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$(p-1)$-Bracket for Dp-branes in Large R-R Field Background

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The volume-preserving diffeomorphism is a key feature that characterizes the large constant R-R $(p-1)$-form field background in a Dp-brane theory. It represents a symmetry of the theory that preserves the volume of space. To describe this symmetry, we introduce the concept of the $(p-1)$-bracket, which generates the volume-preserving diffeomorphism. The $(p-1)$-bracket is a mathematical operation that acts on $(p-1)$-forms and encodes the transformation of the background field under the symmetry. To generalize the $(p-1)$-bracket, we can apply it to the non-Abelian one-form gauge field, which is relevant in gauge theories with non-Abelian gauge groups. This allows us to extend the concept of volume-preserving diffeomorphism and its associated symmetry to non-Abelian gauge theories. When considering D-branes and T-duality, we introduce the transverse coordinates of the branes. T-duality is a symmetry transformation that relates String Theory compactified on different backgrounds. It exchanges the momentum and winding modes of strings and leads to an equivalence between theories with different numbers of dimensions. By incorporating T-duality and the generalized bracket, a general expression for the action in Dp-branes can be derived when $p \leq 6$. This result connects the existing construction of Dp-branes with our generalized bracket, illustrating the relationship between the symmetry and its associated transformations and the dynamics of the branes. In addition, we can discuss the non-Abelianization of the $(p-2)$-form gauge potential. This process involves generalizing the concept of non-Abelian gauge fields to higher-form gauge potentials. By extending the Lagrangian description of a single D-brane to multiple D-branes, a similar Lagrangian description can be established for both cases, highlighting the common underlying structure and symmetry properties. Our developments demonstrate the interplay between symmetries, gauge fields, and D-brane dynamics, providing a deeper understanding of the underlying principles within D-branes.

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