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Hidden Fermionic Symmetry in Conformal Topological Field Theories

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Abstract. We point out that bosonic conformal coset models $G_l \times G_k/G_{l+k}$ for all semi-simple Lie algebras G have a hidden fermionic symmetry at $l=0$ (the central charge $=0$) and may be interpreted as twisted versions of some superconformal theories.

In a previous communication we pointed out that a series of $c=0$ conformal models of the $SU(2)$ GKO coset construction may be interpreted as a twisted version of $N=2$ minimal superconformal theories [1]. When a conformal model has a vanishing central charge $c=0$, it no longer depends on the complex structure of the Riemann surface and becomes a topological field theory. It turned out [2] that the twisted $N=2$ minimal theories reproduce the results of the matrix models [3] when coupled to gravity and thus twisted $N=2$ models appear to play some basic role in the theory of 2 dimensional gravity.

In this article we would like to generalize our previous treatment and ask if a bosonic coset model $G_l \times G_k/G_{l+k}$ based on a general Lie algebra G has a hidden fermionic symmetry at $c=0$ ($l=0$). We point out that in the case of a Lie algebra G which yields a hermitian symmetric space $G/H \times U(1)$ when a suitable subgroup H is chosen, G-coset model is identified as the twisted version of superconformal (Kazama–Suzuki) model [4] based on the hermitian symmetric space $G/H \times U(1)$. On the other hand in the case of Lie algebras G_2, F_4, E_8 which do not yield hermitian symmetric spaces, we find a new way of constructing fermionic symmetry. We identify the bosonic coset models as the twisted version of the $N=1$ supercoset theories based on the Wolf spaces $G/H \times SU(2)$. Thus all bosonic coset models with vanishing central charge have a hidden fermionic symmetry. Furthermore some of the coset models are identified as the twisted versions of not one but several superconformal theories at the same time.

Let us first briefly recall our previous observation on the $SU(2)$ GKO coset