

Seminar

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Exact gauge fields from Anti-de Sitter space

Thursday, May 4, 2023

at 13:15 h

ESI, Schrödinger Lecture Hall

Abstract: In 1977 Lüscher found a class of $SO(4)$ -symmetric $SU(2)$ Yang–Mills solutions in Minkowski space, which have been rederived 40 years later by employing the isometry of the 3-sphere with $SU(2)$ and conformally mapping $SU(2)$ -equivariant solutions of the Yang–Mills equations on (two copies of) 4-dimensional de Sitter space dS_4 , which is conformal to a finite cylinder over the 3-sphere. Here we present the noncompact analog of this construction using the equivalence between 3-dimensional anti-de Sitter space AdS_3 with $SU(1,1)$. On (two copies of) AdS_4 —which is conformal to a finite cylinder over AdS_3 —we write down $SU(1,1)$ -equivariant Yang–Mills solutions and conformally map them to Minkowski space. This yields a two-parameter family of exact $SU(1,1)$ Yang–Mills solutions on Minkowski space, whose field strengths are essentially rational functions of Cartesian coordinates. Gluing the two AdS copies happens on a dS_3 hyperboloid in Minkowski space, and our Yang–Mills configurations are singular on a two-dimensional hyperboloid. This renders their action and the energy infinite, although the field strengths fall off fast asymptotically except along the lightcone. We also construct Abelian solutions, which share these properties but are less symmetric and of zero action, and also illustrate their energy density and field lines.

H. Steinacker

April 21, 2023