Unitary Evolution on a Discrete Phase Space

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Abstract: We construct quantum evolution operators on the space of states, that realize the metaplectic representation of the modular group $SL(2, \mathbb{Z}_{2^n})$. This representation acts in a natural way on the coordinates of the non-commutative 2-torus, $\mathbb{T}_{2^n}^2$ and thus is relevant for noncommutative field theories as well as theories of quantum space-time. The larger class of operators, thus defined, may be useful for the more efficient realization of new quantum algorithms.