (for example, Maudlin 2014, ‘What Bell did’), but replacing PP by LOC (some version of Bell’s ‘local causality’ assumption). Meanwhile microstate-counting implies PP, $\neg BELL$, and $\neg UNIQUE$, and demonstrably involves no action-at-a-distance.

This work is based on <http://arxiv.org/abs/2505.06983>, just posted.