Physics Letters B 718 (2012) 70–74

Contents lists available at SciVerse ScienceDirect

Physics Letters B

www.elsevier.com/locate/physletb

# Testing No-Scale $\mathcal{F}$–$SU(5)$: A 125 GeV Higgs boson and SUSY at the $\sqrt{s} = 8$ TeV LHC

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ARTICLE INFO

*Article history:*
Received 13 July 2012
Received in revised form 22 September 2012
Accepted 26 September 2012
Available online 2 October 2012
Editor: M. Cvetič

ABSTRACT

We celebrate the recent Higgs discovery announcement with our experimental colleagues at the LHC and look forward to the implications that this success will bring to bear upon the continuing search for supersymmetry (SUSY). The model framework named No-Scale $\mathcal{F}$–$SU(5)$ possesses the rather unique capacity to provide a light CP-even Higgs boson mass in the favored 124–126 GeV window while simultaneously retaining a testably light SUSY spectrum that is consistent with emerging low-statistics excesses beyond the Standard Model expectation in the ATLAS and CMS multijet data. In this Letter we review the distinctive $\mathcal{F}$–$SU(5)$ mechanism that forges the physical 125 GeV Higgs boson and make a specific assessment of the ATLAS multijet SUSY search observables that may be expected for a 15 $\text{fb}^{-1}$ delivery of 8 TeV data in this model context. Based on our Monte Carlo study, we anticipate that the enticing hints of a SUSY signal observed in the 7 TeV data could be amplified in the 8 TeV results. Moreover, if the existing signal is indeed legitimate, we project that the rendered gains in significance will be sufficient to conclusively rule out an alternative attribution to statistical fluctuation at that juncture.



We take the occasion of the historic July 4, 2012 joint announcement [1,2] by the Large Hadron Collider (LHC) ATLAS and CMS collaborations regarding the status of the Higgs boson search to offer a most heartfelt congratulations to our experimental colleagues, including the full host of physicists and technicians tasked with maintaining an efficient and stable beam operation environment, detecting and recording the intricate visible signature of each unique event, distributing and processing innumerable Terabytes of raw information, and reconstructing the delicate natural order that collectively underlies the violence and chaos of each isolated collision. As this grand effort now reaches the five standard deviation statistical threshold that by conventional assent represents "discovery", we stand with the rest of the world's scientific community to raise a glass.

Together with this moment of celebration arrives also an opportunity for reflection on the fate to come for the second great LHC search target of supersymmetry (SUSY). Such contemplation must take to account the existing state of decimation exacted upon the leading minimal supergravity (mSUGRA) and constrained minimal supersymmetric standard model (CMSSM) constructions by the 2011 5 $\text{fb}^{-1}$ data integration at $\sqrt{s} = 7$ TeV, the projected consequences for the collected but unstudied 6 $\text{fb}^{-1}$ of data at $\sqrt{s} = 8$ TeV, and perhaps most importantly, the new constraints imposed by the emerging reality of a light Higgs boson at a mass around 125 GeV. It is for these causes that we take pen to hand for a short letter regarding our best anticipations for the next great LHC year, refocused by the successes of the year passed.

It is only through the specificity afforded by a model that one may hope to correlate the Higgs and SUSY searches, or to make projections for the expected yield of various event selection strategies to be applied against the present accumulation of data. We know only one particular class of model possessing the capacity to simultaneously satisfy constraints related to the dark matter relic density, rare physical processes, precision electroweak measurements, LHC squark and gluino searches, and now also, the light Higgs boson mass. Satisfying the dynamically established boundary conditions of No-Scale supergravity [3–7] and featuring the field content of the Flipped $SU(5)$ grand unified theory [8–10] (GUT) with additional TeV-scale vector-like supersymmetric multiplets [11–15] (flippons) (for previous study, see [16,17]), these

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0370-2693 
http://dx.doi.org/10.1016/j.physletb.2012.09.064

constructions have been dubbed No-Scale $\mathcal{F}$–$SU(5)$. This family of models has not only survived the onslaught of negative LHC data, but has unambiguously demonstrated the ability to handily produce a 125 GeV Higgs boson while efficiently explaining emergent low-statistics positive excesses above Standard Model (SM) expectations in the elusive SUSY hunt. Crucially, this congruence with experiment has been achieved while reducing the overall cardinality of parameterization available to the CMSSM, opting instead for the enhanced parsimony, predictive stricture and depth of theoretical motivation inherent to the No-Scale framework. We shall review the unique mechanisms employed by $\mathcal{F}$–$SU(5)$ toward the realization of these physical observables, and project forward how SUSY might subsequently join the Higgs boson as an experimentally detected phenomenon.

No-Scale $\mathcal{F}$–$SU(5)$ (see Refs. [18–30] and all references therein) is constructed upon the foundation of the Flipped $SU(5)$ [8–10] GUT, two pairs of hypothetical TeV-scale flippons of mass $M_V$ derived from local F-Theory model building [11–15], and the dynamically established boundary conditions of No-Scale supergravity [3–7]. In the simplest No-Scale scenario, $M_0 = A = B_\mu = 0$ at the unification boundary, while the complete collection of low energy SUSY breaking soft-terms evolve down with a single non-zero parameter $M_{1/2}$. Consequently, the particle spectrum will be proportional to $M_{1/2}$ at leading order, rendering the bulk "internal" physical properties invariant under an overall rescaling. The matching condition between the low-energy value of $B_\mu$ that is demanded by EWSB and the high-energy $B_\mu = 0$ boundary is notoriously difficult to reconcile under the renormalization group equation (RGE) running. The present solution relies on modifications to the $\beta$-function coefficients that are generated by the flippon loops. Naturalness in view of the gauge hierarchy and $\mu$ problems suggests that the flippon mass $M_V$ should be of the TeV order. Avoiding a Landau pole for the strong coupling constant restricts the set of vector-like multiplets which may be given a mass in this range to only two constructions with flipped charge assignments, which have been explicitly realized in the $F$-theory model building context [11–13]. In either case, the (formerly negative) one-loop $\beta$-function coefficient of the strong coupling $\alpha_3$ becomes precisely zero, flattening the RGE running, and generating a wide gap between the large $\alpha_{32} \simeq \alpha_3(M_Z) \simeq 0.11$ and the much smaller $\alpha_X$ at the scale $M_{32}$ of the intermediate flipped $SU(5)$ unification of the $SU(3)_C \times SU(2)_L$ subgroup. This facilitates a very significant secondary running phase up to the final $SU(5) \times U(1)_X$ unification scale, which may be elevated by 2–3 orders of magnitude into adjacency with the Planck mass, where the $B_\mu = 0$ boundary condition fits like hand to glove [31,32,18].

The $\mathcal{F}$–$SU(5)$ model space is bounded primarily by a set of "bare-minimal" experimental constraints distinguished by a great longevity of relevance, as defined in Ref. [21]. These include the top quark mass 172.2 GeV $\leqslant m_t \leqslant$ 174.4 GeV, 7-year WMAP cold dark matter relic density $0.1088 \leqslant \Omega_{\rm CDM}h^2 \leqslant 0.1158$ [33], and precision LEP constraints on the SUSY mass content. We further append to this classification an adherence to the defining high-scale boundary conditions of the model. In light of recent developments, the favored parameter space may be further circumscribed by the demands of a 124–126 GeV Higgs boson mass. The surviving region is comprised of a narrow strip of space confined to $400 \leqslant M_{1/2} \leqslant 900$ GeV, $19.4 \leqslant \tan\beta \leqslant 23$, and $950 \leqslant M_V \leqslant 6000$ GeV, as illustrated in Fig. 1. The border at the minimum $M_{1/2} = 400$ GeV is required by the LEP constraints, while the maximum boundary at $M_{1/2} = 900$ GeV prevents a charged stau LSP at around $\tan\beta \cong 23$. In the bulk of the model space the lightness of the stau, which is itself a potential future target for direct collider probes by the forthcoming $\sqrt{s} = 14$ TeV LHC, is leveraged to facilitate an appropriate dark matter relic density via stau-neutralino coannihilation. The SUSY particle masses and relic densities are calculated with `MicrOMEGAs 2.1` [34], via application of a proprietary modification of the `SuSpect 2.34` [35] codebase to evolve the flippon-enhanced RGEs.

The convergence of the predicted $\mathcal{F}$–$SU(5)$ Higgs mass with the collider measured value is achieved through contributions to the lightest CP-even Higgs boson mass from the flippons, calculated from the RGE improved one-loop effective Higgs potential approach [36,37]. The mechanism for the serendipitous mass shift is a pair of Yukawa interaction terms between the Higgs and vector-like flippons in the superpotential, resulting in a 3–4 GeV upward shift in the Higgs mass to the experimentally measured range [26]. Using the relevant shift in the Higgs mass-square as approximated in Refs. [38,26], which implements a leading dependence of the flippon mass $M_V$, larger shifts correspond to lighter vector-like flippons. This flippon induced mechanism operates in synthesis with the top quark mass, whose elevation similarly raises the non-flippon contributed Higgs mass. The cumulative result is the very narrow strip of model space in Fig. 1, with the lower strip boundary truncated by the upper top quark mass extremity, and the upper strip boundary situated at the minimum Higgs mass of 124 GeV, conveniently establishing a stable, thin band of experimentally viable points with which to explore new physics.

A pair of key venues for the appearance of new physics are the rare decay processes $B_S^0 \to \mu^+\mu^-$ and $b \to s\gamma$. In Ref. [30], we analyzed the recently improved LHCb constraints on the flavor changing neutral current B-decay process $B_S^0 \to \mu^+\mu^-$. It was discovered that the SUSY contribution throughout the narrow strip of model space is much smaller than the computed SM prediction of $Br(B_S^0 \to \mu^+\mu^-) = (3.2 \pm 0.2) \times 10^{-9}$ [39,40], in fine consistency with the LHCb result of $Br(B_S^0 \to \mu^+\mu^-) < 4.5(3.8) \times 10^{-9}$ at the 95% (90%) confidence level [41]. The left-hand plot space of Fig. 1 illustrates smoothly graded contours of color depicting the calculation of $Br(B_S^0 \to \mu^+\mu^-)$ within the model space, using `MicrOMEGAs 2.1` and our proprietary modification of `SuSpect 2.34`. For the benchmark highlighted, which is favored by the low-statistics SUSY event over-production already observed in the 5 fb$^{-1}$ 7 TeV data to be discussed shortly, the $Br(B_S^0 \to \mu^+\mu^-) = 3.5 \times 10^{-9}$ is very close to the SM prediction, thus suggesting that indeed the $\mathcal{F}$–$SU(5)$ SUSY contribution is quite small, consistent with indications from experiment that any SUSY contribution must be a great deal less than the SM value. We have suppressed here the flippon contributions by appealing to some combined effect of the natural heaviness of the multiplets, and an assumption that the mixings between the flippons and the SM fermions are relatively small.

The other rare decay process to which we extend a detailed analysis is $b \to s\gamma$. The right-hand plot space of Fig. 1 exhibits smooth color gradients of $Br(b \to s\gamma)$, computed with `MicrOMEGAs 2.4` [42], where the SM and Higgs contributions at NLO are included, in addition to the leading order SUSY contributions. The emphasized benchmark computes to $Br(b \to s\gamma) = 3.15 \times 10^{-4}$, which is noteworthy for its quite close proximity to the SM estimate. The NNLO SM contribution was computed to be $Br(b \to s\gamma) = (3.15 \pm 0.23) \times 10^{-4}$ [43,44], though it was shown that this SM value could be reproduced by the NLO calculation by choice of the c-quark mass scale [44,45]. As such, the `MicrOMEGAs 2.4` codebase, employed here, computes the NLO SM contribution at $Br(b \to s\gamma) = 3.27 \times 10^{-4}$, corresponding to the result of Ref. [45]. Therefore, as shown in Fig. 1, our $\mathcal{F}$–$SU(5)$ benchmark result of $Br(b \to s\gamma) = 3.15 \times 10^{-4}$ includes only a very small negative SUSY contribution to the SM estimate, though well within theoretical uncertainty and experimental resolution.

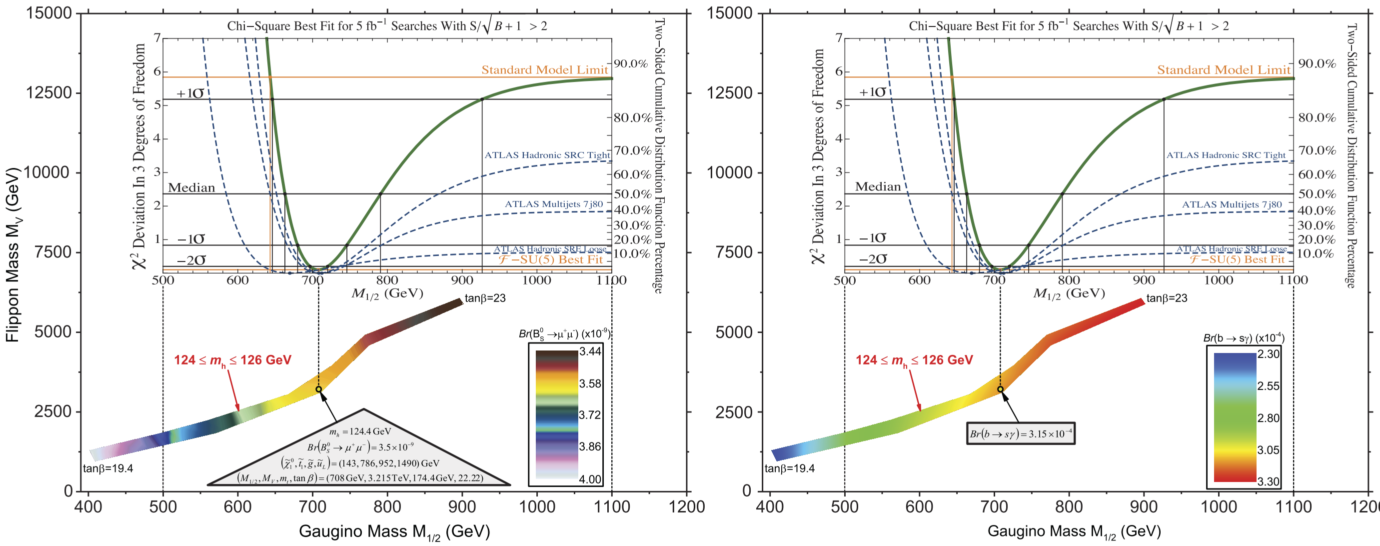


**Fig. 1.** We depict the experimentally viable parameter space of No-Scale $\mathcal{F}$–$SU(5)$ as a function of the gaugino mass $M_{1/2}$ and flippon mass $M_V$. The surviving model space after application of the bare-minimal constraints of Ref. [21] and Higgs boson mass calculations of Ref. [26] is illustrated by the narrow strip with the smoothly contoured color gradient. The gradient represents the total branching ratio (SM + SUSY) of the B-decay process $B_S^0 \to \mu^+\mu^-$ (left), and the total branching ratio (SM + SUSY) of $b \to s\gamma$ (right). The inset diagrams (with linked horizontal scale) are the multi-axis cumulative $\chi^2$ fitting of Ref. [28], depicting the best SUSY mass fit and Standard Model limit of only those ATLAS and CMS SUSY searches exhibiting a signal significance of $S/\sqrt{B+1} > 2$. The best fit benchmark of Ref. [28] is highlighted at $M_{1/2} = 708$ GeV, with $m_h = 124.4$ GeV.

The intriguing aspect of the $\mathcal{F}$–$SU(5)$ contribution to the rare decay processes is the nearly negligible SUSY contributions to both $B_S^0 \to \mu^+\mu^-$ and $b \to s\gamma$. The benchmark model denoted in Fig. 1 carries with it virtually no SUSY contribution to these two processes. Hence, in an era when evidence supporting any sizable contribution to these rare decay processes by new physics is rapidly fading away and consequently disfavoring a majority of SUSY constructions, the experimental standing of No-Scale $\mathcal{F}$–$SU(5)$ is instead characteristically enhanced. With the $\mathcal{F}$–$SU(5)$ SUSY contributions positioned interior to any foreseeable uncertainty bounds around the SM value, it is difficult to envision a scenario under which $\mathcal{F}$–$SU(5)$ could suffer exclusion by these rare decay processes, absent an unexpected reversion of the experiments toward the side of a large SUSY contribution. Topically parallel to this discussion is the possibility of post-SM contributions to the magnetic moment $(g-2)_\mu$ of the muon, although we extend somewhat less credulity to the related limits due to large lingering uncertainties in the QCD calculations, an inconclusive experimental deviation from zero, and large discrepancies between the $e^+e^-$ and $\tau^+\tau^-$ based results. Nevertheless, the $\mathcal{F}$–$SU(5)$ SUSY contribution $\Delta a_\mu$ follows the lead of $B_S^0 \to \mu^+\mu^-$ and $b \to s\gamma$ in this regard, where $\Delta a_\mu \cong 7.5 \times 10^{-10}$ for the benchmark as computed with `MicrOMEGAs 2.4` is again only a very small deviation from the SM estimate, and within any anticipated future experimental uncertainty. Therefore, we observe a comforting consistency amongst these three rare decay processes in $\mathcal{F}$–$SU(5)$ through each of their practically negligible SUSY contributions.

The same flippon induced perturbation to the RGE unification structure of $\mathcal{F}$–$SU(5)$ that was responsible for facilitating a consistent application of the No-Scale boundary conditions near the Planck mass also produces a key phenomenological signature. The flat RGE evolution of the $SU(3)_C$ gaugino mass $M_3$, which mirrors the flatness of the $\beta$-coefficient $b_3 = 0$, suppresses the standard logarithmic mass enhancement at low-energy and yields a SUSY spectrum $M(\tilde{t}_1) < M(\tilde{g}) < M(\tilde{q})$ where the light stop $\tilde{t}_1$ and gluino $\tilde{g}$ are both less massive than all other squarks. This highly unusual hierarchy produces a distinct event topology initiated by the pair-production of heavy first or second generation squarks $\tilde{q}$ and/or gluinos in the hard scattering process, with the heavy squark likely to yield a quark-gluino pair $\tilde{q} \to q\tilde{g}$. The gluino then has only two main channels available in the cascade decay, $\tilde{g} \to \tilde{t}_1 \bar{t}$ or $\tilde{g} \to q\bar{q}\tilde{\chi}_1^0$, with $\tilde{t}_1 \to t\tilde{\chi}_1^0$ or $\tilde{t}_1 \to b\tilde{\chi}_1^\pm$. As $M_{1/2}$ increases, the stop-top channel becomes dominant, ultimately reaching 100% for $M_{1/2} \geqslant 729$ GeV. For $M_{1/2} < 729$ GeV, both avenues have sufficient branching fractions to produce observable events at the LHC. Each gluino produces 2–6 hadronic jets, with the maximum of six jets realized in the gluino-mediated stop decay, so that a single gluino–gluino pair-production event can net 4–12 jets. After further fragmentation processes, the final event is characterized by a definitive SUSY signal of high-multiplicity jets.

The most robust test of any supersymmetric model is the prediction of a unique signature plainly accounting for observed anomalies in collider data. The exceptional mass ordering in No-Scale $\mathcal{F}$–$SU(5)$ provides a distinctive marker at the LHC, since multijet events are expected to dominate a probed $\mathcal{F}$–$SU(5)$ framework. We first suggested in March 2011 [19,20] that SUSY in an $\mathcal{F}$–$SU(5)$ universe would become manifest at the colliders in high-multiplicity jet events, extending this initial study in Refs. [22–29]. The first ample accumulation of multijet data was released by the collaborations later in 2011 in Refs. [46–48], based upon 1 fb$^{-1}$ of luminosity. Though the number of events remaining after the collaboration data cuts was less than ten, there did appear small but curious excesses beyond the SM estimates in these searches targeting multijet events. The most prominent examples came from ATLAS, where the 7j80 ($\geqslant 7$ jets and jet $p_T > 80$ GeV) search of Ref. [48] and High Mass ($\geqslant 4$ jets and jet $p_T > 80$ GeV) search of Ref. [47] displayed interesting event production over the data-driven background estimates. Employing the signal significance metric $S/\sqrt{B+1}$, we computed a value of 1.1 for 7j80 and 1.3 for the High Mass search. Despite the weak signal, reasonably attributable to statistical fluctuations, No-Scale $\mathcal{F}$–$SU(5)$ provided a neat and efficient explanation for the minor over-productions in these two searches. Despite the long odds at that time, those clean fits prompted us to extrapolate from the ATLAS published statistics of Refs. [47,48] to predict signal strengths of $S/\sqrt{B+1} = 1.9$ for 7j80 and $S/\sqrt{B+1} = 3.0$ for the High Mass [27] search in the forthcoming 5 fb$^{-1}$ data set at 7 TeV, assuming a legitimate physics origin for the intriguing over-production.

We provided a detailed analysis of the ATLAS and CMS 5 $\text{fb}^{-1}$ observations at the 7 TeV LHC in Ref. [28], focused on those search strategies where the signal significance was strongest and the largest number of events had accumulated, imposing $S/\sqrt{B+1} > 2.0$ as a minimal boundary. Strikingly, the 7j80 [49] search and the composite successors to the High Mass search were the only 5 $\text{fb}^{-1}$ strategies to surmount this significance hurdle. To elaborate, ATLAS essentially segregated the former High Mass $\geqslant 4$ jet SUSY search of Ref. [47] into three separate searches of 4 jets, 5 jets, and 6 jets for the latter study, intended to isolate the $\widetilde{g}\widetilde{g}$, $\widetilde{q}\widetilde{g}$, and $\widetilde{q}\widetilde{q}$ 0-lepton channels via $\widetilde{q} \to q\widetilde{g}$ and $\widetilde{g} \to q\bar{q}\widetilde{\chi}_1^0$ [50]. In addition to the ATLAS 7j80 [49], these ATLAS 4-jet and 6-jet searches of Ref. [50], referred to as SRC Tight and SRE Loose, respectively, were the only other 5 $\text{fb}^{-1}$ searches to achieve $S/\sqrt{B+1} > 2.0$ in all the ATLAS and CMS 5 $\text{fb}^{-1}$ studies analyzed at that time. Granting that the 1 $\text{fb}^{-1}$ data sample is a subset of the 5 $\text{fb}^{-1}$ data, the signal strength nevertheless expanded in the precise proportionality expected. The final 5 $\text{fb}^{-1}$ 7 TeV ATLAS observations computed signal significances of $S/\sqrt{B+1} = 2.1$ for 7j80 [49], $S/\sqrt{B+1} = 3.2$ for SRC Tight (4j) [50], and $S/\sqrt{B+1} = 2.6$ for SRE Loose (6j) [50], in line with our predictions and very consistent with the signal growth expected to be observed in an $\mathcal{F}$–$SU(5)$ universe.

This enlarged signal strength simultaneously presented a golden opportunity to derive a best fit SUSY mass to the 5 $\text{fb}^{-1}$ data through a $\chi^2$ fitting procedure. We demonstrated [28] clear internal consistency in the $\mathcal{F}$–$SU(5)$ mass scale favored by the various search windows, in addition to the described correlation across time in the signal growth. This analysis favored sparticle masses of $m_{\widetilde{\chi}_1^0} = 143$ GeV, $m_{\widetilde{t}_1} = 786$ GeV, $m_{\widetilde{g}} = 952$ GeV, and $m_{\widetilde{u}_L} = 1490$ GeV, complementing a Higgs mass of $m_h = 124.4$ GeV at the $M_{1/2} = 708$ GeV well of the 5 $\text{fb}^{-1}$ multi-axis cumulative $\chi^2$ curve, combining the 7j80, SRC Tight, and SRE Loose search channels. To exemplify this best fit at the $\chi^2$ minimum, we choose the $M_{1/2} = 708$ GeV point as our standing favored benchmark, exhibited and pinpointed in Fig. 1. The superimposed cumulative $\chi^2$ curve of Ref. [28] visibly showcases how the ATLAS 7j80, SRC Tight, and SRE Loose over-productive search strategies illuminate the $\mathcal{F}$–$SU(5)$ model space as naturally conforming to the collider observations. By lowering the minimum threshold for signal significance to $S/\sqrt{B+1} > 1.0$, the CMS 5 $\text{fb}^{-1}$ MT2 search strategy [51] was included into our 5 $\text{fb}^{-1}$ multi-axis $\chi^2$ fitting in Ref. [29] along with an additional ATLAS search, namely the 8j55 case from Ref. [49]. It was demonstrated in this manner that further non-trivial correlations exist between the mass scale favored by independently productive ATLAS and CMS SUSY searches, bolstering the case against attribution of the excesses to random statistical fluctuations.

The data observations for the ATLAS multijet searches discussed here have shown a very natural progression from 1 $\text{fb}^{-1}$ to 5 $\text{fb}^{-1}$. In fact, the $S/\sqrt{B+1} \sim 3$ signal significance of the combined ATLAS 5 $\text{fb}^{-1}$ multijet searches, which we can consider to be about $3\sigma$, is near the same signal level as the Higgs boson after 5 $\text{fb}^{-1}$ at 7 TeV. With the Higgs boson now at the discovery threshold of $5\sigma$ in the first 8 TeV data tranche, it would only be fitting if the ATLAS multijet SUSY searches continued to track the Higgs signal strength. Looking forward and preparing for potentially more significant SUSY production as we shift to forthcoming larger LHC beam collision energies and hence greater numbers of statistics, we transition here to a more appropriate metric for measuring signal strength in the presence of larger excess event production beyond expectations, $2 \times (\sqrt{S+B} - \sqrt{B})$. We employ the background statistics derived by the ATLAS Collaboration for 5 $\text{fb}^{-1}$ at 7 TeV from Ref. [49], though to determine an estimate of the SM background for 8 TeV, we scale up these ATLAS statistics using the same factor observed in our Monte Carlo for $\mathcal{F}$–$SU(5)$ simulations. This estimator, while serving our limited scope here satisfactorily, can only be as reliable as the expectation of statistical, dynamic and procedural stability across the transition in energy, luminosity and model. We further assume here a static data cutting strategy between the ATLAS 7 and 8 TeV multijet searches. We indeed project that there should be a visible multijet signal strength sufficient for SUSY discovery in the isolated 15 $\text{fb}^{-1}$ 8 TeV data, expected to be recorded in 2012 and processed in 2013, if the existing signal in the 5 $\text{fb}^{-1}$ 7 TeV data is legitimately and wholly attributable to new physics. More precisely, assuming no important modifications to the background calibration procedures by ATLAS, we can project the 7j80 SUSY search tactics of Ref. [49] to yield a signal significance of $2 \times (\sqrt{S+B} - \sqrt{B}) \sim 6$ for 15 $\text{fb}^{-1}$ at 8 TeV, and $2 \times (\sqrt{S+B} - \sqrt{B}) \sim 7$–$8$ for the SRC-Tight and SRE-Loose search strategies of Ref. [50]. Although potentially quite susceptible to large statistical fluctuation, these rather strong signal projections nonetheless indicate that a probing of the $\mathcal{F}$–$SU(5)$ framework at the LHC could indeed yield further tantalizing, and possibly convincing, evidence that nature herself is fundamentally supersymmetric. The summation of the 5 $\text{fb}^{-1}$ of 7 TeV data to the 8 TeV data only improves the signal significance modestly. Moreover, the presence of excess events in the 15 $\text{fb}^{-1}$ ATLAS multijet searches at 8 TeV will resoundingly indicate that random background anomalies are not the source of the 7 TeV multijet over-production. We find the predictable evolution of our SUSY exploration from the initial 1 $\text{fb}^{-1}$ at 7 TeV to the 5 $\text{fb}^{-1}$ at 7 TeV to warrant such positive speculation as we move forward to the 15 $\text{fb}^{-1}$ at 8 TeV.

After taking pause to revel in the landmark discovery of the Higgs boson, we arrive now at potentially the most consequential inflection point in the dual effort to reveal the definitive imprint of supersymmetry upon natural processes. The most welcome news of a light Higgs around 125 GeV serves ironically as yet another nail into the coffin of the most conventional mSUGRA/CMSSM constructions, which become irreconcilably torn between two masters in the effort to pair this elevated scale with a testably light SUSY spectrum. The explanation of any persistent production excesses in multijet events will require a turn toward alternative formulations such as No-Scale $\mathcal{F}$–$SU(5)$ for a proper accounting. In such a context, the empirically confirmed addition of the Higgs into the fold of known particles serves only to further narrow the already precise model predictions. Success builds upon success, and the next stride into the 8 TeV SUSY search collision data could cement 2012 as a truly historic year for particle physics.

## Acknowledgements

This research was supported in part by the DOE grant DE-FG03-95-Er-40917 (TL and DVN), by the Natural Science Foundation of China under grant numbers 10821504, 11075194, and 11135003 (TL), by the Mitchell-Heep Chair in High Energy Physics (JAM), and by the Sam Houston State University 2011 Enhancement Research Grant program (JWW). We also thank Sam Houston State University for providing high performance computing resources.

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