Abstract

In this master’s thesis we review recent developments in our understanding of the topological character of $D$-branes. As suggested in the title this is to be viewed as a starting point for the study of more sophisticated aspects of what has become referred to as String Topology. Starting from the notion that $D$-branes act as sources for the RR-fields in Supergravity we argue, using the anomaly canceling argument of [CY] [GHM] [MM], that their charges take values in the $K$-groups of spacetime. This argument is refined and reformulated, following [Wit2], by incorporating Sen’s work on tachyon condensation and brane/anti-brane annihilation to argue that all lower dimensional branes can be seen as the decay product of a stack of $N D9$ and $N \overline{D9}$-branes. As a consequence we arrive at a direct geometric interpretation of the notion that the RR-charge of a $D$-brane, and hence its topological stability, is given by a class in the relative group $K(X; Y)$ where $X$ is the spacetime manifold and $Y$ is the complement, in $X$, of a tubular neighborhood of the $D$-brane world-volume. These arguments only hold in the case when the cohomology class of the three-form field-strength, $H$, is trivial. In the final section of this thesis we review modifications of this argument required in order to incorporate non-trivial field-strengths, $H$, and we will say something about their consequences. The focus will mostly be on the torsion case following [Kap].

There are several other review papers available in this area [OS] [Wit4]. This review differs from these mostly in its level and its scope. It is intended to be relatively pedagogical (as its length will attest to) aiming at graduate students with a basic knowledge of string theory. It also attempts to cover the major developments in the early part of this field which are often neglected in other reviews.