Abstract Submitted
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Entangled Bloch spheres: Bloch matrix and two-qubit state space[1] OMAR GAMEL, University of California, Berkeley — We represent a two-qubit density matrix in the basis of Pauli matrix tensor products, with the coefficients constituting a Bloch matrix, analogous to the single qubit Bloch vector. We find the quantum state positivity requirements on the Bloch matrix components, leading to three important inequalities, allowing us to parametrize and visualize the two-qubit state space. Applying the singular value decomposition naturally separates the degrees of freedom to local anr nonlocal, and simplifies the positivity inequalities. It also allows us to geometrically represent a state as two entangled Bloch spheres with superimposed correlation axes. It is shown that unitary transformations, local or nonlocal, have simple interpretations as axis rotations or mixing of certain degrees of freedom. The nonlocal unitary invariants of the state are then derived in terms of local unitary invariants. The positive partial transpose criterion for entanglement is generalized, and interpreted as a reflection, or a change of a single sign. The formalism is used to characterize maximally entangled states, and generalize two-qubit isotropic and Werner states.

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