# Characterizing the set of doubly stochastic matrices having unitary preimages

**Wojciech Tadej**

*Cardinal Stefan Wyszyński University, Warszawa, Poland*

## Abstract

The problem of characterizing doubly stochastic n x n matrices that can be obtained by squaring the moduli of the entries of some unitary matrix will be presented.

It is associated with the experimental physics problem of determining a discrete time unitary transformation of the state space of a finite dimensional quantum system undergoing a quantum process, corresponding to a doubly stochastic matrix of transition probabilities between basis states, measured in this process.

It is also related to the problem of finding all real and complex Hadamard matrices, having various applications in mathematics and theoretical physics.

Results concerning the geometry and spectra of the set of doubly stochastic matrices and those originating from unitary matrices will be presented, for n=3 and n=4.

## References

Bengtsson, I., A. Ericsson, M. Kus, W. Tadej, K. Zyczkowski. *Birkhoff's polytope and unistochastic matrices, N=4 and N=4.* www.arxiv.org/abs/math.CO/0402325