

# Positive energy representations of gauge groups on conformally compactified Minkowski space

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*Gauge groups*  $\text{Aut}(P)$  of vertical automorphisms of a principal bundle  $P \rightarrow M$  arise in gauge theories, such as the Yang-Mills theory used in the standard model of elementary particles.

We aim to classify projective unitary representations of these infinite dimensional Lie groups under a rather natural *positive energy condition*, which expresses compatibility with a finite dimensional group of space-time symmetries acting on the base manifold  $M$ . To some extent, our results reduce the problem to the 1-dimensional case, where  $M$  is the circle and  $\text{Aut}(P)$  is a twisted loop group. Here a complete solution is available in terms of highest weight theory of affine Kac-Moody algebras. If  $M$  is compactified Minkowski space, we obtain in this way a full classification in dimension  $2+1$  and higher, and we recover the familiar picture of two twisted loop groups at null infinity in dimension  $1+1$ . Somewhat surprisingly, our classification also produces representations connected to jets of order at most 2 at infinity, which appear to be new in this context.