Homotopy Physics and Path Integral Formulation

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In the Path Integral Formulation[1] of Quantum Mechanics[2], paths are functions of type:

$$I \to \mathbb{C}^M$$

$$I <=> \mathbb{R} \wedge (>= 0) \wedge (<= 1)$$
$$M : nat$$

`I` is a shorthand for the unit interval and `M` is some natural number.

The paths are continuous maps.

Homotopy Physics[3] extends the notion of paths into homotopy[4] paths, which are functions of type:

$$I^N \to \mathbb{C}^M$$

$$N : nat$$
$$M : nat$$

Both `N` and `M` are natural numbers.

References:

[1] “Path integral formulation”
Wikipedia
https://en.wikipedia.org/wiki/Path_integral_formulation

[2] “Quantum mechanics”
Wikipedia
https://en.wikipedia.org/wiki/Quantum_mechanics

[3] “Homotopy Physics”
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https://github.com/advancedresearch/path_semantics/blob/master/papers-wip/homotopy-physics.pdf

[4] “Homotopy”
Wikipedia
https://en.wikipedia.org/wiki/Homotopy