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High Energy Physics - Theory

Integrability vs Supersymmetry: Poisson Structures of The Pohlmeyer Reduction

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We construct recursively an infinite number of Poisson structures for the supersymmetric integrable hierarchy governing the Pohlmeyer reduction of superstring sigma models on the target spaces $AdS_{n} \times S^n$, n=2,3,5. These Poisson structures are all non-local and not relativistic except one, which is the canonical Poisson structure of the semi-symmetric space sine-Gordon model (SSSSG). We verify that the superposition of the first three Poisson structures corresponds to the canonical Poisson structure of the reduced sigma model. Using the recursion relations we construct commuting charges on the reduced sigma model out of those of the SSSSG model and in the process we explain the integrable origin of the Zukhovsky map and the twisted inner product used in the sigma model side. Then, we compute the complete Poisson superalgebra for the conserved Drinfeld-Sokolov supercharges associated to an exotic kind of extended non-local rigid 2d supersymmetry recently introduced in the SSSSG context. The superalgebra has a kink central charge which turns out to be a generalization to the SSSSG models of the well-known central extensions of the N=1 sine-Gordon and N=2 complex sine-Gordon model Poisson superalgebras computed from 2d superspace. The computation is done in two different ways concluding the proof of the existence of 2d supersymmetry in the reduced sigma model phase space under the boost invariant SSSSG Poisson structure.

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