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In string theory there are also higher dimensional objects, such as Dirichlet p-branes, where p counts the spatial dimensions. A D-brane is defined as a hypersurface where an open string can end. Type IIA (IIB) string theory admits Dp-branes for even (odd) p. They are charged non-perturbative objects and play a key role in various string dualities. Type IIA (IIB) contains also Dp-branes for odd (even) p which are uncharged and expected to be unstable against decay to the vacuum. In addition, a system of D-brane anti-D-brane pair and any dimensional bosonic D-brane are uncharged unstable configurations.

In this thesis we start by studying basic properties of stable BPS Dp-branes in Type II string theories. D-branes are found to be dynamical rather than rigid objects, when the open string excitations are taken into account. It has been proposed that the low-energy dynamical behavior of D-branes is correctly described by the fully supersymmetric Dirac-Born-Infeld action. D-branes are heavy objects, hence they curve spacetime around them. In this thesis we also study the corresponding supergravity solutions.

Having learned some essential properties of stable D-branes, we proceed to unstable configurations. The instability is manifested as a state with $m^2 < 0$ in the spectrum of open strings, a tachyon. An unstable D-brane configuration is supposed to decay as the tachyon rolls down from the maximum of its potential, the unstable vacuum, to the minimum, the stable vacuum. This process is called the tachyon condensation. We review Sen's approach to tachyon condensation and outline the static properties of unstable D-brane configurations.

Tachyon condensation as a time-dependent process has attracted attention only recently. Since D-branes act as sources for various closed string fields, a time-dependent open string field configuration such as the rolling tachyon solution acts as a time-dependent source for closed string fields, and produces closed string radiation. We review the tree level computation by using standard techniques of conformal field theory. For unstable bosonic Dp-branes with $p \leq 2$ we observe that the total energy carried by the closed string radiation is infinite. However since the initial Dp-brane has finite energy it is appropriate to regulate this divergence by putting an upper cutoff on the energy of the emitted closed string. A natural choice of this cutoff is the initial energy of the D-brane. In that case all the energy of the D-brane is radiated away into closed strings.

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