

Abstract Here are some of the results of the LHC.

# RESULTS of work of LHC

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“There will be a wealth of excellent physics results from the LHC Run 2 and from other CERN experiments.”

*Fabiola Gianotti*



## Introduction

The Manhattan Project began on September 17, 1943. It was attracted many outstanding physicists, many of whom were refugees from Europe. By the summer of 1945, the Americans had managed to build 3 atomic bombs, 2 of which were dropped on Hiroshima and Nagasaki, and a third had been tested shortly before.

And the atomic race began.

In the following years, the governments of many states allocated enormous sums of money to scientific organizations. Following these money, huge masses of easy luck seekers moved to physics.

They invented SUSY, WIMP, BIG BANG, HIGGS and other theories of the same kind.

Giant laboratory facilities were built and enormous human resources were attracted to experimentally confirm these theories.



Results of the LHC and other science giant laboratory work are describe in [1] ( since 10 September 2008 till 14 February 2013: RUNI) and [2] (from June 2015 to January 2018, RUNII)

## **Results**

Here are the RUNII results of 2018:

Search for light resonances decaying to boosted quark pairs and produced in association with a photon or a jet in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1801.08769>

"No evidence of a new resonance is observed "

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First Limit on the direct detection of Lightly Ionizing Particles for Electric Charge as Low as  $e/1000$  with the `\textsc{Majorana Demonstrator}`

<https://arxiv.org/abs/1801.10145>

"no candidate events have been found in 285 days of data taking"

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Search for a strangeonium-like structure  $Z_s$  decaying into  $??$  and a measurement of the cross section  $e^+e^- \rightarrow ???$

<https://arxiv.org/abs/1801.10384>

"No signal is observed"

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Search for lepton-flavor violating decays of heavy resonances and quantum black holes to  $e\gamma$  final states in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1802.01122.pdf>

"In all cases, the results of this search improve the previous lower limits by about 1 TeV."

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Search for single production of vector-like quarks decaying to a b quark and a Higgs boson

<https://arxiv.org/pdf/1802.01486.pdf>

"No significant deviations are observed"

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Search for natural and split supersymmetry in proton-proton collisions at  $\sqrt{s} = 13$  TeV in final states with jets and missing transverse momentum

<https://arxiv.org/pdf/1802.02110.pdf>

"The observed yields in the signal region are found to be in agreement with the expected contributions from standard model processes." \_\_\_\_\_

Search for heavy neutral leptons in events with three charged leptons in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1802.02965>

"The data are found to be consistent with the expected standard model background."

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Search for photonic signatures of gauge-mediated supersymmetry in 13 TeV pp collisions with the ATLAS detector

<https://arxiv.org/abs/1802.03158>

"No significant excess of events is observed"

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Search for Higgs boson decays to beyond-the-Standard-Model light bosons in four-lepton events with the ATLAS detector at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1802.03388>

"No significant excess of events above Standard Model background predictions is observed"

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Projected WIMP sensitivity of the LUX-ZEPLIN (LZ) dark matter experiment

<https://arxiv.org/pdf/1802.06039.pdf>

"For a 1000 day exposure utilizing a 5.6 tonne fiducial mass, LZ is projected to exclude, at 90% CL, SI WIMPnucleon cross sections of  $1.6 \times 10^{-48} \text{cm}^2$  and above for a 40 GeV/c<sup>2</sup> WIMP."

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Search for Axion like particles using Laue-case conversion in a single crystal

<https://arxiv.org/abs/1802.08388>

"No significant signals are observed"

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Limits on light WIMPs from the first 102.8 kg-days data of the CDEX-10 experiment

<https://arxiv.org/abs/1802.09016>

"At an analysis threshold of 160 eVee, improved limits of  $8 \cdot 10^{42} \text{ cm}^2$  and  $3 \cdot 10^{36} \text{ cm}^2$  at 90% confidence level on spin-independent and spin-dependent WIMP-nucleon cross-sections, respectively, at a WIMP mass ( $m_\chi$ ) of 5 GeV/c<sup>2</sup> are achieved."

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Search for electroweak production of supersymmetric particles in final states with two or three leptons at  $\sqrt{s}=13\text{TeV}$  with the ATLAS detector

<https://arxiv.org/abs/1803.02762>

"No significant deviations from the Standard Model expectation are observed "

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Search for third-generation scalar leptoquarks decaying to a top quark and a lepton at  $\sqrt{s}= 13 \text{ TeV}$

<https://arxiv.org/abs/1803.02864>

"No evidence for pair production of LQs is found."

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Search for a heavy resonance decaying into a Z boson and a vector boson in the  $qq$  final state

<https://arxiv.org/abs/1803.03838>

"No excess is observed in data with regard to background expectations."

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Search for high-mass resonances in dilepton final states in proton-proton collisions at  $\sqrt{s}= 13 \text{ TeV}$

<https://arxiv.org/pdf/1803.06292.pdf>

"No significant deviations are observed."

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Search for additional neutral MSSM Higgs bosons in the  $??$  final state in proton-proton collisions at  $\sqrt{s}= 13 \text{ TeV}$

<https://arxiv.org/abs/1803.06553>

"No significant deviation above the expected background is observed."

---

Search for a new X(16.7) boson and dark photons in the NA64 experiment at CERN

<https://arxiv.org/abs/1803.07748>

"no evidence for such decays was found"

---

Search for new physics in dijet angular distributions using proton-proton collisions at  $\sqrt{s} = 13$  TeV and constraints on dark matter and other models

<https://arxiv.org/pdf/1803.08030.pdf>

"No significant deviation

from the SM prediction is observed."

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Search for pair production of up-type vector-like quarks and for four-top-quark events in final states with multiple b-jets with the ATLAS detector

<https://arxiv.org/abs/1803.09678>

"No significant excess above the Standard Model expectation is observed"

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Search for a new heavy resonance decaying into a Z boson and a Z or W boson in  $Z\gamma$  final states at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1803.10093>

"No excess is observed "

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Search for top squarks decaying to tau sleptons in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1803.10178>

"No significant deviation from the Standard Model predictions is observed "

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Search for high-mass resonances in final states with a lepton and missing transverse momentum at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1803.11133>

" No significant deviation from the standard model prediction is found."

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Search for Higgs boson decays into pairs of light (pseudo)scalar particles in the  $\tau\tau$  final state in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1803.11145>

"The data are in agreement with the Standard Model predictions"

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Search for a heavy Higgs boson decaying into a Z boson and another heavy Higgs boson in the  $\tau\tau$  final state in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1804.01126>

"No evidence for the production of an A boson is found."

---

Search for a new scalar resonance decaying to a pair of Z bosons in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1804.01939>

" No significant excess of events with respect to the standard model expectation is observed"

---

Search for low-mass dijet resonances using trigger-level jets with the ATLAS detector in pp collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1804.03496>

"No excesses are found"

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Search for R-parity-violating supersymmetric particles in multi-jet final states produced in p-p collisions at  $\sqrt{s}=13$  TeV using the ATLAS detector at the LHC

<https://arxiv.org/abs/1804.03568>

" No significant excess above the expected Standard Model background is observed."

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Search for supersymmetry in events with four or more leptons in  $\sqrt{s}=13$  TeV pp collisions with ATLAS

<https://arxiv.org/pdf/1804.03602.pdf>

"Data yields in the signal regions are consistent with Standard Model expectations".

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A Search for Invisible Axion Dark Matter with the Axion Dark Matter Experiment

<https://arxiv.org/abs/1804.05750>

"The search excludes the range of axion-photon couplings predicted by plausible models of the invisible axion."

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Search for pair production of Higgs bosons in the  $b\bar{b}b\bar{b}$  final state using proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1804.06174>

"No significant excess is observed"

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Search for disappearing tracks as a signature of new long-lived particles in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1804.07321.pdf>

"The observation is consistent with the background-only hypothesis. " \_

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A search for lepton-flavor-violating decays of the Z boson into a  $\tau$ -lepton and a light lepton with the ATLAS detector

<https://arxiv.org/abs/1804.09568>

" No significant excess of events above the expected background is observed"

---

Search for heavy particles decaying into top-quark pairs using lepton-plus-jets events in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1804.10823>

"No significant deviations from the Standard Model predictions are found."

---

Search for flavor-changing neutral currents in top quark decays  $t \rightarrow Hc$  and  $t \rightarrow Hu$  in multilepton final states in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1805.03483>

"No signal is observed"

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Search for an exotic decay of the Higgs boson to a pair of light pseudoscalars in the final state of two muons and two  $\tau$  leptons in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1805.04865>

"no significant excess of data is observed "

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Search for heavy neutral leptons with the CMS detector

<https://arxiv.org/pdf/1805.05084.pdf>

"No statistically significant

excess above the SM expectation is observed,"

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Search for top squarks decaying via four-body or chargino-mediated modes in single-lepton final states in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1805.05784>

"No evidence for the production of top squarks is found"

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Search for black holes and sphalerons in high-multiplicity final states in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1805.06013>

"No evidence for excesses above the predicted background is observed."

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Search for resonances in the mass distribution of jet pairs with one or two jets identified as b-jets in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1805.09299>

"No evidence of a significant excess of events above the smooth background shape is found."

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Searching for All-Scale Anisotropies in the Arrival Directions of Cosmic Rays above the Ankle

<https://arxiv.org/abs/1805.08220>

" We do not find evidence for the presence of medium- or small-scale anisotropies. "

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Search for a dimuon resonance in the  $\mu\mu$  mass region

<https://arxiv.org/abs/1805.09820>

"No evidence is found for a signal"

---

Search for an exotic decay of the Higgs boson to a pair of light pseudoscalars in the final state with two b quarks and two  $\tau$  leptons in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1805.10191>

"no excess of events above the SM expectation is observed. "

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Constraints on models of scalar and vector leptoquarks decaying to a quark and a neutrino at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1805.10228.pdf>

" no significant deviations from the SM prediction are observed"

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Hunting for Axionlike Dark Matter by Searching for an Oscillating Neutron Electric Dipole Moment

<https://arxiv.org/abs/1805.10252>

"No signal consistent with dark matter is observed"

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Direct dark matter search by annual modulation with 2.7 years of XMASS-I data

<https://arxiv.org/abs/1801.10096>

"We also did not find any significant amplitude"

---

XENON1T probes deeper into Dark Matter WIMPs, with 1300 kg of cold Xe atoms

<https://e.mail.ru/message/15275015950000000768/>

"none were detected, setting the most stringent limit on WIMPs"

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Search for new phenomena using the invariant mass distribution of same-flavour opposite-sign dilepton pairs in events with missing transverse momentum in  $\sqrt{s}=13$  TeV pp collisions with the ATLAS detector

<https://arxiv.org/abs/1805.11381>

"The data are found to be consistent with the Standard Model expectation"

---

Search for beyond the standard model Higgs bosons decaying into a  $b\bar{b}$  pair in pp collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1805.12191>

"No signal above the standard model background expectation is observed."

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Dark Matter Search Results from a One Tonne-Year Exposure of XENON1T

<https://arxiv.org/abs/1805.12562>

"No significant excess over background is found"

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Operation of a ferromagnetic Axion haloscope at  $m_a=58$  eV

<https://arxiv.org/pdf/1806.00310.pdf>

"no statistically significant signal consistent with axions was found." \_

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Search for Higgs boson pair production in the  $b\bar{b}$  final state in pp collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1806.00408.pdf>

"No evidence for HH production is observed in the data."

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Search for narrow and broad dijet resonances in proton-proton collisions at  $\sqrt{s}=13$  TeV and constraints on dark matter mediators and other new particles

<https://arxiv.org/abs/1806.00843>

"no evidence for the production of new particles is observed. "

---

Search for resonant WZ production in the fully leptonic final state in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1806.01532>

"No significant excess is observed"

---

Search for pair production of heavy vector-like quarks decaying into high- $p_T$  W bosons and top quarks in the lepton-plus-jets final state in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1806.01762>

"No significant deviation from the Standard Model expectation is observed."

---

Search for chargino-neutralino production using recursive jigsaw reconstruction in final states with two or three charged leptons in proton-proton collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/pdf/1806.02293.pdf>

"No significant

excesses above the SM expectation are observed i\_ "

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Measurements of ZZ production with the ATLAS detector and simulation of loop-induced processes with the HERWIG event generator

Stefan Richter

<https://arxiv.org/abs/1806.02697>

"No significant deviations from the Standard Model predictions are observed."

---

Search for a singly produced third-generation scalar leptoquark decaying to a lepton and a bottom quark in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1806.03472.pdf>

"third-generation scalar leptoquarks

with mass below 740 GeV are excluded at 95% confidence level."

---

Search for resonant pair production of Higgs bosons decaying to bottom quark-antiquark pairs in proton-proton collisions at 13 TeV

<https://arxiv.org/abs/1806.03548>

"No evidence for such a signal is observed"

---

Search for pair production of higgsinos in final states with at least three b-tagged jets in  $\sqrt{s} = 13$  TeV pp collisions using the ATLAS detector

<https://arxiv.org/abs/1806.04030>

"No significant excess is found above the predicted background. "

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Search for dark matter produced in association with a Higgs boson decaying to  $\tau\tau$  or  $\tau\nu$  at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1806.04771>

"No significant excess over the expected standard model background is observed."

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Search for supersymmetric partners of electrons and muons in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1806.05264>

"The observed yields are consistent with the expectations from the standard model."

---

Search for the decay of a Higgs boson in the  $???$  channel in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1806.05996>

"No significant excess above the background prediction has been found"

---

Search for the Higgs boson produced in association with a vector boson and decaying into two spin-zero particles in the  $H \rightarrow aa \rightarrow 4b$  channel in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1806.07355>

"No significant excess of events above the Standard Model background prediction is observed,"

---

Search for pair- and single-production of vector-like quarks in final states with at least one Z boson decaying into a pair of electrons or muons in pp collision data collected with the ATLAS detector at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1806.10555>

"No significant excess over the background-only hypothesis is found"

---

Search for heavy Majorana neutrinos in same-sign dilepton channels in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1806.10905.pdf>

"No significant excess of events

compared to the expected standard model background prediction is observed."

---

Search for Higgs boson decays into a pair of light bosons in the  $b\bar{b}$  final state in pp collision at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.00539>

"No significant deviation from the Standard Model prediction is observed."

---

Searches for exclusive Higgs and Z boson decays into  $J/\psi$ ,  $\psi(2S)$ , and  $\psi(nS)$  at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.00802>

"No significant excess of events is observed above the expected backgrounds"

---

Search for standard-model Z and Higgs bosons decaying into a bottom-antibottom quark pair in proton-antiproton collisions at 1.96 TeV

<https://arxiv.org/abs/1807.01363>

"No significant signal is expected in our data"

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Constraining WIMP-Nucleon Effective Interactions from PandaX-II Experiment

<https://arxiv.org/pdf/1807.01936.pdf>

"no significant deviation in

Run 9 and Run 10 data sets is observed from the estimated

background."

---

Search for supersymmetry in events with a  $\tau$  lepton pair and missing transverse momentum in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1807.02048.pdf>

"No significant excess is observed"

---

Search for heavy resonances decaying into a vector boson and a Higgs boson in final states with charged leptons, neutrinos and b quarks at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1807.02826.pdf>

"no significant excess of events above the background predictions is observed"

---

Dark Matter Search in Nucleon, Pion, and Electron Channels from a Proton Beam Dump with MiniBooNE

<https://arxiv.org/abs/1807.06137>

"No excess from the background predictions was observed,"

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Search for the Higgs boson decaying to two muons in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1807.06325.pdf>

"No significant evidence for this decay is observed."

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Search for dark matter particles produced in association with a top quark pair at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1807.06522>

" No significant excess over the standard model expectation is observed"

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Search for lepton-flavor violation in different-flavor, high-mass final states in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.06573>

"No excesses over the Standard Model predictions are observed."

---

A strategy for a general search for new phenomena using data-derived signal regions and its application within the ATLAS experiment

<https://arxiv.org/abs/1807.07447>

" No significant deviations are found"

---

A search for annual and diurnal rate modulations in the LUX experiment

<https://arxiv.org/abs/1807.07113>

" No statistically significant annual modulation was observed"

---

Searches for pair production of charginos and top squarks in final states with two oppositely charged leptons in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1807.07799>

"No significant deviation is observed from the predicted standard model background."

---

Search for charged Higgs bosons decaying via  $H^{\pm} \rightarrow \tau^{\pm} \nu_{\tau}$  in the  $\tau + \text{jets}$  and  $\tau + \text{lepton}$  final states with 36 fb<sup>-1</sup> of pp collision data recorded at  $\sqrt{s} = 13$  TeV with the ATLAS experiment

<https://arxiv.org/abs/1807.07915>

"No evidence of a charged Higgs boson is found"

---

Search for Higgs boson pair production in the  $WW$  channel using pp collision data recorded at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.08567>

"No significant deviation from the Standard Model prediction is observed"

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Search for dark matter in the form of hidden photons and axion-like particles in the XMASS detector

<https://arxiv.org/abs/1807.08516>

"No significant signal was observed"

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A Search for Halo Axions

<https://arxiv.org/ftp/arxiv/papers/1807/1807.09369.pdf>

"no observable effect"

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Search for vector-boson resonances decaying to a top quark and bottom quark in the lepton plus jets final state in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.10473>

"No significant deviation from the Standard Model (SM) expectation is observed"

---

Search for a  $W'$  boson decaying to a  $\tau$  lepton and a neutrino in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1807.11421>

"No excess in the event yield is observed"

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Search for dark matter in events with a hadronically decaying vector boson and missing transverse momentum in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1807.11471>

" No significant excess over the Standard Model prediction is observed."

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Search for a Dark Photon in Electro-Produced  $e+e?$  Pairs with the Heavy Photon Search Experiment at JLab

<https://arxiv.org/abs/1807.11530>

"no evidence of dark photon decays"

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"Search for a Dark Photon in Electro-Produced  $e+e?$  Pairs with the Heavy Photon Search Experiment at JLab

<https://arxiv.org/abs/1807.11530>

"no evidence of dark photon decays"

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"Search for a Dark Photon in Electro-Produced  $e+e?$  Pairs with the Heavy Photon Search Experiment at JLab

<https://arxiv.org/abs/1807.11530>

"no evidence of dark photon decays"

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Search for new phenomena in events with same-charge leptons and b-jets in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/pdf/1807.11883.pdf>

"No significant excess over the expected background is observed."

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A search for resonant and non-resonant Higgs boson pair production in the  $bb\gamma\gamma$  decay channel in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.00336>

"No significant excess above the expected background is observed"

---

Search for heavy resonances decaying into two Higgs bosons or into a Higgs boson and a W or Z boson in proton-proton collisions at 13 TeV

<https://arxiv.org/pdf/1808.01365.pdf>

"No evidence of significant deviations from the background expectation are found."

---

Search for pair production of heavy vector-like quarks decaying into hadronic final states in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.01771>

" No significant deviation from the Standard Model expectation is observed."

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Search for doubly charged scalar bosons decaying into same-sign W boson pairs with the ATLAS detector

<https://arxiv.org/abs/1808.01899>

"No significant deviations from the Standard Model predictions are found."

---

Search for long-lived particles in final states with displaced dimuon vertices in pp collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.03057>

"No significant excess over the Standard Model expectation is observed"

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Search for long-lived particles with displaced vertices in multijet events in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1808.03078>

"No events with two well-separated high-track-multiplicity vertices are observed."  
"

---

Search for pair-produced resonances decaying to quark pairs in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1808.03124.pdf>

"We exclude top squark masses with the  $\kappa_{00312}$  coupling from 80 to 520 GeV. For the  $\kappa_{00323}$  coupling, the boosted search excludes masses from 80 to 270

and from 285 to 340 GeV; and the resolved search excludes masses from 400 to 525 GeV. These

results probe lower masses than previously explored at the LHC, and extend the top squark

mass limits in the  $t \rightarrow qq_0$  scenario."

---

Search for long-lived particles in final states with displaced dimuon vertices in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.03057>

"No significant excess over the Standard Model expectation is observed."

---

Search for charged Higgs bosons decaying into top and bottom quarks at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.03599>

"No significant excess above the background-only hypothesis is observed"

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Search for heavy charged long-lived particles in proton-proton collisions at  $\sqrt{s} = 13$  TeV using an ionisation measurement with the `\mbox{ATLAS}` detector

<https://arxiv.org/abs/1808.04095>

"No significant deviation from Standard Model background expectations is observed"

---

Searches for new heavy quarks in ATLAS

<https://arxiv.org/pdf/1808.04695.pdf>

"T masses up to between 1.17 TeV

and 1.43 TeV are excluded at 95% CL. Additionally, VL B masses are excluded up to 1.25 TeV

assuming 100% BR to W t. Finally, exclusion limits are set for scenarios with intermediate BR

compositions and interpretations in the two-dimensional BR plane for the highest excluded VLQ

masses are provided."

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Search for pair production of second-generation leptoquarks at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1808.05082.pdf>

"No significant excess above the predicted background

is seen "

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Search for squarks and gluinos in final states with hadronically decaying  $\tau$ -leptons, jets, and missing transverse momentum using pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1808.06358>

"No significant excess is observed "

---

Search for a charged Higgs boson decaying to charm and bottom quarks in proton-proton collisions at  $\sqrt{s} = 8$  TeV

<https://arxiv.org/abs/1808.06575>

"No evidence for the presence of a charged Higgs boson is observed"

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Search for sub-GeV dark matter by annual modulation using XMASS-I detector

<https://arxiv.org/abs/1808.06177>

"No significant modulation signal was observed"

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Search for lepton-flavour-violating decays of Higgs-like bosons

<https://arxiv.org/pdf/1808.07135.pdf>

"No signal has been found"

---

Search for physics beyond the standard model in high-mass diphoton events from proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1809.00327.pdf>

"no evidence for new physics is seen."

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Measurement of  $B(J/\psi \rightarrow e^+e^-)$  and search for dark photon

<https://arxiv.org/pdf/1809.00635.pdf>

"no significant dark

photon signal is observed"

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Searches for LFV with CMS: leptoquarks with couplings to quarks of the 3rd generation

<https://arxiv.org/abs/1809.04298>

"No significant deviation from the SM is observed in any of these channels."

---

Search for a light CP-odd Higgs boson and low-mass dark matter at the Belle experiment

<https://arxiv.org/abs/1809.05222>

"we find no evidence for a signal."

---

Search for WIMP-129Xe inelastic scattering with particle identification in XMASS-I

<https://arxiv.org/abs/1809.05358>

"No evidence of a WIMP signal was found."

---

Search for leptoquarks coupled to third-generation quarks in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1809.05558>

"No deviation from the standard model prediction has been observed"

---

Search for invisible decays of a Higgs boson produced through vector boson fusion in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1809.05937.pdf>

"No significant deviations from the SM expectations are observed in any of the searches."

---

Search for single production of vector-like quarks decaying to a top quark and a W boson in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1809.08597>

"No significant deviation from the standard model background expectation is observed."

---

Search for heavy Majorana or Dirac neutrinos and right-handed W gauge bosons in final states with two charged leptons and two jets at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1809.11105>

"No significant deviations from the Standard Model are observed."

---

Searches for new phenomena in leptonic final states using the ATLAS detector

<https://arxiv.org/pdf/1810.00030.pdf>

"No

significant excess above the SM expectation was found,"

---

Search for new physics in final states with a single photon and missing transverse momentum in proton--proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1810.00196>

"No deviations from the predictions of the standard model are observed."

---

Searches for rare and non-Standard Model decays of the Higgs boson

<https://arxiv.org/pdf/1810.00999.pdf>

"no searches to date have resulted in an observation

of a significant excess, "

---

Searches for gamma-ray lines and 'pure WIMP' spectra from Dark Matter annihilations in dwarf galaxies with H.E.S.S

<https://arxiv.org/pdf/1810.00995.pdf>

"No significant excesses have been found,"

---

Rare decays: A window on new physics

<https://arxiv.org/pdf/1810.02214.pdf>

"The results show no significant

deviation from zero."

---

Search for top quark partners with charge  $5/3$  in the same-sign dilepton and single-lepton final states in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1810.03188>

"No significant excess of events is observed"

---

Evidence for light-by-light scattering and searches for axion-like particles in ultraperipheral PbPb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV

<https://arxiv.org/pdf/1810.04602.pdf>

"The measured exclusive diphoton invariant mass distribution is used to set new exclusion limits on the production of pseudoscalar axion-like particles"

---

Search for new particles decaying to a jet and an emerging jet

<https://arxiv.org/pdf/1810.10069.pdf>

"No significant excess with respect to the SM prediction is observed"

---

Search for four-top-quark production in the single-lepton and opposite-sign dilepton final states in pp collisions at  $\sqrt{s} = 13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1811.02305>

"No significant excess above the Standard Model expectation is observed."

---

Search for the production of a long-lived neutral particle decaying within the ATLAS hadronic calorimeter in association with a Z boson from pp collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1811.02542>

"No significant excess of events is observed above the expected background"

---

Search for heavy neutrinos and third-generation leptoquarks in hadronic states of two  $\tau$  leptons and two jets in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1811.00806.pdf>

"Assuming that only the  $N_1$  flavor contributes significantly to the WR decay width, WR masses below 3.52 (2.75) TeV are excluded at 95% confidence level, assuming the  $N_1$  mass is 0.8 (0.2) times the mass of the WR boson. In the second beyond the standard model scenario, leptoquarks with a mass less than 1.02 TeV are excluded at 95% confidence level, to be compared with an expected mass limit of 1.00 TeV. Both of these results represent the most stringent limits to date for  $\tau\tau$  final states."

---

Search for the production of a long-lived neutral particle decaying within the ATLAS hadronic calorimeter in association with a Z boson from pp collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1811.02542>

"No significant excess of events is observed above the expected background."

---

Search for Higgs boson pair production in the  $b\bar{b}WW$  decay mode at  $\sqrt{s}=13$  TeV with the ATLAS detector

<https://arxiv.org/abs/1811.04671>

" No evidence of events beyond the background expectation is found. "

---

Search for dark matter produced in association with a Higgs boson decaying to a pair of bottom quarks in proton-proton collisions at  $\sqrt{s}=13$  TeV

<https://arxiv.org/pdf/1811.06562.pdf>

" No significant deviation from the predictions of the standard model is observed"

---

Search for a  $W'$  boson decaying to a vector-like quark and a top or bottom quark in the all-jets final state

<https://arxiv.org/abs/1811.07010>

"No significant deviation in data with respect to the standard model background predictions is observed"

---

Search for long-lived particles decaying into displaced jets in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/pdf/1811.07991.pdf>

"The observed yields in data are in agreement with the background predictions"

---

The First Direct Search for Inelastic Boosted Dark Matter with COSINE-100

<https://arxiv.org/abs/1811.09344>

"No excess over the predicted event rate is observed."

---

Search for resonant production of second-generation sleptons with same-sign dimuon events in proton-proton collisions at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1811.09760>

" No significant deviation is observed with respect to standard model expectations. "

---

Search for dark matter in events with a leptoquark and missing transverse momentum in proton-proton collisions at 13 TeV

<https://arxiv.org/pdf/1811.10151.pdf>

"The data are

observed to agree with the standard model background predictions within the uncertainties."

---

Search for Higgs boson pair production in the  $WW(?)WW(?)$  decay channel using ATLAS data recorded at  $\sqrt{s}=13$  TeV

<https://arxiv.org/abs/1811.11028>

"No significant excess over the expected Standard Model backgrounds is observed."

---

Constraints on Bosonic Dark Matter with Low Threshold Germanium Detector at Kuo-Sheng Reactor Neutrino Laboratory

<https://arxiv.org/abs/1811.11415>

"no significant excess of super-WIMP signals are observed. "

---

Overview of searches for single production of vector-like top and bottom quarks with the ATLAS experiment at 13 TeV

<https://arxiv.org/abs/1811.11496>

"No significant excess over the SM prediction is found"

---

Searches for strongly-produced SUSY at CMS

<https://arxiv.org/pdf/1811.11935.pdf>

" we have excluded gluinos and squarks up to about 1100 GeV and 1950 GeV, respectively"

---

First results on the scalar WIMP-pion coupling, using the XENON1T experiment

<https://arxiv.org/abs/1811.12482>

"no significant excess is found"

---

A search for pair production of new light bosons decaying into muons in proton-proton collisions at 13 TeV

<https://arxiv.org/abs/1812.00380>

" No significant deviation from the predicted background is observed."

---

Search for Tri-Nucleon Decay in the Majorana Demonstrator

<https://arxiv.org/pdf/1812.01090.pdf>

"We find no evidence for  $B/\alpha$ "

---

Search for pair-production of vector-like quarks in final states with at least one Z boson decaying into a pair of electrons or muons in pp collision data collected with the ATLAS detector at  $\sqrt{s} = 13$  TeV

<https://arxiv.org/abs/1812.02112>

"No significant excess over the Standard Model expectation was found"

---

Search for a Dark Photon in Electro-Produced  $e^+e^-$  Pairs with the Heavy Photon Search Experiment at JLab

<https://arxiv.org/abs/1812.02169>

" no evidence of dark photon decays above the large QED background"

## **Conclusion**

Therefore, there is no hint at the existence of supersymmetry. There is no hint at the existence of particles of dark matter. there is no hint of going into a new physics. No connection was found between the 124.5 - 126 GeV particle and the Higgs mechanism. There is no explanation of the stability of the universe in the Higgs field. Nothing in Standard Model gives a precise value for the Higgs's own mass, and calculations from first principles, based on quantum

theory, suggest it should be enormous—roughly a hundred million billion times higher than its measured value. Physicists have therefore introduced an ugly fudge factor into their equations (a process called “fine-tuning”) to sidestep the problem.

Besides, all the known elementary bosons are gauge - it is photons, W- and Z-bosons and gluons.

It is likely that the 125-126 particle is of some hadrons multiplet.

## **Epilogue**

In the study of the logical foundations of probability theory, I found that the terms and equations of the fundamental theoretical physics represent terms and theorems of the classical probability theory, more precisely, of that part of this theory, which considers the probability of dot events in the  $3 + 1$  space-time.

In particular, all Standard Model's formulas (higgs ones except) turn out theorems of such probability theory. And the masses, moments, energies, spins, etc. turn out of parameters of probability distributions such events. The terms and the equations of the electroweak and of the quark-gluon theories turn out the theoretical-probabilistic terms and theorems. Here the relation of a neutrino to his lepton becomes clear, the W and Z bosons masses turn out dynamic ones, the cause of the asymmetry between particles and antiparticles is the impossibility of the birth of single antiparticles. In addition, phenomena such as confinement and asymptotic freedom receive their probabilistic explanation. And here we have the logical foundations of the gravity theory with phenomena dark energy and dark matter.



Gunn Quznetsov

# Fundamental Theoretical Physics is Part of Probability Theory



Thus, physics is a game of probabilities in space-time. But what is time? What is space? What is probability?

## Reference

1. Gunn Quznetsov (2017), [Farewell to Higgs](#)
2. Gunn Quznetsov (2018), [Runii: no Susy, no Wimp, no Higgs, no New Physics](#)
3. Gunn Quznetsov (2018), [Fundamental Theoretical Physics is Part of Probability Theory](#) LAP