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Galois-unitary operators that cycle mutually-unbiased bases<sup>1</sup> HOAN DANG, Perimeter Institute for Theoretical Physics & University of Waterloo, MARCUS APPLEBY, University of Sydney, INGEMAR BENGTSSON, Stockholms University — Wigner's theorem states that probability-preserving transformations of quantum states must be either unitary or anti-unitary. However, if we restrict ourselves to a subspace of a Hilbert space, it is possible to generalize the notion of anti-unitaries. Such transformations were recently constructed in search of Symmetric Informationally-Complete (SIC) states. They are called Galois-unitaries (g-unitaries for short), as they are unitaries composed with Galois automorphisms of a chosen number field extension. Despite certain bizarre behaviors of theirs, we show that g-unitaries are indeed useful in the theory of Mutually-Unbiased Bases (MUBs), as they help solve the MUB-cycling problem and provide a construction of MUB-balanced states.

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Hoan Dang Perimeter Institute for Theoretical Physics & University of Waterloo

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