1 Referee Report

This paper contains a very interesting study of the quantisation of models which are abelian Yang-Baxter deformations of the $AdS^5 \times S^5$ superstring theory. For a sub-class of these models an S-matrix scheme is setup and the relationship with Drinfeld twists is established, while for another example the authors find obstacles in defining an S-matrix due to the impossibility of eliminating the worldsheet coordinate dependence.

The paper is written very clearly. It also contains a sufficient amount of novel material in my opinion to grant its publication. The study is very nice and of definite interest.

I do not really have any request, but rather a set of points which the authors may or may not decide to take on board, or in fact to answer. I do not make the addressing of these points a condition for my recommendation, but I consider them merely as an opportunity for interesting discussion.

1. Above formula (2.6), it is said that "As A and B are operators, the boundary conditions are operator valued." Perhaps it might be helpful to slightly expand on what it means to have operator-valued boundary conditions, on what would otherwise appear to be ordinary fields.

2. Formula (3.18) - it might be helpful to slightly clarify how this is in fact an independent test. Starting from a twisted S-matrix one obtains twisted Bethe equations, but that does not naively seem to be an independent test, so another ingredient must be entering at this point.

3. Below (4.17) it is said that "However this completely removes the deformation form the Lagrangian and shifts it into the boundary conditions of the model'.' I seem to fail to understand why this is portrayed as a negative thing - what would then be the consequent problem with this conclusion?

4. In the Conclusions, it is said that "Interestingly, the resulting S matrix satisfies not the usual, but a shifted version of the (quantum) Yang-Baxter equation." This seems quite a significant issue - perhaps the authors could expand a bit more, especially on the impact this has on integrability.