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R-parity Conserving Minimal SUSY U(1)x Model

We propose a simple gauged U(1)x extension of the minimal supersymmetric Standard Model (MSSM), where R-parity is conserved as usual in the MSSM. The U(1)_X group is a linear combination of the B-L (baryon number minus lepton number) U(1) and the SM U(1)_Y hyper-charge gauge groups. Three MSSM singlet chiral multiplets with a unit U(1)_X charge are introduced, ensuring the model free from gauge and gravitational anomalies. We assign an odd R-parity for two of the singlet chiral multiplets and hence they are identified with the right-handed neutrino superfields, while an even R-parity is assigned to the other one (Φ). The scalar component of Φ plays the role of a Higgs field to break the U(1)x symmetry through its negative mass squared, which is radiatively generated by the renormalization group running of soft supersymmetry (SUSY) breaking parameters from a high energy. This radiative U(1)x symmetry breaking leads to its breaking scale being at the TeV naturally. Because of our novel R-parity assignment, three light neutrinos are Dirac particles with one massless state. Since R-parity is conserved, the lightest neutralino is a prime candidate of the dark matter as usual. In our model, the lightest eigenstate of the mixture of the U(1)x gaugino and the fermionic component of Φ appears as a new dark matter candidate. We investigate phenomenology of this dark matter particle. We also discuss collider phenomenology of our model. In particular, the U(1)x gauge boson (Z'), once discovered at the Large Hadron Collider, can be a probe to determine the number of (right-handed) Dirac neutrinos with its invisible decay width, in sharp contrast with the conventional U(1)x extension of the SM or MSSM where the right-handed neutrinos are heavy Majorana particles and decay to the SM leptons.

Parallel Session

Supersymmetry: Models, Phenomenology and Experimental Results

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