Towards Non-Archimedean Superstring Amplitudes

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ABSTRACT

String theory amplitudes are theoretical objects that aim to compute scattering amplitudes of string states. Mathematically, these objects are local zeta functions over local fields such as the real, complex, or p-adic numbers. P-adic string theory emerged in the 1980's, in which p-adic analogs of string amplitudes were studied. For physicists, it is a useful toy model with similarities to real strings. For mathematicians, the amplitudes represent novel and interesting local zeta functions to study. In physics, one constructs theories through what is known as an action, that is a functional of fields that represent particles. Physical states are represented with so called vertex operators. The amplitudes are obtained as the weighted expectation value of the vertex operators, integrating over the fields' function space. This is known as a path integral. Superstrings are a more general type of string theory that includes supersymmetry, an invariance between the description of two types of particles. In this work propose an action for p-adic superstrings. We show that it admits a family of supersymmetric transformations, as well as a description in a superspace approach. From this action we derive the simplest N-point scattering amplitudes. These turn out to be local zeta functions twisted by the p-adic sign function. We show explicitly the case N=4.