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TITLE: Deriving the Qubit from Entropy Principles" (with Pierfrancesco La Mura)

We provide an axiomatization of the simplest quantum system, namely the qubit, based on entropic principles. Following Wigner [Physical Review, 1932], our formulation employs quasi-probabilities in phase space. We work with Renyi [Proceedings of the 4th Berkeley Symposium on Mathematical Statistics and Probability, 1961] entropy (which includes Shannon [Bell System Technical Journal, 1948] entropy as a special case) and impose the additional condition (Information Reality Principle) that the entropy of a physical system, as a measure of the amount or quantity of information it contains, must be a real number. We then impose an entropic version of the Heisenberg uncertainty principle (Minimum Entropy Principle) as a deliberately chosen physical axiom. We show that the set of empirical probabilities compatible with our entropic uncertainty principle identifies the Bloch sphere (a standard representation of the qubit).