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Open Problems Session:

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Title: *Algebraic structures of the vertex operators of elliptic solitons*

Abstract: We take the KdV equation as an example to explain the problem. For the classical solitons of the KdV equation, it is well known that the τ function can be generated by a vertex operator that corresponds to $A_1^{(1)}$. Here by “elliptic solitons” we mean the soliton solutions living on an elliptic background and being characterized by the Lamé function (instead of the usual exponential functions). Recently we found how the elliptic solitons of the KP, KdV and Boussinesq equation are formulated in bilinear method, and their τ functions can be generated by the “elliptic type” vertex operators [J. Nonlinear Science, 32 (2022) No.70]. However, so far it is not known how such “elliptic type” vertex operators can be connected to any affine Lie algebras. I will introduce the context of this problem. A more general problem is how such elliptic solitons can be formulated in Sato’s theory.