Abstract Submitted
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Quaternions and the Quantum[1] MATTHEW GRAYDON, University of Waterloo and Perimeter Institute for Theoretical Physics — Birkhoff and von Neumann pointed out that quantum probability calculi could be formulated over rings admitting involutory anti-automorphisms [1]. We discuss a model for generalized quantum measurements and quantum states based on quaternionic matrix algebras. We show that the usual Born rule for calculating probabilities for outcomes of quantum measurements can be carried over into quaternionic quantum theories within a Jordan-algebraic framework. We exploit a group isomorphism between Sp(1) and SU(2) to show that single-system unitary dynamics and generalized measurements in a quaternionic quantum theory can be simulated by corresponding processes in usual quantum mechanics. We resurvey the divide between quaternionic and complex quantum theories given this quadit-qudit correspondence. Reference: [1] G. Birkhoff and J. Von Neumann, "The logic of quantum mechanics", Ann. Math., 37, 823-843 (1936).

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