CCSU

DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

Friday, September 6
3:00 – 4:00 PM
Maria Sanford, Room 101

PROJECTIVE SPACE FOLIATED BY KLEIN BOTTLES AS A GEOMETRICAL REPRESENTATION OF TWO-QUBIT STATES AND THEIR ENTANGLEMENT

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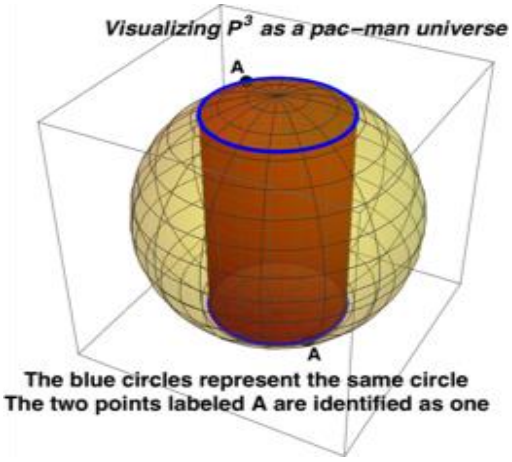
Abstract: We study the set of two-qubit states with real phases. We show that the maximally entangled states --those locally equivalent to the Bell States --form two disjoint circles perpendicular to each other. We also show that, taking the natural Riemannian metric on this space, the set of states connected by local gates are equidistant to this pair of circles. Moreover, the untangled, or so-called product states, are $\pi/4$ units away to the maximally entangled states. This is, the unentangled states are the farthest away to the maximally entangled states. In this way, if we define two states to be equivalent if they are connected by local gates, we have that there are as many equivalent classes as points in the interval $[0,\pi/4]$ with the point 0 corresponding to the maximally entangled states. The point $\pi/4$ corresponds to the unentangled states which geometrically are described by a Klein bottle. Finally, for every $0<t<\pi/4$ the point t corresponds to a disjoin pair of Klein bottles. Finally, we also show how this geometrical interpretation allows to clearly see that any pair of two qubit states with real phases can be connected with a circuit that only has local gates and a CZ gate. More details can be found in the preprint https://arxiv.org/pdf/1903.01940.pdf.



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