Optimal Quantum Error Correcting codes From Absolutely Maximally Entangled States

Study included in JPhysA Highlights Collection 2018

May 31, 2019

Each year the IOP Science's **Journal of Physics A: Mathematical and Theoretical** creates a selection of best papers published in the previous year, representing the breadth and excellence of the work published in the journal.

The paper entitled i¿½Optimal quantum error correcting codes from absolutely maximal y entangled statesi¿½ by ICFO researchers Zahra Raissi, Christian Gogolin and Arnau Ri ra, supervised by ICREA Prof. at ICFO Dr. Antonio Acin, has been included in the 018 highlighted selection.

Entanglement represents a form of correlations with no analogue in classical physics. Absolutely maximally entangled (AME) states are extreme entangled states of N systems in

which for any splitting of the N systems into two groups the resulting state has maximal entanglement. AME states are of interest for multipartite teleportation and quantum secret sharing and have recently found new applications in the context of high-energy physics in toy models realizing the AdS/CFT-correspondence.

In this study, researchers report in detail on the connection between a family of AME states known as of minimal support and classical error correcting codes called maximum distance separable. This allows them to provide explicit closed form expressions for AME states of N systems of dimension q whenever q is a power of a prime and q? n -1. They also use this connection to construct a basis in which all elements are AME and to design quantum error correcting codes that encode a logical quantum systems of dimension q into a subspace spanned by AME states. Under a conjecture for which they provide numerical evidence, this construction produces a family of quantum error correcting codes with the highest distance allowed by the quantum Singleton bound.