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PhD under the supervision of Ricardo D'Elia Matheus (IFT-UNESP, São Paulo, Brazil) and Aurore Savoy-Navarro (APC Lab – Université Paris Diderot / CNRS-IN2P3)

Thesis Title: “Search for Compositeness in the Physics of the Higgs and related dark matter candidates” (Recherche de la Compositeness dans la Physique du Boson Higgs et les candidats associés pour la Matière Noire.)

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Summary of the project

This work focuses on a search for New Physics based on Vector-like fermions. They appear in different kinds of well motivated models, like Composite Models and Extra Dimension Models. Two models containing vector-like fermions are explored in this work. The first model considers the Standard Model (SM) of Particle Physics with the addition of a vector-like fermion that is a singlet of $SU(2)$, while the second model considers the addition of a vector-like fermion that is a doublet of $SU(2)$. Moreover these new particles are considered to be partners of the top quark, meaning they have the same quantum numbers of the top singlet or the (top, bottom) doublet, so they can mix with the SM quarks. Both models predict a top-Higgs Yukawa coupling that is smaller than the SM prediction (~ 1) and this will be measured at LHC in a few years. Besides, new physics models containing vector-like fermions can also provide dark matter candidates, so constraints on the models given by the study of the vector-like fermions can give information about what types of Dark Matter models are possible.