

## A Kaluza-Klein Interpretation of an Extended Gauge Theory

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Recebido em 26 de janeiro de 1987

**Abstract** A possible geometric justification for the inclusion of three vector potentials transforming under a common compact and simple gauge group is presented in terms of the spontaneous compactification of a higher-dimensional theory of coupled Yang-Mills-gravity with non-trivial torsion.

Taking for granted all the benefits stemming from the requirement of local gauge invariance in the formulation of interacting theories for massless and massive spin-1 particles, and adopting the widespread viewpoint of basing the description of the fundamental forces of Nature on local gauge symmetries, our efforts in refs.1,2 have been an attempt to extend the notion of gauge principle through the introduction of more than just one gauge potential in association with a single compact and simple gauge group.

An immediate consequence following from such an approach would be the possibility of having a unified description of massless and massive gauge bosons without the need of introducing families of scalar particles to spontaneously break the gauge symmetry. Issues like the proof of the renormalisability and unitarity for this kind of extended gauge theories have been completed for the U(1)-case. The non-Abelian version is still lacking a better understanding of the structure of the globally conserved currents that are present in the theory along with the local gauge current. This would be an essential step in the programme of proving that possible unphysical modes carried by the extra gauge potentials effectively decouple from the physical amplitudes. In ref. 3, the Hamiltonian quantisation and the construction of a relativistic functional integral are discussed for a massive Yang-Mills model where two gauge potentials are associated with a single non-