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Comment on dynamical randomness in quantum systems. (English) Zbl 1229.82103

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Summary: We propose a mechanism by which dynamical randomness may appear in many-body systems without sensitivity to initial conditions. We characterize dynamical randomness using the Kolmogorov-Sinaĭ (KS) entropy per unit time and its 1987 quantum extension by Connes, Narnhofer, and Thirring (CNT). In this respect, quantum systems fall into (at least) two large classes: (1) few-body bounded systems with discrete energy spectra whose entropy per unit time is vanishing; and (2) many-body open systems of statistical mechanics with continuous energy spectra whose entropy per unit time may be positive, like ideal gases and beams of particles. We calculate the classical and quantum entropies per unit time of the ideal gases and show that they are positive and in correspondence. Moreover, we show that the KS entropy per unit time is recovered from the CNT entropy per unit time using a decomposition suggested by the works of Griffiths, Gell-Mann, Hartle, and Omnès on quantum histories. We also discuss the relationships between the quantum histories, the exponential decay of some n-time correlation functions, repeated measurements, and the CNT entropy per unit time.

MSC:

82C03 Foundations of time-dependent statistical mechanics
81S25 Quantum stochastic calculus

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