

## Non-Abelian statistics in quantum internal degree of freedoms

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### About the speaker:

Prof. Xin Liu got his B.S. degree in Nankai University and M.S. degree in Chern Institute of Mathematics, Tianjin. He received his Ph. D. from Texas A&M University in 2012. After graduation, he had worked as a postdoctoral researcher in the Pennsylvania State University from 2012 to 2014 and Condensed Matter Theory Center, University of Maryland from 2014-2015. He joined Huazhong University of Science and Technology in 2015. And in 2016 he received China's 1000-Talents Plan for Young Researchers.



### Abstract:

Quantum states in solids inevitably have internal degrees of freedom, including anyons such as Majorana zero modes (MZMs). In this talk, I will first give an intuitive introduction of Ising anyons and their non-Abelian statistics. Just as the bosons and fermions have integer and half-integer spins respectively, the statistics are locked to particles internal spin degree of freedom which is called spin-statistics theorem. This motives us to demonstrate non-Abelian braiding statistics of MZMs from their internal degree of freedom, which topologically corresponds to twisting the associated worldribbons, tracking the evolution of MZMs in both time-spatial and inner spaces. We found the superconducting phase and Majorana spin are two fundamental parameters of MZMs and can be used to braiding MZMs in the parameter space. Due to additional intrinsic particle-hole symmetry, we may also realize robust  $\pi/8$  gate which is beyond the general theory of Ising anyons.

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