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Realization of a spontaneous gauge and supersymmetry breaking vacuum

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It is one of the major issues to realize a vacuum which breaks supersymmetry (SUSY) and R-symmetry, in a supersymmetric model. We study the model, where the same sector breaks the gauge symmetry and SUSY. In general, the SUSY breaking model without gauge symmetry has a flat direction at the minimum of F-term scalar potential. When we introduce U(1) gauge symmetry to such a SUSY breaking model, there can appear a runaway direction. Such a runaway direction can be lifted by loop effects, and the gauge symmetry breaking and SUSY breaking are realized. The R-symmetry, that is assigned to break SUSY, is also spontaneously broken at the vacuum. This scenario can be extended to non-Abelian gauge theories. We also discuss application to the Pati-Salam model and the SU(5) grand unified theory. We see that non-vanishing gaugino masses are radiatively generated by the R-symmetry breaking and the gauge messenger contribution.

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