

Nonlinear Schrodinger Equation, 2D $N=(2, 2)$ Topological Yang-Mills-Higgs Theory and Their Gravity Dual

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The N -particle sector of the quantum nonlinear Schrodinger equation has been shown to be equivalent to the 2-dimensional topological $U(N)$ Yang-Mills-Higgs theory by Gerasimov and Shatashvili. On the other hand, the 2D topological Yang-Mills-Higgs theory can be viewed as the dimensional reduction of the topologically twisted 4D $N=2$ super-Yang-Mills theory with a mass deformation, which should have a gravity dual. By explicitly constructing the gravity dual theory, we set up the first concrete example of dualities between integrable models, gauge theories and gravity theories. Taking the classical limits, we also demonstrate that the soliton solutions to the nonlinear Schrodinger equation correspond to the D-branes in the gravity theory.