

# The ATLAS Detector at the LHC

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The contemporary theory of fundamental building blocks describing matter and its interactions is the Standard Model (SM). It unites electromagnetic, “weak”, and “strong” forces within a single theoretical framework – missing only a rigorous treatment of gravity to account for the full set of fundamental interactions.

Proton-proton collisions at the Large Hadron Collider (LHC)[1] provide a sustained source of events featuring high energy SM interactions. The ATLAS detector[2] surrounds one of the LHC collision points and is designed as a general-purpose detector capable of reconstructing properties of most SM particles emerging from the collision point.

This enables ATLAS to make precision tests of the SM while also tackling many of the unresolved topics in particle physics including Dark Matter[3] and the recent emergence of “B anomalies”[4].

ATLAS detector upgrades such as NSW[5] and ITk are underway to prepare ATLAS for the High Luminosity LHC which will enable ATLAS to refine many of its measurements and expand its searches.

[1] Lyndon Evans and Philip Bryant. “LHC Machine”. In: *Journal of Instrumentation* 3.08 (Aug. 2008), S08001-S08001. doi: 10.1088/1748-0221/3/08/s08001. url: <https://doi.org/10.1088/1748-0221/3/08/s08001>

[2] The ATLAS Collaboration. “The ATLAS Experiment at the CERN Large Hadron Collider”. In: *Journal of Instrumentation* 3.08 (Aug. 2008), S08003-S08003. doi: 10.1088/1748-0221/3/08/s08003. url: <https://doi.org/10.1088/1748-0221/3/08/s08003>

[3] The ATLAS Collaboration. Constraints on mediator-based dark matter and scalar dark energy models using  $s\sqrt{s} = 13$  TeV  $pp$  collision data collected by the ATLAS detector. *J. High Energ. Phys.* **2019**, 142 (2019). [https://doi.org/10.1007/JHEP05\(2019\)142](https://doi.org/10.1007/JHEP05(2019)142)

[4] LHCb Collaboration. *Test of lepton universality in beauty-quark decays*. Tech. rep. Geneva: CERN, Mar. 2021. arXiv: 2103.11769. url: <https://cds.cern.ch/record/2758740>

[5] Bernd Stelzer. *The New Small Wheel Upgrade Project of the ATLAS Experiment*. Tech. rep. Geneva: CERN, Oct. 2014. doi: 10.1016/j.nuclphysbps.2015.09.182. url: <https://cds.cern.ch/record/1958265>