

What is quantum in quantum randomness?

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It is often said that quantum and classical randomness are of different nature, the former being ontological and the latter epistemological. However, so far the question of “What is quantum in quantum randomness”, i.e. what is the impact of quantization and discreteness on the nature of randomness, remains to answer. In this talk I will first explicit the differences between quantum and classical randomness within a recently proposed ontology for quantum mechanics based on contextual objectivity. In this view, quantum randomness is the result of contextuality and quantization. I will show that this approach strongly impacts the purposes of quantum theory as well as its areas of application. In particular, it challenges current programs inspired by classical reductionism, aiming at the emergence of the classical world from a large number of quantum systems. In a second part, I will analyze quantum physics and thermodynamics as theories of randomness, unveiling their mutual influences. I will finally consider new technological applications of quantum randomness opened in the emerging field of quantum thermodynamics.

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Session Classification: Quantum and/or Classical Worlds?