1035-81-624 **Stephen S. Bullock*** (ssbullo@super.org), 17100 Science Drive, Bowie, MD 20716. *Spin Flips and KAK Decompositions.*

This talk surveys how KAK decompositions of the unitary group have been applied to quantum computing. Such decompositions view $U(2^n)$ as the space of quantum computations of arbitrary complexity and (often) choose $K \subseteq U(2^n)$ to be the symmetry subgroup of the (real) quadratic form which carries $(x, y) \in (\mathbb{C}^{2^n})^2$ to the component of x on the spin-flip of y. In two qubits, $K = SU(2) \otimes SU(2)$ which is conjugate to $SO(4)$, and $U(4) = SU(2)^{\otimes 2}\ A\ SU(2)^{\otimes 2}$ has been exploited in quantum control theory (Khaneja,Brockett,Glaser, *Physical Review A* **63** 032308) and CNOT-optimized two qubit logic circuits (Vidal, Dawson *PRA* **69** 010301) (Shende, Bullock, Markov, *PRA* **70** 012310). In the general case, K is symplectic or orthogonal as n is odd or even, and in the latter case the KAK decomposition has implications for an entanglement monotone (Bullock,Brennen,O'Leary, *Journal of Mathematical Physics* **46** 062104). Certain constructions generalize to involutions other than spin flips (D'Alessandro,Albertini preprint). (Received September 12, 2007)