Just a knock on the door

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Final construction of N=8 supergravity:

N = 8 SUPERGRAVITY

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The complete structure of *N* = 8 supergravity is presented with an optional local SO(8) invariance. The SO(8) gauge interactions break E_7 invariance, but leave the local SU(8) unaffected. Exploiting $E_7 \times SU(8)$ invariance and using explicit lowest order results, we first derive the complete action and transformation laws. Subsequently, we introduce local SO(8) invariance and prove the consistency of the theory. Possible implications of our results are discussed.

1. Introduction

Already some years ago, supergravity was introduced in an attempt to fuse gravity with matter interactions in a consistent fashion [1] (for a general review of the subject, see ref. [2]). The largest extended supergravity theory is based on one irreducible multiplet of *N* = 8 supersymmetry, in which the graviton is naturally combined with particles of lower spin. This multiplet is unique in the sense that it is the only *N* = 8 supermultiplet containing maximal spin 2. Hence, the introduction of "matter" multiplets of low spin fields is not possible in this framework. This is just one aspect of the restrictive power of supergravity which makes it such an outstanding candidate for a unified description of elementary particles and their interactions. Local supersymmetry naturally combines particles of different spin and implies gravitational interactions. The balanced decomposition in bosons and fermions has a softening effect on its quantum divergences, thus offering hopes for a consistent quantum theory of gravity and a solution to the so-called hierarchy problem in elementary particle physics. However, its main problem is in making contact with low-energy phenomenology; although several attempts have been made to show that "superunification" is a viable idea, the dynamical structure of these theories is not at all understood, which hampers the construction and investigation of specific unification scenarios.

The world according to Maharishi Mahesh Yogi
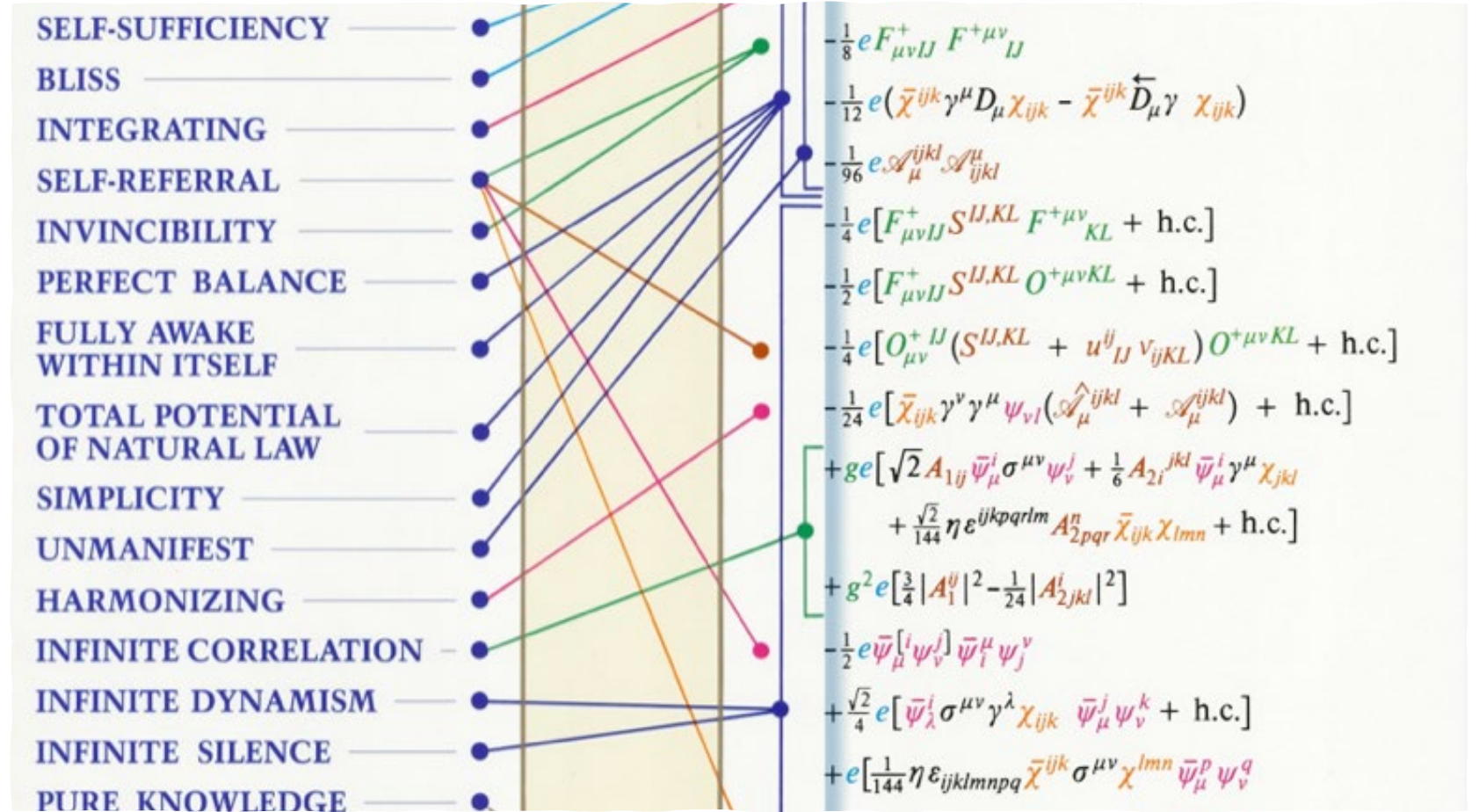
After this work there were many open problems that had to be addressed:

- Was this theory equivalent to the compactified 11-dimensional supergravity?

- Are there more examples of inequivalent dimensional compactifications?

- The first version was gauge-invariant under SO(8). Are there alternative options?

Many people, quite a few are present here, have made important contributions to this amazing area of (theoretical) research.

HAPPY BIRTHDAY HERMANN !!