Quantum Geometric Tensor and Luttinger Liquids: A Framework for Fractionalized Topological Phases

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Fractionalized topological phases are among the most intriguing and challenging states of quantum matter, largely because strong interactions make them difficult to analyze and comprehend. In this talk, I will present the coupled-wire approach to interacting topological phases and discuss the role of the quantum geometric tensor within this framework. In the coupled-wire construction, two-dimensional topological phases emerge from arrays of one-dimensional Luttinger liquids that are coupled in a controlled manner. Rather than providing a fully quantitative description of a specific system, the coupled-wire approach offers an analytical framework that captures the essential physics, provides valuable physical insight, and makes concrete predictions about the possible interacting and fractionalized phases that can arise. It also offers a natural way to understand how lattice geometry shapes these phases and their low-energy properties. If time permits, I will discuss how collective excitations, including magnetorotons, emerge within this framework.