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Constructing and Deconstructing Non-Abelian Anyons

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Non-Abelian anyons are profoundly unintuitive quasiparticles. When braiding them, the order of the braids matters, dramatically changing the properties of the underlying piece of quantum matter. They are predicted to occur as excitations of certain quantum Hall liquids and as Majorana fermions attached to vortices in special superconductors. But their experimental realization remains a major challenge, possibly because our theoretical understanding of non-Abelian matter is also far from complete. In this talk I will deconstruct non-Abelian anyons, revealing that they are made of clusters of simpler quasiparticles, Abelian anyons, which become indistinguishable. I will show that deconstruction into identical indistinguishable components is a useful framework for the theoretical understanding of non-Abelian anyons, providing an intuitive picture for the physical mechanism leading to their emergence. Moreover, deconstruction opens a route for the construction and characterization of non-Abelian physical models and for their experimental realization in nature. To illustrate the approach, I will construct and characterize a non-Abelian spin-1 lattice model, discussing directions to detect the emergent non-Abelian anyons in experiments with ultracold atoms.