Mathematical Physics

Riemann-Hilbert Problem and Quantum Field Theory: Integrable Renormalization, Dyson-Schwinger Equations

Ali Shojaei-Fard

(Submitted on 15 Nov 2010)

In the first purpose, we concentrate on the theory of quantum integrable systems underlying the Connes-Kreimer approach. We introduce a new family of Hamiltonian systems depended on the perturbative renormalization process in renormalizable theories. It is observed that the renormalization group can determine an infinite dimensional integrable system such that this fact provides a link between this proposed class of motion integrals and renormalization flow. Moreover, with help of the integral renormalization theorems, we study motion integrals underlying Bogoliubv character and BCH series to obtain a new family of fixed point equations. In the second goal, we consider the combinatorics of Connes-Marcolli approach to provide a Hall rooted tree type reformulation from one particular object in this theory namely, universal Hopf algebra of renormalization $H_{\mathbb{U}}$. As the consequences, interesting relations between this Hopf algebra and some well-known combinatorial Hopf algebras are obtained and also, one can make a new Hall polynomial representation from universal singular frame such that based on the universal nature of this special loop, one can expect a Hall tree type scattering formula for physical information such as counterterms. In the third aim, with attention to the given rooted tree version of $H_{\mathbb{U}}$ and by applying the Connes-Marcolli's universal investigation, we discover a new geometric explanation from Dyson-Schwinger equations.

Comments:	Keywords: Combinatorial Hopf Algebras; Connes-Kreimer Renormalization Group; Connes-Kreimer-Marcolli Perturbative Renormalization; Dyson-Schwinger Equations; Hall Rooted Trees; Quantum Integrable Systems; Renormalizable Quantum Field Theory; Riemann-Hilbert Correspondence; Universal Hopf Algebra of Renormalization
Subjects:	**Mathematical Physics (math-ph)**
MSC classes:	05C05, 83C47, 18D50, 05E05, 22E65, 37K25, 37K30, 35Q15, 81T15
Cite as:	**arXiv:1011.3290v1 [math-ph]**

Submission history

From: Ali Shojaei-Fard [view email]
[v1] Mon, 15 Nov 2010 04:59:25 GMT (105kb)