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Quasi-Orthonormal Bases for the Space of Density Operators CHRISTOPHER A. FUCHS, Bell Labs, Lucent Technologies, D. M. APPLEBY, Queen Mary University of London, HOAN B. DANG, Princeton University — Recently there has been much interest in the quantum information community to prove (or find a counterexample to) the existence of so-called symmetric informationally complete measurements (SICs). In this talk we show that there should be even more interest. For, under a robust measure of orthonormality for operator bases (one that does not build in any symmetry at the outset), one can show that SICs, if they exist, come as close as possible to being orthonormal bases for the space of density operators. Moreover, in contrast to the usual expression of the superposition principle (where bases are taken to be orthogonal sets of state vectors), writing a superposition principle in terms of SICs leads to a more intrinsically-quantum representation for quantum states. This is because the basis states, rather than being the easiest to eavesdrop on, are actually the hardest. Moreover, they fulfill a few other extreme quantum properties which will be outlined.

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