On the Dimensional Structure of String Theory

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09 January 2025

Abstract

This paper presents a new decomposition of the dimensions in String Theory, specifically in Bosonic String Theory and M-theory, which highlights the redundancy in the theory. By focusing on a symmetrical decomposition, I propose a more natural description of the structure of the Universe, one that aligns with the holographic principle underlying the AdS/CFT correspondence [1].

1. Proposed Decomposition

The standard dimensional breakdowns in String Theory are typically expressed as:

$26 = (3 + 1) + 22$	25 spatial and 1 time dimensions [2]
$11 = (3 + 1) + 7$	10 spatial and 1 time dimensions [3]

I propose a refined and symmetric decomposition:

$26 = (3 + 1) + (3 \times A + 1)$	21 spatial and 5 time dimensions
$11 = (3 + 1) + A$	9 spatial and 2 time dimensions

where $A = 3 \times 2 + 1$.

The overall time T may be represented by:

$$T = \sum_{n=0}^{d-1} i^{2n/d} t$$ where d is the number of time dimensions.

This representation highlights the interplay between real and imaginary components of time, reminiscent of the Wick rotation technique used in QFT [4]. The uniqueness of time t ensures the unified nature of time T despite the multidimensional structure as shown in Appendix, Figures 1 and 2.

2. Observations and Implications

The redundancy in the String Theory decomposition is intrinsic, providing the same information but presented differently [1]. The terms (3+1), (3×A+1) and A overlap in their informational content, each 2d from A being a projection, a collapsed version of the 3d from (3+1). In particular, the redundancy that arises highlights the fact that the particles described in A are the supersymmetric counterparts of the particles described in (3+1), bringing about localized supersymmetry.

By emphasizing a symmetric structure, the new decomposition offers a more refined and cohesive representation, reinforcing the connection between the multiple lower-dimensional descriptions of our Universe and our higher-dimensional Spacetime within String Theory, while providing deeper insight into the fundamental redundant nature of the theory.

3. Appendix

Figure 1 – Representation of the 26 dimensions

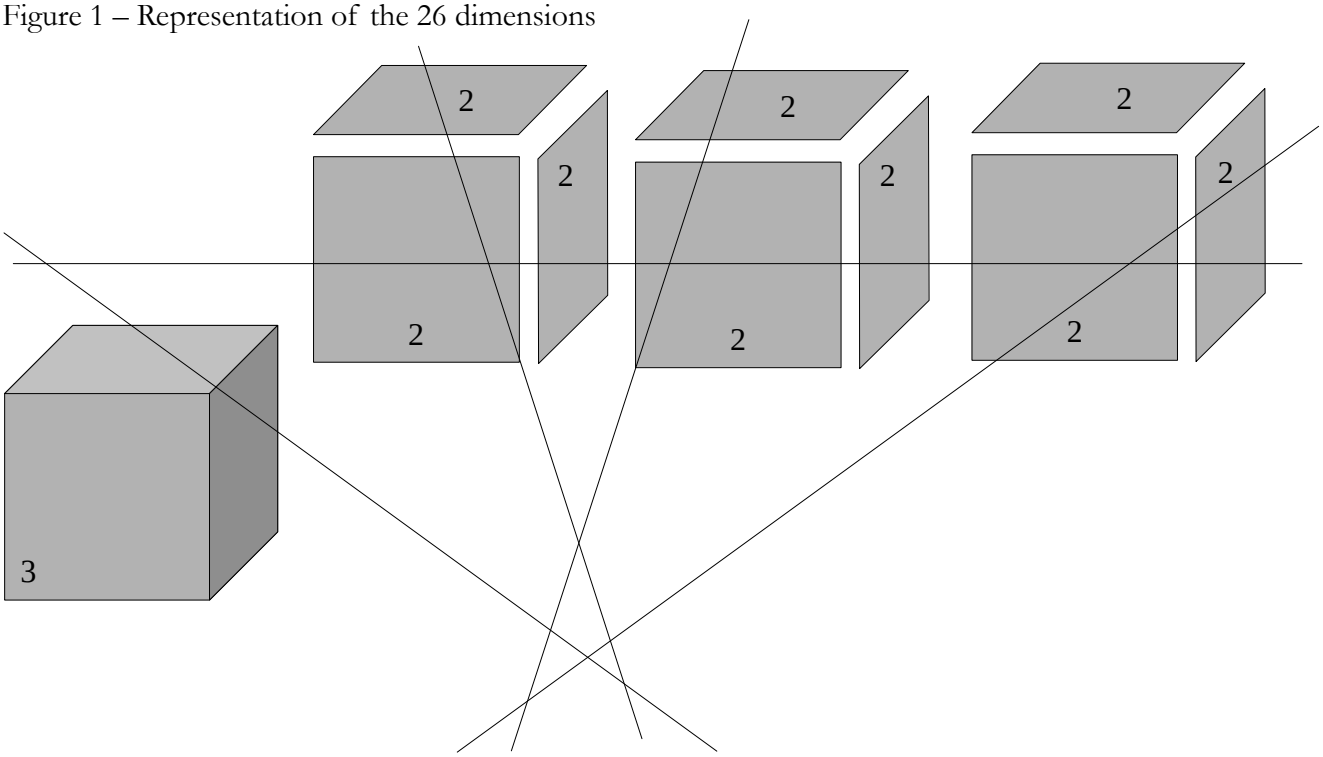
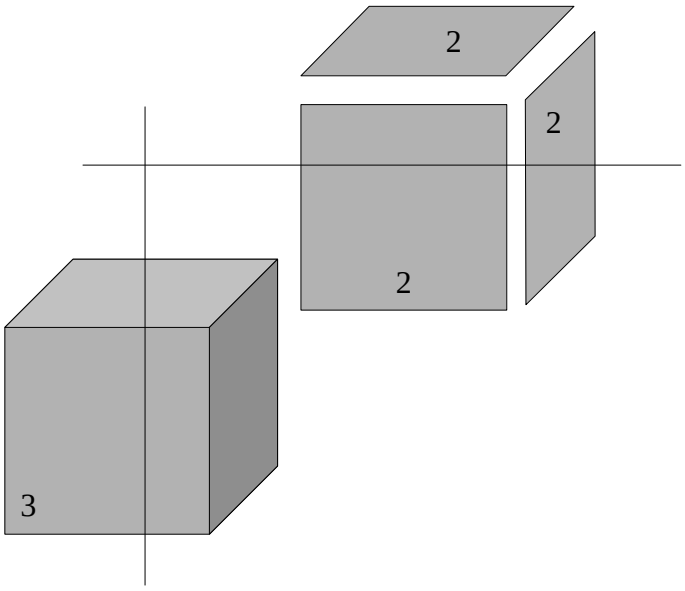


Figure 2 – Representation of the 11 dimensions



4. References

1. Maldacena, J. (1999). The large-N limit of superconformal field theories and supergravity. *International journal of theoretical physics*, *38*(4), 1113-1133.
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