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Application of Machine Learning in the search for the magnetic monopole in 13TeV p-p collisions at ATLAS

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Among the outstanding questions of particle physics, proof of the existence of a magnetic monopole is still one of great interest. Not only would the observation of a magnetically charged particle bring symmetry between electric and magnetic fields in Maxwell's equations, but it would also explain the quantization of the electric charge. TeV-mass Dirac Magnetic Monopoles, which behave as a high-electric-charge objects, could potentially be produced by the 13 TeV proton-proton collisions at the LHC. Detection is based on the particles' characteristic high ionization, penetration distance and lack of calorimeter shower. The increase in the average number of collisions per bunch crossing during the last 2 years of Run 2 brought the challenge of isolating the monopole high energy depositions in the inner detector. In order to overcome this challenge, we introduce a random forest classifier trained on region of interest wedges of the transition radiation tracker (TRT) against a random wedge of the TRT in the same event - same pileup conditions. We achieve discrimination power equivalent to that of the traditional cut-and-count method applied in previous searches, and some improvement in charges and masses at which ATLAS has low sensitivity.

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