

## Evolution of Nielsen-Olesen's String from Chern-Simons Field Theory

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**Abstract:** We study the topology of Nielsen-Olesen's local field theory of single dual string. Based on the Chern-Simons field theory in three dimensions, we find many strings that can form world sheets in four dimensions. These strings have important relation to the zero point of the complex scalar field. These world sheets of strings can be expressed by the topological invariant number, Hopf index, and Brower degree. Nambu-Goto's action is obtained from the Nielsen's action definitely by using  $\varphi$ -mapping theory.

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**Key words:**  $\varphi$ -mapping theory, dual string, Nambu-Goto's action, Hopf index, Brower degree

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