This article is one of the series of papers on recently proposed off-shell formulation of conformal supergravity in three dimensions [1]. The formulation adopts an algebraic approach, that is, it is based on the $\mathcal{N}$-extended superconformal algebra in superspace, with modifications required by gauge invariance and covariant constraints. In [2] this formulation, what is called the superform formulation by the authors, is applied to obtain off-shell actions for three-dimensional conformal supergravity. The results reproduce well-known actions in literature [3, 4] for the case of $\mathcal{N} = 1, 2$ and also give new forms of off-shell actions for $\mathcal{N} = 3, 4$ and 5. The new forms are consistent with previously known results [5] on $\mathcal{N} = 4$ three-dimensional massive supergravity.

In this article, the authors further consider inclusion of matter coupling terms in the $\mathcal{N}$-extended three-dimensional supergravity in the framework of [1], in a way to reframe the the earlier work [6]. The idea to obtain the supergravity-matter actions in this article is to construct Chern-Simons actions in the superform formulation and to derive linear multiplet actions out of them. The linear maltiplet actions are then given for $\mathcal{N} \leq 4$ and careful studies in relation to anti-de Sitter supergravity and topological massive gravity are carried out in the cases of $\mathcal{N} = 3$ and 4. The authors also comment on possible connection to Chern-Simons matter theories in harmonic superspace in three dimensions [7].

The main contents of the article is technical and rather lengthy due to the nature of this particular subject. Those readers who are unfamiliar to the superform formulation would find it difficult to get through the whole paper but it should be noted that the supergravity-matter actions obtained in this paper suggest a new and universal formulation of topologically massive supergravity theories which possibly provides novel technical tools for modern cosmology.

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