Anyon models in 2D and 1D — a short introduction

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This first talk of the school introduces the basic ideas and models of two- and one-dimensional anyons. Following the historical development, I first focus on the mathematically sound notion of indistinguishable particles, which directly leads to fermions and bosons in dimensions ≥ 3 and anyons in 1D and 2D by geometric quantization or by the path integral formalism. I will then particularly talk about 1D models of anyons, which can be interpreted as bosons with peculiar scattering properties. Because of the ambiguity of anyons in 1D by lacking the possibility of braiding, several models have been developed, which we briefly discuss.

$$\mathcal{C}_2^{1D} \cong \mathbb{R}^2 / \left[(x,y) \sim (y,x)\right] \quad \mathcal{C}_2^{2D} \cong \mathbb{R}^2 \backslash \{(0,0)\} \times \mathbb{R}^2 \quad \mathcal{C}_2^{3D} \cong \mathbb{P}^2(\mathbb{R}) \times (0,\infty) \times \mathbb{R}^3$$

$$\pi_1\left(\mathcal{C}_2^{1D}\right) \cong \mathbb{Z}_1 \qquad \pi_1\left(\mathcal{C}_2^{2D}\right) \cong \mathbb{Z} \qquad \pi_1\left(\mathcal{C}_2^{3D}\right) \cong \mathbb{Z}_2$$
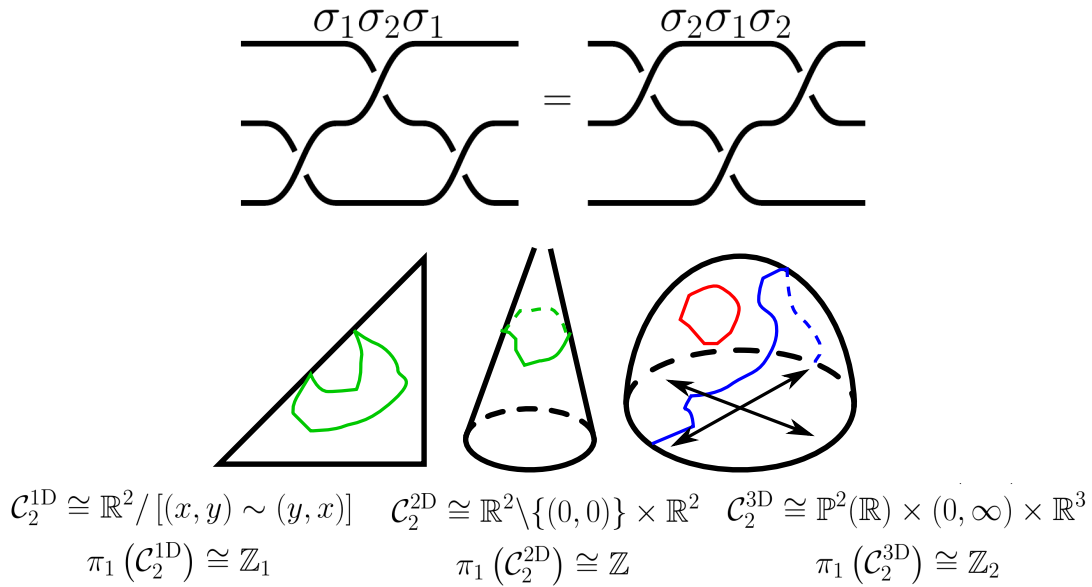
FIG. 1. (bottom) The basic mathematical concepts of anyons in 1D and 2D include configuration spaces and homotopy groups. (top) Well known in this context is Artin's braid group and the Yang-Baxter equation.