

Results of research

Takeshi Oota

For 1+1 dimensional affine Toda field theories, I introduced the “quantum deformed Coxeter element of the Weyl group” and showed that the structure of the S-matrices can be explained by this element. As a byproduct, the universal form of integral representation of S-matrices is obtained ([7] of Publication List).

For integrable models with diagonal S-matrices, the some of form factors and correlations functions are considered. The functional relations for the minimal form factors and the structure of poles of the form factors are determined ([3]). In a massive perturbation of a series of the minimal conformal field theories, form factors of “off-critical” primary fields are determined and their correlation functions are analyzed. It was found that the two-point correlation functions of these fields have deep connection with the Fredholm determinant of certain operators ([8,9]).

In the low-energy effective theories of the type IIA/IIB superstring, we showed that a special combination of Ramond-Ramond gauge potentials with the NS-NS potentials transforms as a spinor representation under the T-duality group. ([10]).

A free scalar field theory on a cylinder is considered under the non-trivial boundary conditions. The theory has close relation with the tachyon condensation of the string theory. The partition function is determined by using the off-shell boundary state and the zeta function regularization method. The boundary entropy is also determined. Moreover, using supersymmetric sine-Gordon model, we extended the theory to the supersymmetric cases ([12]).

Symplectic potentials are determined for a wide class of toric Sasaki-Einstein manifolds. The spectrum of the scalar Laplacian on $L^{a,b,c}$ metrics are investigated. The eigenvalue problem leads to two Heun’s differential equations. The ground states and first excited states are studied in detail. It turns out that the scaling dimensions of the holomorphic functions which correspond to the ground states are consistent with R -charges of the dual quiver gauge theories ([15]).

We present an explicit non-singular complete toric Calabi-Yau metric using the local solution recently found by Chen, Lü and Pope. This metric gives a new supergravity solution representing D3-branes ([16]).

We construct a new infinite family of quiver gauge theories which blow down to the $X^{p,q}$ quiver gauge theories. This family includes a quiver gauge theory for the third del Pezzo surface. These theories generically have irrational R -charges ([17]).

The kappa-symmetry-fixed Green-Schwarz action in the $AdS_5 \times S^5$ background is treated canonically in a version of the light-cone gauge ([18]).

We explicitly calculate the Riemannian curvature of D-dimensional metrics recently discussed by Chen, Lü and Pope. We find that they can be concisely written by using a single function. It is shown that the metrics are of type D ([19]).