

Oscillator-Like Unitary Representations of Non-Compact Groups with a Jordan Structure and the Non-Compact Groups of Supergravity

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“Dedicated to Feza Gürsey on the occasion of his 60th birthday”

Abstract. We give a general bosonic construction of oscillator-like unitary irreducible representations (UIR) of non-compact groups whose coset spaces with respect to their maximal compact subgroups are Hermitian symmetric. With the exception of $E_{7(7)}$, they include all the non-compact invariance groups of extended supergravity theories in four dimensions. These representations have the remarkable property that each UIR is uniquely determined by an irreducible representation of the maximal compact subgroup. We study the connection between our construction, the Hermitian symmetric spaces and the Tits–Koecher construction of the Lie algebras of corresponding groups. We then give the bosonic construction of the Lie algebra of $E_{7(7)}$ in $SU(8)$, $SO(8)$ and $U(7)$ bases and study its properties. Application of our method to $E_{7(7)}$ leads to reducible unitary representations.

1. Introduction

Recently, Cremmer and Julia [1] have discovered a set of non-compact invariance groups in the bosonic sectors of $N = 5, 6, 8$ extended supergravity theories in four dimensions, thereby generalizing the non-compact invariance group of the $N = 4$ theory found by Cremmer, Ferrara and Scherk [2]. The vector field strengths in these theories and their duals get transformed into each other under the action of the non-compact group G and form a linear representation, whereas the scalar fields transform non-linearly as the coset space G/H where H is the maximal compact subgroup of G . The full invariance has the form $G_{\text{global}} \otimes H_{\text{local}}$ as in the two-dimensional generalized σ models [3].

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