High Energy Physics - Phenomenology

Elements of F-ast Proton Decay

Tianjun Li, Dimitri V. Nanopoulos, Joel W. Walker

(Submitted on 12 Mar 2010)

Gauge coupling unification in the Minimal Supersymmetric Standard Model (MSSM) strongly suggests the existence of a Grand Unified Theory (GUT), which could be probed by the observation of proton decay. Proton lifetime in the $p \to {(e|\mu)}^{+} \pi^0$ dimension six mode is proportional in the fourth power to the GUT mass scale, and inversely proportional in the fourth power to the GUT coupling. We provide an updated dictionary of solutions for the relevant unification parameters with generic β-function coefficients, significantly upgrading the level of detail with which second order effects are treated, and correcting subtle published errors. $\mathcal{F}$-lipped SU(5) with strict MSSM field content is known to survive existing null detection limits for proton decay approaching 10^{34} years, and indeed, the lifetime predicted by prior studies can be so long that successful detection is not currently plausible. Recently studied classes of $\mathcal{F}$-theory derived GUT models postulate additional vector-like multiplets at the TeV scale which modify the renormalization group to yield a substantial increase in the $SU(3)_C\times SU(2)_L$ unified coupling. We find the conjunction of these models with the $\mathcal{F}$-resh analysis employed to be comparatively $\mathcal{F}$-ast proton decay, only narrowly evading existing detection limits, and likely falling within the observable range of proposed next generation detectors such as DUSEL and Hyper-Kamiokande. The TeV-scale vector multiplets are themselves suitable for cross correlation by the Large Hadron Collider. Their presence moreover magnifies the gap between the dual mass scales of Flipped SU(5), allowing for an elongated second stage renormalization, pushing grand unification to the doorstep of the reduced Planck mass.

Comments:	45 pages, 7 figures, 12 tables
Subjects:	**High Energy Physics - Phenomenology (hep-ph)**; High Energy Physics - Experiment (hep-ex); High Energy Physics - Theory (hep-th)
Report number:	ACT-03-10, MIFPA-10-09
Cite as:	**arXiv:1003.2570v1 [hep-ph]**

Submission history

From: Joel W. Walker [view email]
[v1] Fri, 12 Mar 2010 16:08:18 GMT (2942kb)

Which authors of this paper are endorsers?