Re: Quantum Phase Compactification via Spacetime Expansion

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It is, in essence, a complementary duality.

−−−−>|U|<−−−−

is the same as:

<−−−−|U|−−−−>

T−duality proposes that the winding particles for a circle of radius R are the same as the "vibration" particles for a circle of radius 1/R, and vice versa. The two two sets of particles are in a sense, indistinguishable: theoretically speaking, a large compact dimension appears to give the same particles as a thin one.

T−duality, if true, has interesting consequences. There has been a long conceptual struggle, by theorists, to understand reality at the extremely small scales near the Planck length at 10^35 meters. The supposition has always been that the laws of nature break down at the extreme micro scales. T−duality basically suggests that that at the Planck scales, the universe looks just the same as it does at large scales. One may even imagine that if the universe were to shrink to less than the Planck length, it would simultaneously transform as an expanding space−time of macroscopic dimensions.

When four of the 10 dimensions compactify, or "curl up" and the five−brane wraps around them, the latter ends up as a one−dimensional object described as a solotonic string in six−dimensional space−time. In addition, a fundamental string in 10 dimensions remains fundamental even in six dimensions. So the concept of duality between strings and five−branes gives another interesting conjecture, which is a duality between a solitonic string and a fundamental string.

When the six−dimensional space−time is reduced to four dimensions, via the compactification of two dimensions: the fundamental string and the solitonic string each inherit a T−duality. Consequently, the T−duality of the solitonic string is just the S−duality of the fundamental

string, and vice versa; an S−duality transformation maps states with coupling constant g in one theory to states with coupling constant 1/g in the dual theory. It exchanges the electric and magnetic fields, and the electrically charged particles with magnetic monopoles.

Where the interchange of charges in one picture is just the inversion of length in the dual picture, is named the Duality of Dualities by string theory. It is puts the previously shaky S−duality on as firm a footing as the well−established T−duality. In addition, it predicts that the strength at which objects interact, i.e. their charges, corresponds to the size of the invisible dimensions. What is charge in one universe of radius 1/R may be size in its dual universe of radius R.