BARYON AND LEPTON NUMBER VIOLATION WITH SCALAR BILINEARS

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We consider all possible scalar bilinears, which couple to two fermions of the standard model. The various baryon and lepton number violating couplings allowed by these exotic scalars are studied. We then discuss which are constrained by limits on proton decay (to a lepton and a meson as well as to three leptons), neutron–antineutron oscillations, and neutrinoless double beta decay.

Keywords: Neutrinoless double beta decay; operator analysis; proton decay; lepton number violation.

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Grand unified theories (GUTs) appear to be the most natural extensions of the standard model at the very high scale. In GUTs the gauge group is unified, so there is only one single gauge coupling constant to explain all the forces of the quarks and leptons, which are also treated at the same footing. However, the scale of unification is much too high to be directly tested in the laboratory. Thus indirect searches become very important. Many predictions of GUTs were studied, but there is no supporting experimental evidence to date, with the possible exception of neutrinoless double beta decay.\cite{1,2} These GUT predictions also include new particles such as leptoquarks or diquarks and new interactions which violate baryon and lepton numbers. The latter are also required for an understanding of the present baryon asymmetry of the Universe. An observed Majorana neutrino mass also requires