

Quantum Physics

Constructing Mutually Unbiased Bases in Dimension Six

Stephen Brierley, Stefan Weigert

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The density matrix of a qudit may be reconstructed with optimal efficiency if the expectation values of a specific set of observables are known. In dimension six, the required observables only exist if it is possible to identify six mutually unbiased complex 6x6 Hadamard matrices. Prescribing a first Hadamard matrix, we construct all others mutually unbiased to it, using algebraic computations performed by a computer program. We repeat this calculation many times, sampling all known complex Hadamard matrices, and we never find more than two that are mutually unbiased. This result adds considerable support to the conjecture that no seven mutually unbiased bases exist in dimension six.

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