Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

**Affine Maps of the Polarization Vector for Quantum Systems of Arbitrary Dimension**[1] MARK BYRD, Southern Illinois University, C. ALLEN BISHOP, YONG-CHENG OU, Physics Department, Southern Illinois University — The operator-sum decomposition (OS) of a mapping from one density matrix to another has many applications in quantum information science. To this mapping there corresponds an affine map which provides a geometric description of the density matrix in terms of the polarization vector representation. This has been thoroughly explored for qubits since the components of the polarization vector are measurable quantities (corresponding to expectation values of Hermitian operators) and also because it enables the description of map domains geometrically. Here we extend the OS-affine map correspondence to qudits, briefly discuss general properties of the map, the form for particular important cases, and provide several explicit results for qutrit maps. We use the affine map and a singular-value-like decomposition, to find positivity constraints that provide a symmetry for small polarization vector magnitudes (states which are closer to the maximally mixed state) which is broken as the polarization vector increases in magnitude (a state becomes more pure). The dependence of this symmetry on the magnitude of the polarization vector implies the polar decomposition of the map can not be used as it can for the qubit case. However, it still leads us to a connection between positivity and purity for general d-state systems.

[1]This material is based upon work supported by NSF-Grant No. 0545798 to MSB.

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Date submitted: 18 Nov 2010 Electronic form version 1.4