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Universal distribution of topological defects and adiabatic quantum computation

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报告人简介：

Adolfo del Campo is a distinguished Ikerbasque research professor of physics at the Donostia International Physics Center (DIPC, Spain), adjunct professor at the University of Massachusetts (Boston, USA) and Faculty Guest Scientist at Los Alamos National Laboratory (Los Alamos, USA). He defended his PhD in 2008 at the University of Basque Country and was a postdoctoral research associate at Imperial College London and distinguished J. Robert Oppenheimer Fellow at the Theoretical Division of Los Alamos National Laboratory. In 2014-2018 he was an Associate Professor of physics at the University of Massachusetts. His research focuses on nonequilibrium phenomena in quantum science and technology. He is one of the pioneers of shortcuts to adiabaticity. During his career, del Campo has published over 100 peer-reviewed papers with seminal contributions to quantum control, quantum thermodynamics, quantum speed limits and the dynamics of phase transitions. Del Campo acts as a member of the Editorial Board of Scientific Reports.

Abstract：

When a quantum phase transition is crossed in finite time, critical slowing down leads to the breakdown of adiabatic dynamics and the formation of topological defects. The average density of defects scales with the quench rate following a universal power-law predicted by the Kibble-Zurek mechanism. We analyze the full counting statistics of kinks and report the exact kink number distribution in the transverse-field quantum Ising model. Kink statistics is described by the Poisson binomial distribution with all cumulants exhibiting a universal power-law scaling with the quench rate. In the absence of finite-size effects, the distribution approaches a normal one, a feature that is expected to apply broadly in systems described by the Kibble-Zurek mechanism. We shall discuss the implications of such universal signatures on the dynamics of quantum annealing and the performance of adiabatic quantum computers.

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