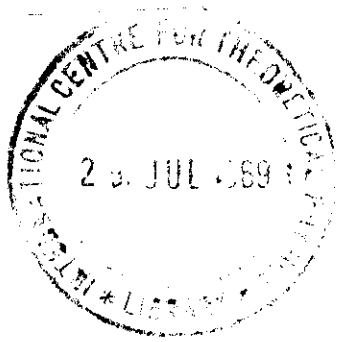

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PHYSICAL IMPLICATIONS OF A NEW QUANTUM NUMBER DERIVED FROM CONFORMAL INVARIANCE *

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From the invariance of relativistic field equations for particles with mass 0 and discrete spin [1] under dilatations and special conformal transformations one is tempted to conclude that these fields also carry a unitary representation of the conformal group [2]. However, a detailed analysis of the conformal group of relativistic space-time and its four-dimensional homogeneous spaces shows that, for example, the mass 0 scalar field in the appropriate (not the usual [3]) conformal compactification of Minkowski space carries a unitary representation not of the conformal group $SO_0(4,2)/C_2$ but of its covering group $SO_0(4,2)$. The invariant definition of causality [4] is given and the unitary representations to mass 0 of the spin-covering group $SU_0(2,2)$ of the conformal group are investigated [5], [6]. The physical consequences are either the existence of a new conserved multiplicative quantum number R for conformal symmetry [7] (the corresponding selection rule would, for example, forbid the process spin $0 \to 2\gamma$ for mass 0 particles, a result which also follows from current algebra), or the prediction that of all mass 0 spin $|s| \leqslant 2$ particles only the γ-quantum, one type of neutrino (the left-handed for example) and a spin 3/2 particle whose helicity has the opposite sign can possibly exist. (This is in good agreement with the experimental facts, as no mass 0 , spin 0 (Goldstone-particle?), spin 2 (graviton?) or right-handed neutrino has been observed.)

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* The results presented at this lecture form part of a paper to be published in "Nuclear Physics".

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