

## On the geometry of quantum complexity

*Thursday, 18 March 2021 16:30 (1 hour)*

Computational complexity is a quantum information concept that recently has found applications in holography. I will consider quantum computational complexity for  $n$  qubits using Nielsen's geometrical approach. In the definition of complexity there is a big amount of arbitrariness due to the choice of the penalty factors, which parameterize the cost of the elementary computational gates. In order to reproduce desired features in holography, negative sectional curvatures are required. With the simplest choice of penalties, this is achieved at the price of singular curvatures in the large  $n$  limit. I will consider a choice of penalties in which negative curvatures can be obtained in a smooth way. I will also talk about the relation between operator and state complexities, framing the discussion in the language of Riemannian submersions. Finally, I'll discuss conjugate points for a large number of qubits in the unitary space and I'll provide a strong indication that maximal complexity scales exponentially with the number of qubits in a certain regime of the penalties space.

45' talk + 15' discussion

**Presenter:** AUZZI, Roberto