

PHYSICS AND ASTRONOMY COLLOQUIUM

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Quantum Mechanics and Cosmology in Very Large Universes

Modern physics frequently envisions scenarios in which the universe is very large indeed: large enough that any allowed local situation is likely to exist more than once, perhaps an infinite number of times. Multiple copies of you might exist elsewhere in space, in time, or on other branches of the wave function. Such duplication is inevitable the Everett (Many-Worlds) formulation of quantum mechanics, and has a beneficial effect: it leads to a simple derivation of the Born Rule for quantum probabilities. Duplication can be a bad thing in cosmology, where it leads to Boltzmann Brains and the cosmological measure problem. An improved understanding of quantum fluctuations shows that Boltzmann Brains can be easily avoided if they don't correspond to decoherent branches of the wave function.



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