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Title:	Majorana representation, qutrit Hilbert space and NMR implementation of qutrit gates
Authors:	Dogra, S. (/jspui/browse?type=author&value=Dogra%2C+S.) Dorai, K. (/jspui/browse?type=author&value=Dorai%2C+K.) Arvind (/jspui/browse?type=author&value=Arvind)
Keywords:	Majorana representation NMR quantum information processing Qutrit gates
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Abstract:	We report a study of the Majorana geometrical representation of a qutrit, where a pair of points on a unit sphere represents its quantum states. A canonical form for qutrit states is presented, where every state can be obtained from a one-parameter family of states via $SO(3)$ action. The notion of spin-1 magnetization which is invariant under $SO(3)$ is geometrically interpreted on the Majorana sphere. Furthermore, we describe the action of several quantum gates in the Majorana picture and experimentally implement these gates on a spin-1 system (an NMR qutrit) oriented in a liquid crystalline environment. We study the dynamics of the pair of points representing a qutrit state under various useful quantum operations and connect them to different NMR operations. Finally, using the Gell Mann matrix picture we experimentally implement a scheme for complete qutrit state tomography.
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