Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Entanglement in Mutually Unbiased Bases[1] MARCIN WIESNIAK, University of Vienna, TOMASZ PATEREK, CQT Singapore, ANTON ZEILINGER, University of Vienna — Higher-dimensional Hilbert spaces are still not fully explored. One issue concerns mutually unbiased bases (MUBs). For primes [1] and their powers (e.g. [2]), full sets of MUBs are known. The question of existence of all MUBs in composite dimensions is still open. We show that for all full sets of MUBs of a given dimension a certain entanglement measure of the bases is constant. This fact could be an argument either for or against the existence of full sets of MUBs in some dimensions and tells us that almost all MUBs are maximally entangled for high-dimensional composite systems, whereas this is not the case for prime dimensions. We present a new construction of MUBs in squared prime dimensions. We use only one entangling operation, which simplifies possible experiments. The construction gives only product states and maximally entangled states.

[1] I. D. Ivanović, J. Phys. A 14, 3241 (1981).
[2] W. K. Wootters and B. D. Fields, Ann. Phys. (N.Y.) 191, 363 (1989).

[1]Research supported by ERC Advanced Grant QIT4QAD and FWF SFB-grant F4007 of the Austrian Science Fund.

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Date submitted: 29 Dec 2010 Electronic form version 1.4