

Mini workshop on HHH and other extended scalar sector signatures

Report of Contributions

Contribution ID: 1

Type: **not specified**

Search for a CP-even Heavy Higgs Boson in Supersymmetric B-L SM extension at the LHC

Wednesday 31 July 2024 15:30 (1 hour)

The detection of a heavy neutral CP-even Higgs boson of the $B - L$ Supersymmetric Standard Model (BLSSM), h' , with $m_{h'} \simeq 400$ GeV, at the Large Hadron Collider (LHC) for a center-of-mass energy of $\sqrt{s} = 14$ TeV, is investigated. The following production and decay channels are considered: $gg \rightarrow h' \rightarrow ZZ \rightarrow 4\ell$ and $gg \rightarrow h' \rightarrow W^+W^- \rightarrow 2\ell + \text{Missing Transverse Energy (MET)}$, where $\ell = e, \mu$, with integrated luminosity $L_{\text{int}} = 300 \text{ fb}^{-1}$ (Run 3). Furthermore, we also look into the di-Higgs channel $gg \rightarrow h' \rightarrow hh \rightarrow b\bar{b}\gamma\gamma$ at the High-Luminosity LHC (HL-LHC) with an integrated luminosity of $L_{\text{int}} = 3000 \text{ fb}^{-1}$.

We demonstrate that promising signals with high signal-to-background statistical significance (S/\sqrt{B}) can be obtained through the three aforementioned channels.

Authors: Mr ASHRY, Mustafa (Department of Mathematics, Faculty of Science, Cairo University, Giza 12613, Egypt); KHALIL, Shaaban (Center for Fundamental Physics, Zewail City of Science and Technology, 6th of October City, Giza 12578, Egypt); Prof. MORETTI, Stefano (School of Physics and Astronomy, University of Southampton, Highfield, Southampton SO17 1BJ and Department of Physics & Astronomy, Uppsala University, Box 516, SE-751 20 Uppsala, Sweden)

Presenter: Mr ASHRY, Mustafa (Department of Mathematics, Faculty of Science, Cairo University, Giza 12613, Egypt)

Contribution ID: 2

Type: **not specified**

Multi-Higgs production and the Electroweak Phase Transition through TRSM

Monday 29 July 2024 14:00 (1 hour)

Exploring the Higgs sector via multi-Higgs production searches is a main goal for run-3 and high-lumi LHC. Can these searches inform us about the electroweak phase transition and matter-antimatter asymmetry?

We address this question in the context of the TRSM (Two-Real-Singlet Model), which has known benchmark points enhancing multi-Higgs production.

We update the triple-Higgs production benchmark points to include refined perturbativity bounds and explore the type of electroweak phase transition that occurs in the early universe; whether continuous or the first-order discontinuous phase transition desired for matter-antimatter asymmetry.

After presenting our work, I outline lessons on correlating the type of electroweak phase transition and the enhancement of di-Higgs or triple Higgs production, highlighting the importance of the theory's vacuum expectation value of today and the symmetries of the model.

Authors: Dr PAPAEFSTATHIOU, Andreas (Kennesaw State University, GA, USA); TETLALMATZ-I-XOLOCOTZI, Gilberto (Siegen University); VAN DE VIS, Jorinde Marjolein; POSTMA, Marieke; KARKOUT, Osama (Nikhef National institute for subatomic physics (NL)); DU PREE, Tristan Arnoldus (Nikhef National institute for subatomic physics (NL))

Presenter: KARKOUT, Osama (Nikhef National institute for subatomic physics (NL))

Contribution ID: 4

Type: **not specified**

$4b + X$ via electroweak multi-Higgs production as smoking gun signal for the Type-I 2HDM at the LHC

Tuesday 30 July 2024 14:00 (1 hour)

The existence of additional Higgs bosons, besides the one discovered by the LHC, already a decade ago, is predicted by most frameworks of new physics. Observation of a second Higgs boson (charged or neutral) will thus provide a firm evidence that the underlying manifestation of the Electroweak Symmetry Breaking (EWSB) mechanism is a non-minimal one. The majority of analyses, both phenomenological and experimental ones, involving additional Higgs bosons concentrate on QCD induced production modes. However, the QCD induced processes are not necessarily to be high in new physics models owing to the non-standard couplings of the new Higgs bosons to the fermions and gauge bosons. As a reference I consider the Type-I two Higgs doublet model (2HDM) as a simple extension of Standard Model where the Electroweak (EW) processes dominate over the QCD processes.

I would like to discuss a full detector-level Monte Carlo analysis to establish that the inclusive $4b + X$ final state via EW processes can provide simultaneous reconstruction of all the additional Higgs boson masses. I will present the algorithms for the mass reconstructions of the additional Higgs bosons.

Author: Dr SANYAL, Prasenjit (Konkuk University)

Presenter: Dr SANYAL, Prasenjit (Konkuk University)

Contribution ID: 5

Type: **not specified**

Welcome and introduction

Monday 29 July 2024 13:30 (30 minutes)

Presenter: ROBENS, Tania Natalie (Rudjer Boskovic Institute (HR))

Contribution ID: 6

Type: **not specified**

tba

Presenter: KARKOUT, Osama (Nikhef National institute for subatomic physics (NL))

Contribution ID: 7

Type: **not specified**

Associate production of light scalars at the LHC [tbc]

Tuesday 30 July 2024 11:00 (1 hour)

Presenter: DESAI, Aman (University of Adelaide (AU))

Contribution ID: 8

Type: **not specified**

tba

Presenters: SANYAL, Prasenjit (Asia Pacific Center for Theoretical Physics); SANYAL, Prasenjit (Asia Pacific Center for Theoretical Physics)

Contribution ID: 9

Type: **not specified**

BSM Phenomenology of Higgs Bosons in Collider Experiments

Tuesday 30 July 2024 15:30 (1 hour)

Presenter: OUCHEMHOU, Mohamed (LHEPA)

Contribution ID: **10**

Type: **not specified**

Experimental perspective [tbc]

Wednesday 31 July 2024 11:00 (1 hour)

Presenter: FERENCEK, Dinko (Rudjer Boskovic Institute (HR))

Contribution ID: 11

Type: **not specified**

Dissecting multi-Higgs production in new physics models

Wednesday 31 July 2024 14:00 (1 hour)

Presenter: Dr PAPAEFSTATHIOU, Andreas (Kennesaw State University, GA, USA)

Contribution ID: 12

Type: **not specified**

Model dependent and model independent enhancement to triple Higgs production

Monday 29 July 2024 15:30 (1 hour)

Presenter: TETLALMATZI-XOLOCOTZI, Gilberto (Siegen University)