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Neutralino Dark Matter and Other LHC Predictions from Quasi Yukawa Unification

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We explore the dark matter and LHC implications of t-b-tau quasi Yukawa unification in the framework of supersymmetric models based on the gauge symmetry G=$SU(4)_c \times SU(2)_L \times SU(2)_R$. The deviation from exact Yukawa unification is quantified by a dimensionless parameter C (|C| <~ 0.2), such that the Yukawa couplings at M_GUT are related by y_t:y_b:y_tau=|1+C| : |1-C| : |1+3C|. In contrast to earlier studies which focused on universal gaugino masses, we consider non-universal gaugino masses at M_GUT that are compatible with the gauge symmetry G. We perform two independent scans of the fundamental parameter space, one of which employs ISAJET, while the other uses SoftSusy interfaced with SuperIso. These scans reveal qualitatively similar allowed regions in the parameter space, and yield a variety of neutralino dark matter scenarios consistent with the observations. These include stau and chargino coannihilation scenarios, the A-resonance scenario, as well as Higgsino dark matter solution which is more readily probed by direct detection searches. The gluino mass is found to be <~ 4.2 TeV, the stop mass is >~ 2 TeV, while the first two family squarks and sleptons are of order 4-5 TeV and 3 TeV respectively.

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