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Topological string as massive spinning particle in three dimensions

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A model is proposed for a classical bosonic string in d=3 Minkowski space with an action functional that includes Gauss and mean world-sheet curvature. The Lagrangian is invariant under 3d Poincaré transformations modulo total divergence. In addition to the diffeomorphism, the action enjoys the extra gauge symmetry with the second derivatives of the scalar gauge parameter. This symmetry gauges out all the local degrees of freedom (DoF's), while some global DoF's survive. The Hamiltonian constrained analysis confirms that the model does not have any local DoF. The world sheet of the string turns out to be a cylinder with time-like axis. The global DoF's of this string describe one single irreducible massive 3d particle with spin. The particle momentum is a conserved vector directed along the cylinder axis while the momentum square is a fixed constant determined by the parameters in the action. The total angular momentum is a conserved vector that defines the position of the axis of the cylinder whose specific value is defined by initial data, while the spin, being the product of momentum and angular momentum is fixed by the parameters in the string Lagrangian.

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