**STRING THEORY**

In Physics, ‘String Theory’ is a theoretical framework in which the point like particles of particle-physics are replaced by the one-dimensional objects called strings. String theory describes how these strings propagate through space and interact with each other. String theory proposes that the fundamental constituents of the universe are one-dimensional strings, rather than the point-like particles. String theory also requires six or seven extra dimensions of space and it contains ways of relating large extra dimensions to the small ones. The names of five string theories are : Type 1, Type IIA, Type IIB, SO(32) heterotic and E8xE8 heterotic.

On larger scales, larger than the string scale, a string looks just like an ordinary particle with its mass, charge and other properties determined by the vibrational state of the string. In string theory one of the many vibrational states of the string corresponds to the graviton, a quantum mechanical particle that carries the gravitational force – thus, string theory is the theory of quantum gravity. String theory is a broad and varied subject that attempts to address a number of deep questions of fundamental physics. String theory has contributed a number of advances to mathematical physics which have been applied to a variety of problems in black hole physics, early universe cosmology, nuclear physics and condensed matter physics by stimulating a number of major developments in pure mathematics. It is because string theory potentially provides a unified description of gravity and particle physics – it is a candidate for a theory of everything, a self-contained mathematical model that describes all fundamental and forms of matter. Despite much work on these problems, it is not known to what extent string theory describes the real world or how much freedom the theory allows in the choice of its details.

String theory was first studied in the late 1960s as a theory of the strong nuclear force, before being abandoned in favour of quantum chromodynamics. Subsequently it was realised that the very properties that made string theory, unsuitable as a theory of nuclear physics, made it a promising candidate for a quantum theory of gravity. The earliest version of string theory, bosonic string theory incorporated only the class of particles known as bosons. It later developed into the superstring theory, which posits a connection called the super-symmetry between bosons and the class of particles called fermions. Five consistent versions of superstring theory were developed before it was conjectured in the mid-1990s that they were all different limiting cases of a single theory in 11 dimensions known as M-theory. In late 1997, theorists discovered an important relationship called the Ads/CFT correspondence, which relates string theory to another type of physical theory called quantum field theory. One of the challenges of the string theory is that the full theory does not have a satisfactory definition in all circumstances. Another issue is that the theory is thought to describe an enormous landscape of possible universes’ which has complicated efforts to develop the theories of particle physics, based on the string theory. These issues have led some in the community to criticise these approaches to Physics and to question the value of continued research on unification of the string theory.

John Schwarz and Andre Neveu of Princeton University created such a reformulation of string theory. The name string theory comes from the modelling of subatomic particles as tiny one-dimensional ‘stringlike’ entities rather than the more conventional approach in which they are modeled as zero-dimensional point particles. The new string theory had the advantage that it did not require for consistency with special relativity and quantum theory the existence of a tachyon and a world of 26 dimensions. A new theory called Quantum Chromodynamics, today remains our theory of the strong nuclear force and as for string theory, it mostly faded into the background and finally today that string theory also remains, still attempting to explain the strong force and so much more.

Both scientific laws and theories are considered as scientific fact. However, theories and laws can be disproven when new evidence emerges. String theory turns the page on the standard description of the universe by replacing all matter and force particles with just one element : Tiny vibrating strings that twist and turn in complicated ways that from our perspective look like particles. The mathematics necessary to solve the theory have not yet been discovered because string theory has near-miraculous breakthroughs every 8 to 10 years, we can expect 2 more breakthroughs in the theory before 2020 and hence might be able to solve this theory by then. If there is no super-symmetry at all energies, string theory must be wrong. For another string theory, even in only 10 dimensions, does not give you real General Relativity as the theory of gravity, but rather a 10-dimensional Brans-Dicke theory of gravity. String theory has so far failed to live up to its promise as a way to unite gravity and quantum mechanics. At the same time, it has blossomed into one of the most useful sets of tools in science.

In addition of being an idea of considerable theoretical interest, string theory provides a framework for constructing models of real world physics that creates a combination between particle physics and general physics. Here comes Phenomenology, the branch of theoretical physics where physicists construct realistic models of nature from more abstract theoretical ideas. String Phenomenology is the part of the string theory that attempts to construct realistic or semi-realistic models based on string theory. Partly because of theoretical and mathematical difficulties and partly because of the extremely high energies needed to test these theories experimentally, there is so far no experimental evidence that would unambiguously point to any of these models being a correct fundamental description of nature. Thus, some in the community to criticise these approaches for unification and question the value of continued research on these problems.

One approach for formulating string theory and studying its properties is provided by the Anti de Sitter/ Conformal Field Theory (AdS/CFT) correspondence. This is a theoretical result which implies that string theory is in some cases equivalent to a quantum field theory. In addition of providing insights into the mathematical structure of string theory, the AdS/CFT correspondence has shed light on many aspects of quantum field theory in regimes where traditional calculative techniques are ineffective. The AdS/CFT correspondence was first proposed by Juan Maldacena in late 1997. Important aspects of these correspondence were elaborated in articles by Steven Gubser, Igor Klebanov, Alexander Markovich Polyakov and Edward Witten. By 2010, Maldacena’s article had over 7000 citations, becoming the most highly cited article in the field of high energy physics.

At the heart of string theory there is a thread of an idea, running through Physics for a century – that at some fundamental level all the different forces, particles, interactions and manifestations of reality are tied together as part of the same framework. Instead of four independent fundamental forces (strong, electromagnetic, weak and gravitational) there is only one unified theory that encompasses all of them. In many regards string theory is considered as the best contender for quantum theory of gravitation which just happens to unify at the highest energy scales. Although there is no experimental evidence for it, there are compelling theoretical reasons to think it might be true.