

The Assessment of Evidence in the Discovery of a Higgs Boson

David A. van Dyk*

Imperial College London, United Kingdom dvandyk@imperial.ac.uk

The 2012-2013 discovery of a Higgs boson filled the last remaining gap in the Standard Model of particle physics and was greeted with fanfare in the scientific community and by the public at large. Particle physicists have developed and rigorously tested a specialized statistical tool kit that is designed for the search for new physics. This tool kit was put to the test in a 40-year search that culminated in the discovery of a Higgs boson. This talk reviews these statistical methods, the controversies that surround them, and how they led to this historic discovery. It concludes with a Bayesian critique of the use of p-values to assess the evidence for a Higgs boson and a discussion of the possible use instead of Bayesian methods that are being developed for a related statistical problem in high-energy astrophysics.

Key Words: Bayes factors, detection, exclusion, hypothesis testing, look elsewhere effect, Lindley's paradox, Poisson models, sensitivity, upper limits