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The q-Gelfand-Tsetlin graph, Gibbs measures and q-Toeplitz matrices

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The problem of the description of finite factor representations of the infinite-dimensional unitary group, investigated by Voiculescu in 1976, is equivalent to the description of all totally positive Toeplitz matrices. Vershik-Kerov showed that this problem is also equivalent to the description of the simplex of central (i.e. possessing a certain Gibbs property) measures on paths in the Gelfand-Tsetlin graph. We study a quantum version of the latter problem. We introduce a notion of a q-centrality and describe the simplex of all q-central measures on paths in the Gelfand-Tsetlin graph. Conjecturally, q-central measures are related to representations of the quantized universal enveloping algebra $U_{\epsilon}(\mathfrak{gl}_{\infty})$. We also define a class of q-Toeplitz matrices and show that every extreme q-central measure corresponds to a q-Toeplitz matrix with non-negative minors. Finally, our results can be viewed as a classification theorem for certain Gibbs measures on rhombus tilings of the halfplane.

We use a class of q-interpolation polynomials related to Schur functions. One of the key ingredients of our proofs is the binomial formula for these polynomials proved by Okounkov.

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