Universal Quantum Computation from Bilayer Quantum Hall States

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Abstract

The possibility of realizing non-Abelian statistics and utilizing it for topologicalquantum computation (TQC) has generated widespread interest. However, the non-Abelian statistics that can be realized in most accessible proposals is not powerful enough for universal TQC. In this talk, I will consider a simple bilayer fractional quantum Hall system with 1/3 Laughlin state in each layer. Then I will show that a certain type of interlayer couplings which are experimentally relevant in higher Landau levels can drive a topological phase transition to an exotic non-Abelian state with famous `Fibonacci' anyon, whose non-Abelian statistics is powerful enough for universal TQC.