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Spontaneous Breaking and Flat directions in Supersymmetry

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In order to reproduce the CMB density fluctuations, inflationary models require an inflaton scalar field ϕ such that the potential is sufficiently flat near $\phi = 0$, and acquires a large curvature around the minimum. In supersymmetric models these flat directions appear naturally in the superpotentials, finding conditions on the fields so the F and D terms are zero. On the other hand, when supersymmetry is spontaneously broken, these directions gain a large enough curvature to produce the field oscillations required in the inflationary scenario. The supersymmetric formalism is constructed from a Super-poincaré symmetry group composed by a Poincaré Subgroup and a fermionic symmetry subgroup, and it's algebra is given by Coleman-Mandula and Haag-Lopuszanski Sohnius theorems. The representations on fields are obtained through the coset Super-Poincaré/Lorentz and the Lagrangians for scalar and vector fields can be constructed. Hereinafter, conditions for spontaneous breaking of Supersymmetry in the Wess-Zumino, O'Raifertaigh and Fayet-Illiopoulos models are analyzed in order to obtain the mass-spectra of the fields involved. Finally, two simple superpotentials for the inflaton are showed to fulfill asymptotic behaviour that could give rise to inflation.

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