

Charged Q-balls in gauge mediated SUSY breaking models

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It is known that after Affleck-Dine baryogenesis, spatial inhomogeneities of Affleck-Dine field grow into non-topological solitons called Q-balls. In gauge mediated SUSY breaking models, sufficiently large Q-balls with baryon charge are stable while Q-balls with lepton charge can always decay into leptons. For a Q-ball that carries nonzero B and L charges, the difference between the baryonic component and the leptonic component in decay rate may induce nonzero electric charge on the Q-ball. This implies that charged Q-ball, also called gauged Q-ball, may emerge in our universe. We investigate two complex scalar fields, a baryonic scalar field and a leptonic one, in an Abelian gauge theory, and we find stable solutions of gauged Q-balls for different baryon and lepton charges. Those solutions shows that a Coulomb potential arises and the Q-ball becomes electrically charged as expected. It is energetically favored that some amount of leptonic component decays, but there is an upper bound on its amount due to the Coulomb force. The baryonic decay also becomes possible by virtue of electrical repulsion and we find the condition to suppress it so that the charged Q-balls can survive in the universe.

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