Searching for mutually unbiased bases in non-prime power dimensions

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Abstract

Mutually unbiased bases (MUBs) play a fundamental role in quantum information theory, yet their full characterisation remains an open challenge [1]. Although infinite families of incomplete sets of MUBs exist in non-prime-power dimensions [2–5], none appear to be extendable to a maximal set of $d + 1$ MUBs in dimension d. In this talk, we present two advanced computational frameworks for numerically investigating the existence of structured constellations in finite-dimensional Hilbert spaces. One of these frameworks harnesses GPU acceleration to significantly enhance computational efficiency, enabling the exploration of higher-dimensional spaces with greater accuracy. As a key application, we employ these tools to examine the existence of MUBs in non-prime-power dimensions ranging from 10 to 30, offering new insights into this longstanding open problem.

References

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