PHYSIKALISCHES KOLLOQUIUM

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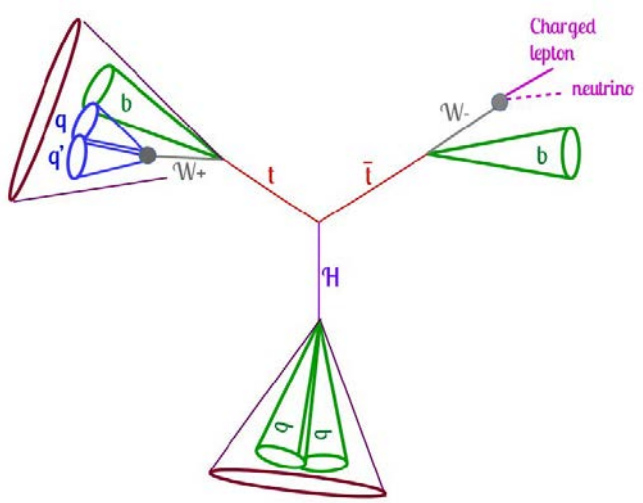

THE TOP QUARK AND THE HIGGS BOSON: A VERY SPECIAL RELATIONSHIP

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Since its discovery in 1995, the top quark has been subject of intense scrutiny in the particle physics community. But why are we still that interested in its properties? It has a mass and a coupling to the Higgs boson (Yukawa coupling) which is much larger than for any of the other fundamental particles. This provides an unique laboratory to test the Standard Model predictions and could open a window to yet unknown physics processes. The large production rates at the Large Hadron Collider (CERN, Geneva) allow to measure its remarkable properties to very high precision and to investigate rare processes that could give new insight into the special relationship between the top quark and the Higgs boson. One of these processes is the associated production of a top-quark pair and a Higgs boson (ttH). A precise measurement of the top-quark mass and the Yukawa coupling is crucial to improve our understanding of the stability of the Higgs vacuum and hence the universe itself. The latest results for these measurements will be shown and the importance of applying machine-learning techniques will be discussed. A detailed overview of the limiting factors of the measurements and promising ideas for further improvements will be given.