2d CFT/Gauge/Bethe correspondence and solvable quantum-mechanical systems

Marcin Piatek

Szczecin University & BLTP JINR
Dubna
Russia
piatek@fermi.fiz.univ.szczecin.pl

Joint work with: Franco Ferrari, Artur Pietrykowski

In 2009 Alday, Gaiotto and Tachikawa (AGT) discovered an amazing relationship which, in particular, identifies Virasoro conformal blocks on Riemann surfaces with genus g and n punctures with instanton sectors of Nekrasov partition functions for certain (Omega–deformed) four-dimensional supersymmetric $N = 2$ SU(2) gauge theories. Soon after its discovery, the AGT conjecture has been extended to the SU(N)–gauge theories/conformal Toda correspondence (Wyllard). On the other hand, at the same time Nekrasov and Shatashvili observed that in the limit in which one of the Omega–deformation parameters vanishes the $N = 2$ SU(N) super Yang–Mills theories describe some quantum integrable systems (Gauge/Bethe correspondence). It turns out that the Nekrasov–Shatashvili limit via AGT hypothesis corresponds to the classical limit of conformal blocks. Therefore, one gets the triple correspondence relating two-dimensional conformal field theory (2d CFT) to supersymmetric gauge theories and then to quantum integrable systems. The latter in the simplest case of SU(2) gauge group are just quantum-mechanical systems. This triple correspondence can be applied in particular to study spectra of some Schrodinger operators. In the talk it will be shown how one can get the so-called accessory parameters for Fuchs (with four singularities), Lame and Mathieu equations (cf. talk by A. Pietrykowski) by taking the classical limit of the null vector decoupling equations for conformal blocks, or equivalently, by solving some Bethe-like equations.