



Πανεπιστήμιο
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ΤΜΗΜΑ ΦΥΣΙΚΗΣ

Το Τμήμα Φυσικής του Πανεπιστημίου Κύπρου
σας προσκαλεί την

Τετάρτη, 20 Μαΐου 2020, ώρα 10:00
στην παρουσίαση της Διδακτορικής Διατριβής του Αιμίλιου Ιωάννου

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“Searches for signatures of a heavy pseudoscalar A boson in the Two-Higgs-Doublet Model”

This PhD thesis, conducted with the CMS Experiment at LHC, CERN (at centre-of-mass energy 13 TeV), is dedicated to the search for a heavy pseudoscalar Higgs boson, A, which could decay to a Z boson ($m_Z = 91 \text{ GeV}$) and the SM Higgs boson ($m_h = 125 \text{ GeV}$), as predicted by the Two-Higgs-Doublet Model (2HDM). Final products of such decay mode ($A \rightarrow Zh$) are a pair of leptons (e^+e^- and $\mu^+\mu^-$) and a pair of b-quarks ($b\bar{b}$). Additionally, events with missing transverse energy (MET) and a pair of b-quarks as final states are also considered. The analysis of the $A \rightarrow Zh \rightarrow \nu\bar{\nu}b\bar{b}$ decay channel, which is unique, performed for the first time at such high energies, is presented in detail in the corresponding PhD thesis.

The $A \rightarrow Zh \rightarrow l^+l^-b\bar{b}$ and $A \rightarrow Zh \rightarrow \nu\bar{\nu}b\bar{b}$ channels were searched for in the gluon-gluon fusion and in the b-quark associated production mechanisms. Thirteen A mass points were generated in a mass range between 225 GeV and 1 TeV in order to extract results for the four types of the 2HDM theory. Nine signal regions (SRs) were determined using the most optimal SM Higgs mass window ($100 \text{ GeV} < m_{b\bar{b}} < 140 \text{ GeV}$) and applying three discriminating sets of variables (kinematic, angular and event shape variables) for reducing a possible contribution of the background sources in the signal region.

Five control regions (CRs) for $Z + \text{Jets}$, $Z + b$, $Z + b\bar{b}$, $W + \text{Jets}$, $t\bar{t}$ background sources were also examined and their background scale factors were computed in order to have the best consistency between MC samples and data. No excess of data over the background prediction is observed and the upper limits are set at 95% confidence level on the product of the A boson production cross sections times the branching ratios $\sigma_A \times Br(A \rightarrow Zh) \times Br(h \rightarrow b\bar{b})$ for the two Higgs production modes. The results exclude 1 pb to 0.02 pb cross sections in the 225-1000 GeV mass range of A. The findings of the analysis are interpreted in the 2HDM model; observed and expected exclusion limits for Type-I, Type-II, Flipped Type and Lepton-specific Type couplings are presented in the planes $\tan\beta$ versus $\cos(\beta - \alpha)$ and $\tan\beta$ versus m_A , reducing considerably the allowed phase space in the 2HDM extension of the Standard Model.

Για περισσότερες πληροφορίες παρακαλώ επικοινωνείτε: Τμήμα Φυσικής, τηλέφωνο: 22892820

