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Thirty-six entangled officers of Euler:

Quantum solution of a classically impossible problem

A *quantum combinatorial design* is composed of quantum states, arranged with a certain symmetry and balance. Such designs determine distinguished quantum measurements and can be applied for quantum information processing. Negative solution to the famous problem of 36 officers of Euler implies that there are no two orthogonal Latin squares of order six. We show that the problem has a solution, provided the officers are entangled, and construct orthogonal quantum Latin squares of this size. The solution can be visualized on a chessboard of size six, which shows that 36 officers are splitted in nine groups, each containing of four entangled states. It allows us to construct a pure nonadditive quhex quantum error detection code.

References:

[1] S.A. Rather, A. Burchardt, W. Bruzda, G. Rajchel-Mieldzioć, A. Lakshminarayan, and K. Życzkowski, Thirty-six entangled officers of Euler, Phys. Rev. Lett. **128**, 080507 (2022).

[2] D. Garisto, Euler's 243-Year-Old 'Impossible' Puzzle Gets a Quantum Solution, Quanta Magazine, Jan. 10, 2022;

https://www.quantamagazine.org/eulers-243-year-old-impossible-puzzle-gets-a-quantum-solution-20220110/