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The superconformal anomaly in the 1 + 1 dimensional Wess-Zumino model

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Abstract. The superconformal trace anomaly is worked out to one-loop order in perturbation theory for the 1 + 1 dimensional Wess-Zumino model.

Keywords. Wess-Zumino model; one + one dimensions; superconformal anomaly.

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1. Introduction

There is now a considerable literature on the anomaly associated with superconformal invariance in supersymmetric theories in 3 + 1 dimensions (Lukierski 1977; Curtright 1977; Abbott *et al* 1977; Hagiwara *et al* 1980; Espriu 1985). The classical conservation law associated with this invariance viz $\gamma^\mu J_\mu = 0$ is broken by quantum corrections and the resulting anomaly has been computed via perturbation theory (Abbott *et al* 1977; Hagiwara *et al* 1980; Espriu 1985) as well as using the normal product method (Clark *et al* 1978).

This paper is a sequel to our recent study (Kamath 1987, hereafter referred to as I) on the trace anomaly associated with broken scale invariance in the 1 + 1 dimensional Wess-Zumino model. The model, with dimensional coupling constants and non-zero mass terms for the fields, exhibits explicit breaking of superconformal invariance classically; thus we have $\gamma^\mu J_\mu = i\sqrt{2}(-\lambda + \mu H + (3g/2)H^2)\psi$ in this case. However, just as in I, this relation becomes anomalous on inclusion of quantum corrections. To one-loop order, as we shall show below, we obtain

$$\gamma^\mu J_{\mu\,\mathrm{anom}} = \gamma^\mu J_\mu + \frac{3ig}{\sqrt{8\pi}}\psi.$$

Here ψ, H are the fields that occur in the lagrangian density for the model, with μ, g and λ being the dimensional coupling constants. For completeness, we record here the corresponding trace anomaly for the Belinfante energy-momentum tensor worked out in I; it reads as

$$\theta^{B\mu}_{\mu\,\mathrm{anom}} = \theta^{B\mu}_{\mu} - \frac{3g}{4\pi}F.$$

The computation of the superconformal anomaly here imitates the approach adopted