

A physics dictionary

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Anti de Sitter spacetime: A maximally symmetric spacetime with negative (Ricci) curvature.

Boson: A particle described in field theory by a field that takes values in a bundle of the form $TM^{\otimes r} \otimes T^*M^{\otimes s}$ and subbundles thereof over the space-time manifold M .

Compactification: Making a space compact. More general, converting a theory living in $n + d$ dimensions to a theory living in d dimensions. In string theory spacetime needs 10 dimensions. One way to ensure the inobservability of the 6 dimensions that seem to be too much is to impose a local geometry of the form $M_4 \times K$ with M_4 four-dimensional and K six-dimensional. Making K small ensures that we need large energies to see the direct product structure.

Configuration: A time-independent solution to the equations of motion.

De Sitter spacetime: A maximally symmetric spacetime with positive (Ricci) curvature.

Equations of Motion: Equations that describe the dynamics of quantities of interest. Mostly, they are differential equations.

Field Theory: Formalism in which quantities of interest are described by functions and sections of some bundles over the (smooth) manifold of space or spacetime.

Field strength: The curvature of a connection.

Fermion: A particle described in field theory by a field that takes values in a bundle of the form $TM^{\otimes r} \otimes T^*M^{\otimes s} \otimes Spin(g)$, where $Spin(g)$ denotes the spin bundle of g , and subbundles thereof over the space-time manifold M with metric.

Fermionic index: Index used to denote components of a spinor (=fermion) field with respect to some local basis for the sections of the spin bundle.

Gauge field: A connection ∇ on a bundle $E \rightarrow M$ can be locally written as $d + A$ where $A \in \text{End}(E) \otimes T^*M$. The object A is called the gauge field.

Gauge symmetry: In field theory, any symmetry that is related to a vector bundle. More specific, the structure group of a vector bundle. Thus relates to principle bundle. NB: symmetry means a group leaving some structure invariant. More classically, a gauge symmetry is a symmetry that arises when there observers can make a certain choice; the symmetry that describes the transitions to different (gauge) choices is the gauge symmetry.

Infinitesimal: Working with first order variations. Thus, for group actions, the infinitesimal transformations describe the action of the Lie group.

Maximally symmetric spacetime: spacetime with the maximal number of isometries, which equals the maximal number of Killing vectors, which in dimension n is $n(n - 1)/2$.

Metric: Just like a metric in mathematics, but we allow non-positive definite metrics. Thus a metric in physics is a nondegenerate symmetric bilinear form.

Minkowski spacetime: A maximally symmetric spacetime with zero (Ricci) curvature.

Multiplet: Representation content for some (Lie) group, Lie algebra and sometimes even for a Lie superalgebra. It is thus a module.

Singlet: A one-dimensional multiplet.

Solution: Solution to the equations of motion.

Spacetime: The smooth manifold that parameterizes the locations and moments that we observe or can observe.

Supergravity: Field theory which contains gravity and supersymmetry. Low energy limits of superstring theory.

Superstring theory: Theory build on the assumptions: (1) Special relativity is valid, (2) quantum mechanics should work, (3) elementary particles are one-dimensional objects.

Supersymmetry: Physical concept in which some fields are grouped together to form a multiplet of some Lie superalgebra, which in the literature are denoted by some \mathcal{N} -number: $\mathcal{N} = 1, 2, 4, 8$. A vacuum state is supersymmetric if it is a singlet of the Lie superalgebra.

Vacuum: Solutions to the equations of motion in a field theory such that the solution has a large symmetrygroup and such that the solution is stable against small perturbations. In many cases the stability can be obtained by minimizing the energy. Some other words to denote the vacuum are *vacuum solution*, *vacuum state* and *vacuum configuration*.