# Integrability and String Sigma Models

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Certain conformal field theories and dual string theories appearing in the AdS/CFT correspondence turn out to possess (in the planar limit) hidden symmetries. These allow us to apply the exact methods of integrability to physical questions such as the spectral problem. For the gauge theory this possibility leads to exact results which go beyond the usual perturbation theory. In this seminar we will concentrate on the string theory side of the correspondence.

As a first step we will outline the derivation of the Green-Schwarz string action for the $AdS_5 \times S^5$ background through the coset procedure. After that, we will briefly mention two possible light-cone gauge choices and describe the spectrum of elementary worldsheet excitations for the two resulting backgrounds. The scattering matrix of such excitations is one of the quantities which can be fixed using the symmetry of the problem and some additional physical inputs, such as unitarity, crossing and agreement with perturbation theory. We will focus on the latter and sketch the procedure for computing the worldsheet S-matrix at strong coupling. We conclude the first part of the talk with a summary of the available perturbative results and a list of possible future directions.

In the second part we will review some concepts of classical integrability of two-dimensional sigma-models which appear also for the string on $AdS_5 \times S^5$. We will further present some methods to generate deformations of the worldsheet theories: they correspond to deformations (e.g. squashing) of the target space, and although they (partially) break the original global symmetries they do not spoil the integrable structure. Some new lines of research motivated by the study of deformations of the superstring will be also briefly discussed, including the so called "generalised supergravity equations". We will conclude by mentioning proposals for the interpretation of these deformations from the gauge theory point of view, and some of the open problems.

## Some suggestions

- Review on integrability of the superstring on $AdS_5 \times S^5$ [1]

- Perturbative scattering on the worldsheet [2, 3] and unitarity techniques [4, 5]

- Integrable deformation of the Principal Chiral Model [6] and of the superstring [7, 8, 9]

- Equations of generalised supergravity [10, 11]

## References

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