Title:	Standard coupling unification in SO(10), hybrid seesaw neutrino mass and leptogenesis, dark matter, and proton lifetime predictions
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Abstract:	We discuss gauge coupling unification of SU(3) C × SU(2) L × U(1) Y descending directly from non-supersymmetric SO(10) while providing solutions to the three out-standing problems of the standard model: neutrino masses, dark matter, and the baryon asymmetry of the universe. Conservation of matter parity as gauged discrete symmetry for the stability and identification of dark matter in the model calls for high-scale spontaneous symmetry breaking through 126 H Higgs representation. This naturally leads to the hybrid seesaw formula for neutrino masses mediated by heavy scalar triplet and right-handed neutrinos. Being quadratic in the Majorana coupling, the seesaw formula predicts two distinct patterns of right-handed neutrino masses, one hierarchical and another not so hierarchical (or compact), when fitted with the neutrino oscillation data. Predictions of the baryon asymmetry via leptogenesis are investigated through the decays of both the patterns of RHv masses. A complete flavor analysis has been carried out to compute CP-asymmetries including washouts and solutions to Boltzmann equations have been utilised to predict the baryon asymmetry. The additional contribution to vertex correction mediated by the heavy left-handed triplet scalar is noted to contribute as dominantly as other Feynman diagrams. We have found successful predictions of the baryon asymmetry for both the patterns of right-handed neutrino masses. The SU(2) L triplet fermionic dark matter at the TeV scale carrying even matter parity is naturally embedded into the non-standard fermionic representation 45 F of SO(10). In addition to the triplet scalar and the triplet fermion, the model needs a nonstandard color octet fermion of mass ~ 5 × 107 GeV to achieve precision gauge coupling unification at the GUT mass scale M 0 U = 1015.56 GeV. Threshold corrections due to superheavy components of 126H and other representations are estimated and found to be substantial. It is noted that the proton life time predicted by the model is accessible to the ongoing and planned experiments over a wide range of parameter space.
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