SUSY 2026

Report of Contributions

https://indico.cern.ch/e/1508223

Contribution ID: **1** Type: **not specified**

Natural SUSY emergent from the string landscape

Superstring theory with flux compactifications results in an enormous number of vacua solutions each leading to different 4d laws of physics, collectively known as the *string landscape*. While the string landscape provides at present the only plausible explanation for the size of the cosmological constant, it may also predict the form of weak scale supersymmetry (SUSY) which is expected to emerge. General statistical arguments suggests a power-law draw to large soft terms, subject to anthropic selection criteria such that one does not derive a a weak scale that is too far removed from our own. In this talk, I will discuss how this combined selection allows one to compute relative probabilities for the emergence of SUSY models from the landscape. To this end, we will go over various notions of naturalness and underscore the need for a reevaluation of the notion in light of lessons from the landscape and recent LHC data. We will see that models with weak scale naturalness, on account of having the largest parameter space on the landscape, are most likely to emerge compared to finetuned SUSY models. Finally, we will go over the implications and predictions from natural SUSY emergent from the landscape to current and future searches for supersymmetric particles.

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Presenter: SALAM, Shadman (East West University)

Session Classification: Plenary

Contribution ID: **8** Type: **not specified**

ATLAS Searches for new scalars & BSM Higgs decays

The discovery of the Higgs boson with the mass of about 125 GeV completed the particle content predicted by the Standard Model. Even though this model is well established and consistent with many measurements, it is not capable to solely explain some observations. Many extensions of the Standard Model addressing such shortcomings introduce additional Higgs bosons, beyond-the-Standard-Model couplings to the Higgs boson, or new particles decaying into Higgs bosons. In this talk, the latest searches in the Higgs sector by the ATLAS experiment are reported.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Non-SUSY

Contribution ID: **9** Type: **not specified**

HH searches and higgs-self couplings measurements by ATLAS

In the Standard Model, the ground state of the Higgs field is not found at zero but instead corresponds to one of the degenerate solutions minimising the Higgs potential. In turn, this spontaneous electroweak symmetry breaking provides a mechanism for the mass generation of nearly all fundamental particles. Experimentally, the Higgs boson self-couplingm and thereby the shape of the Higgs potential, can be probed through the production of Higgs boson pairs (HH). In this talk, the latest HH searches by the ATLAS experiment using the LHC Run 2 and Run 3 datasets are reported. Non-resonant HH search results are interpreted both in terms of sensitivity to the Standard Model and as limits on the Higgs boson self-coupling and the quartic VVHH coupling.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Higgs

Contribution ID: **10** Type: **not specified**

Highlights on Higgs measurements with ATLAS

This talk presents recent precision measurements of key properties of the Higgs boson using the full dataset of proton-proton collisions at $\sqrt{s}$ = 13 TeV and 13.6 teV collected during Run 2 and Run 3, respectively, of the LHC by the ATLAS experiment. Recent projections done for the HL-LHC will also be discussed.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Higgs

Contribution ID: **11** Type: **not specified**

Highlights on top quark physics with the ATLAS experiment at the LHC

The large top quark samples collected with the ATLAS experiment at the LHC have yielded measurements of the production cross section of unprecedented precision and in new kinematic regimes. They have also enabled new measurements of top quark properties that were previously inaccessible, enabled the observation of many rare top quark production processes predicted by the Standard Model and boosted searches in the Top sector. In this contribution the highlights of the ATLAS top quark physics program are presented.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: SUSY Phenomenology and experiment

Contribution ID: **12** Type: **not specified**

Search for supersymmetry with compressed spectra with ATLAS

Supersymmetry (SUSY) models with featuring small mass splittings between one or more particles and the lightest neutralino could solve the hierarchy problem as well as offer a suitable dark matter candidate consistent with the observed thermal-relic dark matter density. However, the detection of SUSY higgsinos at the LHC remains challenging especially if their mass-splitting is O(1 GeV) or lower. Searches are developed using the LHC ATLAS Run 2 dataset to overcome the challenge. Novel techniques are developed exploiting machine-learning techniques, low-momentum tracks with large transverse impact parameters, or topologies consistent with VBF production of the supersymmetric particles. Results are interpreted in terms of SUSY simplified models and, for the first time since the LEP era, several gaps in different ranges of mass-splittings are excluded.

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Session Classification: SUSY Phenomenology and experiment

Contribution ID: **13** Type: **not specified**

Searches for BSM physics using challenging and long-lived signatures with the ATLAS

Various theories beyond the Standard Model predict new, long-lived particles with unique signatures which are difficult to reconstruct and for which estimating the background rates is also a challenge. Signatures from displaced and/or delayed decays anywhere from the inner detector to the muon spectrometer, as well as those of new particles with fractional or multiple values of the charge of the electron or high mass stable charged particles are all examples of experimentally demanding signatures. The talk will focus on the most recent results using 13 TeV pp collision data collected by the ATLAS detector.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Non-SUSY

Contribution ID: **14** Type: **not specified**

Searches for Dark Matter and new phenomena in hadronic final states with ATLAS

Many theories beyond the Standard Model predict new phenomena giving rise to jet final states. These jets could originate from the decay of a heavy resonance into SM quarks or gluons, or from more complicated decay chains involving additional resonances that decay e.g. into leptons. Also of interest are resonant and non-resonant hadronic final states with jets originating from a dark sector, giving rise to a diverse phenomenology depending on the interactions between the dark sector and SM particles. This talk presents the latest Run 2 and Run 3 ATLAS results.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Dark Matter

Contribution ID: **15** Type: **not specified**

Searches for electroweak production of supersymmetric particles with ATLAS

The direct production of electroweak SUSY particles, including sleptons, charginos, and neutralinos, is a particularly interesting area with connections to dark matter and the naturalness of the Higgs mass. The small production cross-sections and challenging experimental signatures lead to difficult searches. This talk will highlight the most recent results of searches performed by the ATLAS experiment for supersymmetric particles produced via electroweak processes.

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Session Classification: SUSY Phenomenology and experiment

Contribution ID: **16** Type: **not specified**

Searches for new phenomena in final states with 3rd generation quarks using the ATLAS detector

Many theories beyond the Standard Model predict new phenomena, such as heavy vectors or scalar, vector-like quarks, and leptoquarks in final states containing bottom or top quarks. Such final states offer great potential to reduce the Standard Model background, although with significant challenges in reconstructing and identifying the decay products and modelling the remaining background. The recent 13 TeV pp results, along with the associated improvements in identification techniques, will be reported.

Author: ATLAS COLLABORATION, TBA

Presenter: ATLAS COLLABORATION, TBA

Session Classification: Non-SUSY

Contribution ID: **17** Type: **not specified**

Searches for resonances decaying into Higgs boson pairs with the ATLAS Experiment

Many new physics models predict the existence of resonant states decaying into two bosons, including the Higgs boson or new scalar S bosons. These processes provide crucial signatures in the search for physics beyond the Standard Model and may offer insights into the mechanism of electroweak symmetry breaking. In this talk, the latest results from searches for resonant Higgs boson pair (HH) production and Higgs-scalar (SH) production are presented, focusing on findings from the full LHC Run 2 dataset at 13 TeV, along with the inclusion of available Run 3 results where relevant.

Author: ATLAS COLLABORATION, TBA

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Session Classification: Non-SUSY

Contribution ID: **18** Type: **not specified**

Searches for resonances decaying to pairs of heavy bosons in ATLAS

Many new physics models predict the existence of resonances decaying into two bosons (W, Z, photon, or Higgs bosons) making these important signatures in the search for new physics. Searches for Vγ, VV, and VH resonances have been performed in various final states. In some of these searches, jet substructure techniques are used to disentangle the hadronic decay products in highly boosted configurations. This talk summarises recent ATLAS searches and explains the experimental methods used, including vector- and Higgs-boson-tagging techniques.

Author: ATLAS COLLABORATION, TBA

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Session Classification: Non-SUSY

Contribution ID: **19** Type: **not specified**

Searches for strong production of supersymmetric particles with ATLAS

Supersymmetry (SUSY) provides elegant solutions to several problems in the Standard Model, and searches for SUSY particles are an important component of the LHC physics program. Naturalness arguments favour supersymmetric partners of the gluons and third-generation quarks with masses light enough to be produced at the LHC. This talk will present the latest results of searches conducted by the ATLAS experiment which target gluino and squark production, including stop and sbottom, in a variety of decay modes.

Author: ATLAS COLLABORATION, TBA

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Session Classification: SUSY Phenomenology and experiment

Contribution ID: **20** Type: **not specified**

Searches for supersymmetry in non-minimal models with ATLAS

Supersymmetry (SUSY) provides elegant solutions to several problems in the Standard Model, and searches for SUSY particles are an important component of the LHC physics program. With increasing mass bounds on MSSM scenarios other non-minimal variations of supersymmetry become increasingly interesting. This talk will present the latest results of searches conducted by the ATLAS experiment targeting strong and electroweak production in R-parity-violating models, as well as non-minimal-flavour-violating models. Recent results and interpretations in the context of the pMSSM are also presented.

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Session Classification: SUSY Phenomenology and experiment