Research plan

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From the perspective of mathematical physics, I will conduct research on integrable systems in field theory and statistical mechanics. For the time being, my goal is to complete the ongoing research related to quantum integrable models associated with quantum affine superalgebras and super-Yangians.

It is known that there are correspondences between representations of different superalgebras. Therefore, it is expected that there are also correspondences between quantum integrable models associated with different superalgebras. A relatively well-known example is the Izergin-Korepin model associated with $U_q(sl(3)^{(2)})$ and the quantum integrable spin model associated with $U_q(osp(1|2)^{(1)})$, which share very similar structures. Keeping this in mind, I have provided Bethe ansatz equations, QQ-relations (functional relations satisfied by Baxter Q-functions), and T-functions (eigenvalue formulas of transfer matrices) for quantum integrable spin models associated with $U_q(gl(2r+1|2s)^{(2)})$, $U_q(gl(2r|2s+1)^{(2)})$, $U_q(gl(2r|2s)^{(2)})$, $U_q(osp(2r|2s)^{(2)})$, $U_q(osp(2r+1|2s)^{(1)})$, and $U_q(osp(2r|2s)^{(1)})$ (and their Yangian counterparts $Y(osp(2r+1|2s))$, $Y(osp(2r|2s))$) as reductions (a kind of folding) of those associated with $U_q(gl(M|N)^{(1)})$.

To clarify the representational meaning of these results and provide proof, I aim to construct Baxter Q-operators concretely, and realize T-functions as operators using Baxter Q-operators. In particular, I want to construct the q-oscillator representation of the quantum affine superalgebras necessary for this purpose. I also wish to investigate extensions to other quantum superalgebras such as $U_q(D(2,1;\alpha)^{(1)})$, $U_q(G(3)^{(1)})$, and $U_q(F(4)^{(1)})$, as well as their connections with higher-dimensional integrable models.